UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

☒ **Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934**

For the fiscal year ended December 31, 2023

or

☐ **Transition Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934**

For the transition period from _________ to _________

Commission file number 001-12658

ALBEMARLE CORPORATION

(Exact name of registrant as specified in its charter)

Virginia	**54-1692118**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**

4250 Congress Street, Suite 900
Charlotte, North Carolina 28209
(Address of principal executive offices) (Zip Code)

Registrant's telephone number, including area code: (980) - 299-5700

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol	Name of each exchange on which registered
COMMON STOCK, $.01 Par Value	**ALB**	**New York Stock Exchange**

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ☒ No ☐

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ☐ No ☒

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for at least the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). Yes ☒ No ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer	☒	Accelerated filer	☐
Non-accelerated filer	☐	Smaller reporting company	☐
		Emerging growth company	☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C.7262(b)) by the registered public accounting firm that prepared or issued its audit report. ☒

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements. ☐

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1(b). ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ☐ No ☒

The aggregate market value of the voting and non-voting common equity stock held by non-affiliates of the registrant was approximately $26.2 billion based on the last reported sale price of common stock on June 30, 2023, the last business day of the registrant's most recently completed second quarter.

Number of shares of common stock outstanding as of February 7, 2024: 117,402,949

Documents Incorporated by Reference

Portions of Albemarle Corporation's definitive Proxy Statement for its 2024 Annual Meeting of Shareholders to be filed with the U.S. Securities and Exchange Commission pursuant to Regulation 14A under the Securities Exchange Act of 1934, as amended, are incorporated by reference into Part III of this Annual Report on Form 10-K.

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Year Ended December 31, 2023

PART I

Item 1. Business.

Albemarle Corporation was incorporated in Virginia in 1993. Our principal executive offices are located at 4250 Congress Street, Suite 900, Charlotte, North Carolina 28209. Unless the context otherwise indicates, the terms “Albemarle,” “we,” “us,” “our” or “the Company” mean Albemarle Corporation and its consolidated subsidiaries.

Albemarle leads the world in transforming essential resources into critical ingredients for mobility, energy, connectivity, and health. Our purpose is to enable a more resilient world. We partner to pioneer new ways to move, power, connect, and protect. The end markets we serve include grid storage, automotive, aerospace, conventional energy, electronics, construction, agriculture and food, pharmaceuticals and medical devices. We believe that our world-class resources with reliable and consistent supply, our leading process chemistry, high-impact innovation, customer centricity and focus on people and planet will enable us to maintain a leading position in the industries in which we operate.

We and our joint ventures currently operate more than 25 production and research and development (“R&D”) facilities, as well as a number of administrative and sales offices, around the world. As of December 31, 2023, we served approximately 1,900 customers in approximately 70 countries. For information regarding our unconsolidated joint ventures, see Note 10, “Investments,” to our consolidated financial statements included in Part II, Item 8 of this report.

Business Segments

Effective January 1, 2023, the Company realigned its Lithium and Bromine global business units into a new corporate structure designed to better meet customer needs and foster talent required to deliver in a competitive global environment. In addition, the Company announced its decision to retain its Catalysts business under a separate, wholly-owned subsidiary renamed Ketjen. During 2023, we managed and reported our operations under three reportable segments: Energy Storage, Specialties and Ketjen. Each segment has a dedicated team of sales, research and development, process engineering, manufacturing and sourcing, and business strategy personnel and has full accountability for improving execution through greater asset efficiency, market focus, agility and responsiveness. Financial results and discussion about our segments included in this report are organized according to these categories except where noted.

For financial information regarding our reportable segments and geographic area information, see Note 25, “Segment and Geographic Area Information,” to our consolidated financial statements included in Part II, Item 8 of this report.

Energy Storage Segment

Our Energy Storage business pioneers better lithium use through reliable supply and consistent quality. We develop and manufacture a broad range of basic lithium compounds, including lithium carbonate, lithium hydroxide, and lithium chloride. Lithium is a key component in products and processes used in a variety of applications and industries, which include lithium batteries used in consumer electronics and electric vehicles, power grids and solar panels, high performance greases, specialty glass used in consumer appliances and electronics, organic synthesis processes in the areas of steroid chemistry and vitamins, various life science applications, as well as intermediates in the pharmaceutical industry, among other applications.

In addition to developing and supplying lithium compounds, we provide technical services, including the handling and use of reactive lithium products. We also offer our customers recycling services for lithium-containing by-products resulting from synthesis with organolithium products, lithium metal and other reagents. We plan to continue to focus on the development of new products and applications.

Competition

The global lithium market is highly competitive and growing very rapidly. It is characterized by aggressive expansion and entry from existing and new players, including automotive OEMs, commodity traders, junior miners, and large, well-capitalized diversified miners. Producers are primarily located in the Americas, Africa, Asia and Australia. Major competitors in lithium compounds include Sociedad Quimica y Minera de Chile S.A., Sichuan Tianqi Lithium, Jiangxi Ganfeng Lithium, Rio Tinto plc, Pilbara Minerals, Arcadium Lithium, Tesla and a large number of additional Chinese companies. Competition in the global lithium market is increasingly based on index-based market pricing and differentiated via product quality, product diversity, reliability of supply and customer service.

Raw Materials and Significant Supply Contracts

We obtain lithium: (a) by purchasing lithium concentrate from our 49%-owned joint venture, Windfield Holdings Pty. Ltd. (“Windfield”), which directly owns 100% of the equity of Talison Lithium Pty. Ltd., a company incorporated in Australia

("Talison") that owns the Greenbushes mine, and from our 50%-owned unincorporated joint venture, MARBL Lithium Joint Venture ("MARBL") in Western Australia, which owns the Wodgina hard rock lithium mine project ("Wodgina"); and (b) through solar evaporation of our ponds at the Salar de Atacama, in Chile, and in Silver Peak, Nevada. In addition, we hold mineral rights in defined areas of Kings Mountain, North Carolina with available lithium resources and we own undeveloped land with access to a lithium resource in Antofalla, within the Catamarca Province of Argentina. As necessary, we can also obtain lithium from other sources. See Item 2. Properties, for additional disclosures of our lithium mineral properties.

Specialties Segment

Our Specialties business optimizes our portfolio of bromine and highly specialized lithium solutions. Our Specialties business serves a variety of industries, including energy, mobility, connectivity, and health. Specialty products are essential in both internal combustion and electric vehicles, from high-voltage cables and powertrains to airbags and tires. We enable digital innovation focused on safety and reliability, including fire safety compounds. Our fire safety technology enables the use of plastics in high performance, high heat applications by enhancing the flame resistant properties of these materials. End market products that benefit from our fire safety technology include plastic enclosures for consumer electronics, printed circuit boards, wire and cable products, electrical connectors, textiles and foam insulation. In energy, infrastructure for renewable grid and electrified transport is enabled by our fire safety solutions. In health, our lithium specialties products are precursors for many pharmaceuticals, while bromine specialties are used to help ensure safer food and water supplies. Other bromine-based specialty chemicals products include elemental bromine, alkyl bromides, inorganic bromides, brominated powdered activated carbon and a number of bromine fine chemicals. Our value-added lithium specialties products include butyllithium and lithium aluminum hydride. We also develop and manufacture cesium products for the chemical and pharmaceutical industries, and zirconium, barium and titanium products for various pyrotechnical applications, including airbag initiators. A number of customers of our Specialties business operate in cyclical industries, including the consumer electronics and oil field industries. As a result, demand from our customers in such industries is also cyclical.

Competition

Our Specialties business serves markets in the Americas, Asia, Europe and the Middle East, each of which is highly competitive. Product performance and quality, price and contract terms are the primary factors in determining which qualified supplier is awarded a contract. R&D, product and process improvements, specialized customer services, the ability to attract and retain skilled personnel and maintenance of a good safety record have also been important factors to compete effectively in the marketplace. Our most significant competitors are Lanxess AG and Israel Chemicals Ltd, as well as producers in India and China.

Raw Materials and Significant Supply Contracts

The bromine we use is originally sourced from two locations: Arkansas and the Dead Sea. Our bromine production operations in Arkansas are supported by an active brine rights leasing program. In addition, through our 50% interest in Jordan Bromine Company Limited ("JBC"), a consolidated joint venture established in 1999 with operations in Safi, Jordan, we acquire bromine that is originally sourced from the Dead Sea. JBC processes the bromine at its facilities into a variety of end products. See Item 2. Properties, for additional disclosures for our mineral properties.

Ketjen Segment

Our three main product lines in this segment are (i) Clean Fuels Technologies ("CFT"), which is primarily composed of hydroprocessing catalysts ("HPC") together with isomerization and akylation catalysts; (ii) fluidized catalytic cracking ("FCC") catalysts and additives; and (iii) performance catalyst solutions ("PCS"), which is primarily composed of organometallics and curatives.

We offer a wide range of HPC products, which are applied throughout the oil refining industry. Their application enables the upgrading of oil fractions to clean fuels and other usable oil feedstocks and products by removing sulfur, nitrogen and other impurities from the feedstock. In addition, they improve product properties by adding hydrogen and in some cases improve the performance of downstream catalysts and processes. We continuously seek to add more value to refinery operations by offering HPC products that meet our customers' requirements for profitability and performance in the very demanding refining market.

We provide our customers with customized FCC catalyst systems, which assist in the high yield cracking of refinery petroleum streams into derivative, higher-value products such as transportation fuels and petrochemical feedstocks like propylene. Our FCC additives are used to reduce emissions of sulfur dioxide and nitrogen oxide in FCC units and to increase liquefied petroleum gas olefins yield, such as propylene, and to boost octane in gasoline. Albemarle offers unique refinery catalysts to crack and treat the lightest to the heaviest feedstocks while meeting refinery yield and product needs.

Within our PCS product line, we manufacture organometallic co-catalysts (e.g., aluminum, magnesium, and zinc alkyls) used in the manufacture of alpha-olefins (e.g., hexene, octene, decene), polyolefins (e.g., polyethylene and polypropylene), and electronics. Our curatives include a range of curing agents used in polyurethanes, epoxies and other engineered resins.

There were more than 700 refineries world-wide as of December 31, 2023. We expect to continue to see some less profitable, typically smaller, refineries shutting down and, over the long-term, being replaced by larger scale and more complex refineries, with growth concentrated in the Middle East and Asia. Oil refinery utilization continues to return to more typical rates after low refinery utilization during the COVID pandemic periods. Advances in sustainable aviation fuels, petroleum products and renewable diesel are expected to continue. We estimate that there are currently approximately 600 FCC units being operated globally, each of which requires a constant supply of FCC catalysts. In addition, we estimate that there are approximately 4,000 HPC units being operated globally, each of which typically requires replacement HPC catalysts once every one to four years.

Competition

Our Ketjen segment serves the global market including the Americas, Asia, Europe and the Middle East, each of which is highly competitive. Competition in these markets is driven by a variety of factors. Product performance and quality, price and contract terms, product and process improvements, specialized customer services, the ability to attract and retain skilled personnel, and the maintenance of a good safety record are the primary factors to compete effectively in the catalysts marketplace. In addition, through our research and development programs, we strive to differentiate our business by developing value-added products based on proprietary technologies.

Our major competitors in the CFT catalysts market include Shell Catalysts & Technologies, Advanced Refining Technologies and Haldor Topsoe. Our major competitors in the FCC catalysts market include W.R. Grace & Co., BASF Corporation and China Petrochemical Corporation (Sinopec). In the PCS market, our major competitors include Nouryon, Lanxess AG and Arxada.

Raw Materials and Significant Supply Contracts

The major raw materials we use in our Ketjen operations include sodium silicate, sodium aluminate, kaolin, aluminum, ethylene, alpha-olefins, isobutylene, toluene and metals, such as lanthanum, molybdenum, nickel and cobalt, most of which are readily available from numerous independent suppliers and are purchased or provided under contracts at prices we believe are competitive. The cost of raw materials is generally based on market prices, although we may use contracts with price caps or other tools, as appropriate, to mitigate price volatility.

Human Capital

Our main human capital management objectives are to attract, retain and develop the highest quality talent and ensure they feel safe, supported and empowered to do the best work they can do. We believe providing a diverse, equal and inclusive workplace facilitates opportunities for innovation, fosters good decision-making practices, and promotes employee engagement and high productivity across our organization.

As of December 31, 2023, we had approximately 9,000 employees, including employees of our consolidated joint ventures, of whom 3,700, or 41%, are employed in the U.S. and the Americas; 3,300, or 36%, are employed in Asia Pacific; 1,500, or 17%, are employed in Europe; and 500, or 6%, are employed in the Middle East or other areas. Approximately 26% of these employees are represented by unions or works councils. We believe that we generally have a good relationship with our employees, and with those unions and works councils.

Health and Safety

The health and safety of our employees is a part of our core values at Albemarle and is integral to how we conduct business. Our employees, contractors, and visitors follow a comprehensive set of written health and safety policies and procedures at both the corporate and local site levels. We routinely audit ourselves against our policies, procedures and standards, using internal and third-party resources. We also include health and safety metrics in our annual incentive plan for all employees to incentivize our commitment to safety. In 2023, we maintained our Occupational Safety and Health Act (“OSHA”) occupational injury and illness incident rate of 0.14 for our employees and nested contractors, the same as in 2022. In addition, we provide all employees and their dependents with access to our Employee Assistance Program, which provides free mental and behavioral health resources.

Diversity, Equity and Inclusion

Led by our Vice President, Diversity and Inclusion, we strive to develop inclusion and diversity initiatives and deliver meaningful change in our global organization. A primary focus in our recruiting efforts is to drive greater diversity in our workforce, including higher representation in the professional and managerial job categories. We want to ensure that our workplace reflects the communities in which we live and work. Our recruiting policy includes a requirement that we include individuals from gender or racial minority groups among those we interview for openings at the manager level and above.

We seek to provide employees with a desirable workplace that will enable us to attract and retain top talent. We believe employees should be compensated through wages and benefits, based on experience, expertise, performance, and the criticality of their roles in the Company. We also perform an annual review of our pay practices by gender, and in the U.S. by gender and race, to ensure that they are fair and equitable, and not influenced by biased opinions or discrimination. In addition, we have established employee groups, known as Connect groups, to promote an atmosphere of inclusion and encouragement in which every employee's voice can be heard. These Connect groups provide opportunities for employees to share their backgrounds, experiences, and beliefs, and to use them to benefit others through mentoring and volunteering in the local community, among other activities.

Investment in Talent

Investing in talent is a critical process for Albemarle because it allows us to be proactive and anticipate key organizational needs for talent and capabilities. This enables us to efficiently and effectively ensure that we have the right talent pipeline to drive Albemarle's success into the future. We also provide leadership development through performance coaching, comprehensive feedback, plant training including health, safety and environmental topics, and experiential development and mentoring. Our leadership development is a cornerstone to our talent management strategy. We also invest in our people through enhanced training and development opportunities and by seeking to foster a diverse workforce, equitable workplace and an inclusive culture that enables employees to reach their full potential. We also invest in our people through enhanced training and development opportunities and by seeking to foster a diverse workforce, equitable workplace and an inclusive culture that enables employees to reach their full potential.

Our incentive program is designed to provide incentives and rewards for achieving Albemarle's annual goals and objectives. The Executive Compensation Committee of the Board has the overall responsibility of evaluating the performance of the CEO and approving the compensation structure for senior management and other key employees. The Executive Compensation Committee determines performance goals under our incentive program annually to ensure our executive officers execute on short-term financial and strategic initiatives that drive our business strategy and long-term shareholder value.

Sales, Marketing and Distribution

We have an international strategic account program that uses cross-functional teams to serve large global customers. This program emphasizes creative strategies to improve and strengthen strategic customer relationships with emphasis on creating value for customers and promoting post-sale service. Complementing this program are regional Albemarle sales and technical personnel around the world who serve numerous additional customers globally. We also utilize commissioned sales representatives and specialists in specific market areas when necessary or required by law.

Research and Development

We believe that in order to generate revenue growth, maintain our margins and remain competitive, we must continually invest in research and development, product and process improvements and specialized customer services. Our research and development efforts support each of our business segments. The objective of our research and development efforts is to develop innovative chemistries and technologies with applications relevant within targeted key markets through both process and new product development. Through research and development, we continue to seek increased margins by introducing value-added products and proprietary processes and innovative green chemistry technologies. Our green chemistry efforts focus on the development of products in a manner that minimizes waste and the use of raw materials and energy, avoids the use of toxic reagents and solvents and utilizes safe, environmentally friendly manufacturing processes. Green chemistry is encouraged with our researchers through periodic focus group discussions and special rewards and recognition for outstanding new green developments.

Intellectual Property

Our intellectual property, including our patents, licenses and trade names, is an important component of our business. As of December 31, 2023, we owned more than 1,600 active patents and more than 550 pending patent applications in key strategic markets worldwide. We also have acquired rights under patents and inventions of others through licenses, and we license certain patents and inventions to third parties.

Regulation

Our business is subject to a broad array of employee health and safety laws and regulations, including those under the OSHA. We also are subject to similar state laws and regulations as well as local laws and regulations for our non-U.S. operations. We devote significant resources and have developed and implemented comprehensive programs to promote the health and safety of our employees, and we maintain an active health, safety and environmental program. We finished 2023 with an OSHA occupational injury and illness incident rate of 0.14 for Albemarle employees and nested contractors, compared to 0.14 in 2022.

Our business and our customers are subject to significant requirements under the European Community Regulation for the Registration, Evaluation, Authorization and Restriction of Chemicals (“REACH”). REACH imposes obligations on European Union manufacturers and importers of chemicals and other products into the European Union to compile and file comprehensive reports, including testing data, on each chemical substance, and perform chemical safety assessments. Additionally, substances of high concern, as defined under REACH, are subject to an authorization process. Authorization may result in restrictions in the use of products by application or even banning the product. REACH regulations impose significant additional responsibilities on chemical producers, importers, downstream users of chemical substances and preparations, and the entire supply chain. Our significant manufacturing presence and sales activities in the European Union require significant compliance costs and may result in increases in the costs of raw materials we purchase and the products we sell. Increases in the costs of our products could result in a decrease in their overall demand; additionally, customers may seek products with lower regulatory compliance requirements, which could also result in a decrease in the demand of certain products subject to the REACH regulations.

The Toxic Substances Control Act (“TSCA”), as amended in June 2016, requires chemicals to be assessed against a risk-based safety standard and calls for the elimination of unreasonable risks identified during risk evaluation. This regulation and other pending initiatives at the U.S. state level, as well as initiatives in Canada, Asia and other regions, will potentially require toxicological testing and risk assessments of a wide variety of chemicals, including chemicals used or produced by us. These assessments may result in heightened concerns about the chemicals involved and additional requirements being placed on the production, handling, labeling or use of the subject chemicals. Such concerns and additional requirements could also increase the cost incurred by our customers to use our chemical products and otherwise limit the use of these products, which could lead to a decrease in demand for these products.

Historically, there has been scrutiny of certain brominated fire safety solutions by regulatory authorities, legislative bodies and environmental interest groups in various countries. We manufacture a broad range of brominated fire safety solution products, which are used in a variety of applications. Concern about the impact of some of our products on human health or the environment may lead to regulation or reaction in our markets independent of regulation.

Environmental Regulation

We are subject to numerous foreign, federal, state and local environmental laws and regulations, including those governing the discharge of pollutants into the air and water, the management and disposal of hazardous substances and wastes and the cleanup of contaminated properties. Ongoing compliance with such laws and regulations is an important consideration for us. Key aspects of our operations are subject to these laws and regulations. In addition, we incur substantial capital and operating costs in our efforts to comply with them.

We use and generate hazardous substances and wastes in our operations and may become subject to claims for personal injury and/or property damage relating to the release of such substances into the environment. In addition, some of our current properties are, or have been, used for industrial purposes, which could contain currently unknown contamination that could expose us to governmental requirements or claims relating to environmental remediation, personal injury and/or property damage. Liabilities associated with the investigation and cleanup of hazardous substances, as well as personal injury, property damages or natural resource damages arising from the release of, or exposure to, such hazardous substances, may be imposed in many situations without regard to violations of laws or regulations or other fault, and may also be imposed jointly and severally (so that a responsible party may be held liable for more than its share of the losses involved, or even the entire loss). Such liabilities also may be imposed on many different entities with a relationship to the hazardous substances at issue, including, for example, entities that formerly owned or operated the property affected by the hazardous substances and entities that arranged for the disposal of the hazardous substances at the affected property, as well as entities that currently own or operate such property. We are subject to such laws, including the federal Comprehensive Environmental Response, Compensation and Liability Act, commonly known as CERCLA or Superfund, in the U.S., and similar foreign and state laws. We may have liability as a potentially responsible party ("PRP") with respect to active off-site locations under CERCLA or state equivalents. We have sought to resolve our liability as a PRP at these sites through indemnification by third parties and settlements, which would provide for payment of our allocable share of remediation costs. Because the cleanup costs are estimates and are subject to revision as more information becomes available about the extent of remediation required, and in some cases we have asserted a defense to any liability, our estimates could change. Moreover, liability under CERCLA and equivalent state statutes may be joint and several, which could require us to pay in excess of our pro rata share of remediation costs. Our understanding of the financial strength of other PRPs has been considered, where appropriate, in estimating our liabilities. Accruals for these matters are included in the environmental reserve. Our management is actively involved in evaluating environmental matters and, based on information currently available to us, we have concluded that our outstanding environmental liabilities for unresolved waste sites currently known to us should not have a material effect on our operations.

See "Safety and Environmental Matters" in Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations for further details.

Climate Change and Natural Resources

The growing concerns about climate change and the related increasingly stringent regulations may provide us with new or expanded business opportunities. We provide solutions to companies pursuing alternative fuel products and technologies (such as renewable fuels), emission control technologies (including mercury emissions), alternative transportation vehicles and energy storage technologies and other similar solutions. As demand for, and legislation mandating or incentivizing the use of, alternative fuel technologies that limit or eliminate greenhouse gas emissions increase, we continue to monitor the market and offer solutions where we have appropriate technology and believe we are well positioned to take advantage of opportunities that may arise from such demand or legislation.

In addition to potential business opportunities, we acknowledge our responsibility to address the impact of our operations on the environment. We are investing in technology and people to reduce energy consumption, greenhouse gas emissions and air emissions. Albemarle supports the goals of the Paris Agreement to avoid climate change by limiting global warming. Our ambition is to achieve net-zero carbon emissions by 2050. We have established greenhouse gas emission targets for each of our businesses, including reducing the scope 1 and 2 carbon-intensity of our Specialties and Ketjen businesses by 35% by 2030, and growing our Energy Storage business in a carbon-intensity neutral manner through 2030. In 2022, we introduced a goal to reduce 90% of our sulfur oxide (SO_x) emissions by 2027.

Water is a critical input to Albemarle's production operations. As water is a scarce resource, we understand the need to responsibly manage our water consumption not only for the preservation of the environment, but also for the viability of our local communities. We are investing in new process technologies to reduce our water footprint and expand capacity sustainably in locations with high water risk. Our goal is to reduce our intensity of freshwater usage by 25% by 2030 in areas of high or extremely high water risk as defined by the World Resources Institute, such as Chile and Jordan.

Our businesses are dependent on the availability and responsible management of natural resources. We manage our natural resources to operate efficiently and preserve the environment for our local communities and the world. Our natural resource management includes mineral resource transparency with local communities, governments, regulators and other key stakeholders, as well as partnering with the Initiative for Responsible Mining Assurance for our lithium production for the assurance of responsible mining. We attempt to maximize the recovery of our extracted minerals and recycle or reuse by-products where possible. In addition, we work with local communities, regulatory agencies and wildlife organizations to preserve and restore land and biodiversity before, during and after all operations commence.

Recent Acquisitions, Joint Ventures and Divestitures

During recent years, we have devoted resources to acquisitions and joint ventures, including the subsequent integration of acquired businesses. These acquisitions and joint ventures have expanded our base business, provided our customers with a wider array of products and presented new alternatives for discovery through additional chemistries. In addition, we have pursued opportunities to divest businesses that do not fit our high priority business growth profile. The following is a summary of our significant acquisitions, joint ventures and divestitures over the last three years.

On October 18, 2023, the Company closed on the restructuring of the MARBL joint venture with Mineral Resources Limited ("MRL"). Under the amended agreements, Albemarle acquired the remaining 40% ownership of the Kemerton lithium hydroxide processing facility in Australia that was jointly owned with MRL through the MARBL joint venture. Following this restructuring, Albemarle and MRL each own 50% of Wodgina, and MRL operates the Wodgina mine on behalf of the joint venture. During the fourth quarter of 2023, Albemarle paid MRL approximately $380 million in cash, which includes

$180 million of consideration for the remaining ownership of Kemerton as well as a payment for the economic effective date of the transaction being retroactive to April 1, 2022.

On October 25, 2022, the Company completed the acquisition of all of the outstanding equity of Guangxi Tianyuan New Energy Materials Co., Ltd. (“Qinzhou”), for approximately $200 million in cash. Qinzhou’s operations include a recently constructed lithium processing plant strategically positioned near the Port of Qinzhou in Guangxi, which began commercial production in the first half of 2022. The plant has a designed annual conversion capacity of up to 25,000 metric tons of lithium carbonate equivalent (“LCE”) and produces battery-grade lithium carbonate and lithium hydroxide.

On June 1, 2021, we completed the sale of our fine chemistry services (“FCS”) business to W. R. Grace & Co. (“Grace”) for proceeds of approximately $570 million, consisting of $300 million in cash and the issuance to Albemarle of preferred equity of a Grace subsidiary having an aggregate stated value of $270 million. As part of the transaction, Grace acquired our manufacturing facilities located in South Haven, Michigan and Tyrone, Pennsylvania.

These transactions reflect our commitment to investing in future growth of our high priority businesses, maintaining leverage flexibility and returning capital to our shareholders.

Available Information

Our website address is *www.albemarle.com*. We make available free of charge through our website our Annual Report on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended (“Exchange Act”), as well as beneficial ownership reports on Forms 3, 4 and 5 filed pursuant to Section 16 of the Exchange Act, as soon as reasonably practicable after such documents are electronically filed with, or furnished to, the Securities and Exchange Commission (“SEC”). The information on our website is not, and shall not be deemed to be, a part of this report or incorporated into any other filings we make with the SEC. The SEC also maintains a website at *www.sec.gov* that contains reports, proxy statements and other information regarding SEC registrants, including Albemarle.

Our Corporate Governance Guidelines, Code of Conduct and the charters of the Audit and Finance, Capital Investment, Sustainability, Safety and Public Policy, Executive Compensation and Talent Development, and Nominating and Governance Committees of our Board of Directors are also available on our website and are available in print to any shareholder upon request by writing to Investor Relations, 4250 Congress Street, Suite 900, Charlotte, North Carolina 28209, or by calling (980) 299-5700.

Item 1A. Risk Factors.

Risk Factor Summary

The following is a summary of some of the principal risks that could adversely affect our business, financial condition or results of operations. This summary should be read together with the more detailed description of each risk contained below.

Risks Related to Our Business

- Our substantial international operations subject us to risks of doing business in foreign countries, which could adversely affect our business, financial condition and results of operations.
- Our inability to secure key raw materials, or to pass through increases in costs and expenses for other raw materials and energy, on a timely basis or at all, including due to climate change, could have an adverse effect on the margins of our products and our results of operations.
- Competition within our industry may place downward pressure on the prices and margins of our products and may adversely affect our businesses and results of operations.
- Our research and development efforts may not succeed in addressing changes in our customers’ needs, and our competitors may develop more effective or successful products.
- The development of non-lithium battery technologies could adversely affect us.
- Downturns in our customers’ industries, many of which are cyclical, could adversely affect our sales and profitability.
- Our results are subject to fluctuation because of irregularities in the demand for our HPC catalysts and certain of our agrichemicals.
- Regulation, or the threat of regulation, of some of our products could have an adverse effect on our sales and profitability.

- We could be subject to damages based on claims brought against us by our customers or lose customers as a result of the failure of our products to meet certain quality specifications.
- Our business is subject to hazards common to chemical and natural resource extraction businesses, any of which could injure our employees or other persons, damage our facilities or other properties, interrupt our production and adversely affect our reputation and results of operations.
- Our business could be adversely affected by environmental, health and safety laws and regulations.
- We may be subject to indemnity claims and liable for other payments relating to properties or businesses we have divested.
- We could be adversely affected by violations of the U.S. Foreign Corrupt Practices Act and similar foreign anti-corruption laws, and in the past have paid fines in order to resolve self-reported potential violations of such laws.
- We are subject to extensive foreign government regulation that can negatively impact our business.
- Our inability to protect our intellectual property rights, or being accused of infringing on intellectual property rights of third parties, could have a material adverse effect on our business, financial condition and results of operations.
- Our inability to acquire or develop additional lithium reserves that are economically viable could have a material adverse effect on our future profitability.
- There is risk to the growth of lithium markets.
- Demand and market prices for lithium will greatly affect the value of our investment in our lithium resources and our revenues and profitability generally.
- If we are unable to retain key personnel or attract new skilled personnel, it could have an adverse effect on our business.
- Some of our employees are unionized, represented by works councils or are employed subject to local laws that are less favorable to employers than the laws of the U.S.
- Our joint ventures may not operate according to their business plans if our partners fail to fulfill their obligations, which may adversely affect our results of operations and may force us to dedicate additional resources to these joint ventures.

Risks Related to Our Financial Condition

- Our required capital expenditures can be complex, may experience delays or other difficulties, and the costs may exceed our estimates.
- We will need a significant amount of cash to service our indebtedness and our ability to generate cash depends on many factors beyond our control.
- Because a significant portion of our operations is conducted through our subsidiaries and joint ventures, our ability to service our debt may be dependent on our receipt of distributions or other payments from our subsidiaries and joint ventures.
- Restrictive covenants in our debt instruments may adversely affect our business.
- Changes in credit ratings issued by nationally recognized statistical rating organizations could adversely affect our cost of financing, the market price of our securities and our debt service obligations.
- We are exposed to fluctuations in currency exchange rates, which may adversely affect our operating results and net income.
- Significant or prolonged periods of higher interest rates may have an adverse effect on our results of operations, financial condition and cash flows.
- Inflationary trends in the price of our input costs, such as raw materials, transportation and energy, could adversely affect our business and financial results.
- Changes in, or the interpretation of, tax legislation or rates throughout the world could materially impact our results.
- Future events may impact our deferred tax asset position and U.S. deferred federal income taxes on undistributed earnings of international affiliates that are considered to be indefinitely reinvested.
- Our business and financial results may be adversely affected by various legal and regulatory proceedings.
- Although our pension plans currently meet minimum funding requirements, events could occur that would require us to make significant contributions to the plans and reduce the cash available for our business.
- We may not be able to consummate future acquisitions or integrate acquisitions into our business, which could result in unanticipated expenses and losses.

- We may continue to expand our business through acquisitions and we may incur additional indebtedness, including indebtedness related to acquisitions.
- If our goodwill, intangible assets or long-lived assets become impaired, we may be required to record a significant charge to earnings.

General Risk Factors

- Adverse conditions in the economy, and volatility and disruption of financial markets can negatively impact our customers, suppliers and other business partners and therefore have a material adverse effect on our business and results of operations.
- Our business and operations could suffer in the event of cybersecurity breaches, information technology system failures, or network disruptions.
- The occurrence or threat of extraordinary events, including domestic and international terrorist attacks, may disrupt our operations and decrease demand for our products.
- National or international disputes, political instability, terrorism war or armed hostilities, could impact our results of operations.
- Natural disasters or other unanticipated catastrophes could impact our operations and could have a material adverse effect on our results of operations, financial position, and cash flows.
- Our insurance may not fully cover all potential exposures.
- We may be exposed to certain regulatory and financial risks related to climate change.
- Failure to meet environmental, social and governance (“ESG”) expectations or standards or achieve our ESG goals could adversely affect our business, results of operations, financial condition, or stock price.

Risk Factors

You should consider carefully the following risks when reading the information, including the financial information, contained in this Annual Report on Form 10-K.

Risks Related to Our Business

Our substantial international operations subject us to risks of doing business in foreign countries, which could adversely affect our business, financial condition and results of operations.

We conduct a substantial portion of our business outside the U.S., with approximately 90% of our net sales to foreign countries. We operate and/or sell our products to customers in approximately 70 countries. We currently have many production, research and development and administrative facilities as well as sales offices located outside the U.S., as detailed in Item 2. Properties. Accordingly, our business is subject to risks related to the differing legal, political, social and regulatory requirements and economic conditions of many jurisdictions. Risks inherent in international operations include the following:

- fluctuations in foreign currency exchange rates may affect product demand and may adversely affect the profitability in U.S. dollars of products and services we provide in international markets where payment for our products and services is made in the local currency;
- transportation and other shipping costs may increase, or transportation may be inhibited;
- increased cost or decreased availability of raw materials;
- increased regulations on, or reduced access to, scarce resources, such as freshwater;
- changes in foreign laws and tax rates or U.S. laws and tax rates with respect to foreign income may unexpectedly increase the rate at which our income is taxed, impose new and additional taxes on remittances, repatriation or other payments by subsidiaries, or cause the loss of previously recorded tax benefits;
- foreign countries in which we do business may adopt other restrictions on foreign trade or investment, including currency exchange controls;
- trade sanctions by or against foreign countries in which we do business could result in our losing access to customers and suppliers in those countries;
- unexpected adverse changes in foreign laws or regulatory requirements may occur;
- our agreements with counterparties in foreign countries may be difficult for us to enforce and related receivables may be difficult for us to collect;
- compliance with the variety of foreign laws and regulations may be unduly burdensome;

- compliance with anti-bribery and anti-corruption laws (such as the Foreign Corrupt Practices Act) as well as anti-money-laundering laws may be costly;
- compliance with changing cybersecurity rules and evolving data privacy rules and regulation, such as the European Union's General Data Protection Regulation, could increase our cost of doing business;
- unexpected adverse changes in export duties, quotas and tariffs and difficulties in obtaining export licenses may occur;
- general economic conditions in the countries in which we operate could have an adverse effect on our earnings from operations in those countries;
- our foreign operations may experience staffing difficulties and labor disputes;
- termination or substantial modification of international trade agreements may adversely affect our access to raw materials and to markets for our products outside the U.S.;
- foreign governments may nationalize or expropriate private enterprises;
- increased sovereign risk (such as default by or deterioration in the economies and credit worthiness of local governments) may occur; and
- political or economic repercussions from terrorist activities, including the possibility of hyperinflationary conditions and political instability, may occur in certain countries in which we do business.

In addition, certain of our operations and ongoing capital projects are in regions of the world such as Asia, the Middle East and South America that are of high risk due to significant civil, political and security instability. Unanticipated events, such as geopolitical changes, could result in a write-down of our investment in the affected joint venture or a delay or cause cancellation of those capital projects, which could negatively impact our future growth and profitability. Our success as a global business will depend, in part, upon our ability to succeed in differing legal, regulatory, economic, social and political conditions by developing, implementing and maintaining policies and strategies that are effective in each location where we and our joint ventures do business.

Furthermore, we are subject to rules and regulations related to anti-bribery and antitrust prohibitions of the U.S. and other countries, as well as export controls and economic embargoes, violations of which may carry substantial penalties. For example, export control and economic embargo regulations limit the ability of our subsidiaries to market, sell, distribute or otherwise transfer their products or technology to prohibited countries or persons. Failure to comply with these regulations could subject us or our subsidiaries to fines and enforcement actions and/or have an adverse effect on our reputation and the value of our common stock. Relating to anti-bribery prohibitions, in September 2023, we finalized agreements with regulatory agencies to resolve self-reported potential violations of the U.S. Foreign Corrupt Practices Act; see "*We could be adversely affected by violations of the U.S. Foreign Corrupt Practices Act and similar foreign anti-corruption laws.*" below.

Because we conduct substantial operations in China, risks associated with regulatory activity and political and social events in China could negatively affect our business and operating results.

In 2023, net sales shipped to China represented 30% of our total net sales. Additionally, we own three production facilities located in China and are in the process of commissioning and starting up a lithium conversion plant in Meishan, China. In addition to the risks described above under "*Our substantial international operations subject us to risks of doing business in foreign countries, which could adversely affect our business, financial condition and results of operations.*", our operations in China expose us to risks particular to conducting business in that country. For example, over the past several years the U.S. and China have applied tariffs to certain of each other's exports, which have resulted in shifting trade flows and restrictions on certain sales of goods into China. Additionally, geopolitical disputes (including as a result of China-Taiwan and U.S.-Taiwan relations) between the U.S. and China may lead to further restrictions on trade and/or obstacles to conducting business in China. Recently, Australia and China have attempted to improve relations and resolve trade disputes. As we ship a significant portion of our lithium from Australia into China for further processing, tensions or a breakdown in relations between the countries could have a material impact on our operations. Furthermore, the Chinese government has, from time to time, curtailed manufacturing operations, with little or no notice, in industrial regions out of growing concern over air quality and in response to COVID-19 outbreaks. The Chinese government has also instituted energy intensity and energy consumption targets in a number of provinces in its efforts to reduce energy consumption, resulting in energy quotas and shortages in energy supply that can be disruptive to construction and manufacturing operations. These and other risks may have an adverse effect on our sales to Chinese customers and/or result in our not realizing a return on, or losing some, or all, of our strategic investments in China.

In December 2021, the United States adopted the Uyghur Forced Labor Prevention Act ("UFLPA") which creates a rebuttable presumption that any goods, wares, articles, and merchandise mined, produced, or manufactured in whole or in part in the Xinjiang Uyghur Administrative Region of China or that are produced by certain entities are prohibited from importation into the United States and are not entitled to entry. These import restrictions came into effect on June 21, 2022. While we are not presently aware of any direct impacts these restrictions will have on its supply chain, the UFLPA may materially and negatively impact our ability to import the goods and products we rely on to manufacture our products and operate our business.

Our inability to secure key raw materials, or to pass through increases in costs and expenses for other raw materials and energy, on a timely basis or at all, including due to climate change, could have an adverse effect on the margins of our products and our results of operations.

The long-term profitability of our operations will, in part, depend on our ability to continue to economically obtain resources, including energy and raw materials. For example, our lithium and bromine businesses rely upon our continued ability to produce, or otherwise obtain, lithium and bromine of sufficient quality and in adequate amounts to meet our customers' demand. If we fail to secure and retain the rights to continue to access these key raw materials, we may have to restrict or suspend our operations that rely upon these key resources, which could harm our business, results of operations and financial condition. In addition, in some cases access to these raw materials by us and our competitors is subject to decisions or actions by governmental authorities, which could adversely impact us. Furthermore, other raw material and energy costs account for a significant percentage of our total costs of products sold, even if they can be obtained on commercially reasonable terms. Our raw material and energy costs can be volatile and may increase significantly. Increases are primarily driven by tightening of market conditions and major increases in the pricing of key constituent materials for our products such as crude oil, chlorine and metals (including molybdenum and rare earths, which are used in the refinery catalysts business). We generally attempt to pass through changes in the prices of raw materials and energy to our customers, but we may be unable to do so (or may be delayed in doing so). In addition, raising prices we charge to our customers in order to offset increases in the prices we pay for raw materials could cause us to suffer a loss of sales volumes. Our inability to efficiently and effectively pass through price increases, or inventory impacts resulting from price volatility, could adversely affect our margins.

Competition within our industry may place downward pressure on the prices and margins of our products and may adversely affect our businesses and results of operations.

We compete against a number of highly competitive global specialty chemical producers. Competition is based on several key criteria, including product performance and quality, product price, product availability and security of supply, climate-related performance and responsiveness of product development in cooperation with customers and customer service. Some of our competitors are larger than we are and may have greater financial resources. These competitors may also be able to maintain significantly greater operating and financial flexibility. As a result, these competitors may be better able to withstand changes in conditions within our industry. Competitors' pricing decisions could compel us to decrease our prices, which could negatively affect our margins and profitability. Our ability to maintain or increase our profitability is, and will continue to be, dependent upon our ability to offset decreases in the prices and margins of our products by improving production efficiency and volume and other productivity enhancements, shifting to production of higher margin chemical products and improving existing products through innovation and research and development. If we are unable to do so or to otherwise maintain our competitive position, we could lose market share to our competitors.

In addition, Albemarle's brands, product image and trademarks represent the unique product identity of each of our products and are important symbols of the Company's reputation. Accordingly, the performance of our business could be adversely affected by any marketing and promotional materials used by our competitors that make adverse claims, whether with or without merit, against our Company or its products, imply or assert immoral or improper conduct by us, or are otherwise disparaging of our Company or its products. Further, our own actions could hurt such brands, product image and trademarks if our products underperform or we otherwise draw negative publicity.

Our research and development efforts may not succeed in addressing changes in our customers' needs, and our competitors may develop more effective or successful products.

Our industries and the end markets into which we sell our products experience technological change and product improvement. Manufacturers periodically introduce new products or require new technological capacity to develop customized products. Our future growth depends on our ability to gauge the direction of the commercial and technological progress in all key end markets in which we sell our products and upon our ability to fund and successfully develop, manufacture and market products in such changing end markets. As a result, we must commit substantial resources each year to research and development. There is no assurance that we will be able to continue to identify, develop, market and, in certain cases, secure regulatory approval for innovative products in a timely manner or at all, as may be required to replace or enhance existing products, and any such inability could have a material adverse effect on our profit margins and our competitive position.

In addition, our customers use our specialty chemicals for a broad range of applications. Changes in our customers' products or processes may enable our customers to reduce consumption of the specialty chemicals that we produce or make our specialty chemicals unnecessary. Customers may also find alternative materials or processes that do not require our products. Should a customer decide to use a different material due to price, performance or other considerations, we may not be able to supply a product that meets the customer's new requirements. Consequently, it is important that we develop new products to replace the sales of products that mature and decline in use. Our business, results of operations, cash flows and margins could be materially adversely affected if we are unable to manage successfully the maturation of our existing products and the introduction of new products.

Despite our efforts, we may not be successful in developing new products and/or technology, either alone or with third parties, or licensing intellectual property rights from third parties on a commercially competitive basis. Our new products may not be accepted by our customers or may fail to receive regulatory approval. Moreover, new products may have lower margins than the products they replace. Furthermore, ongoing investments in research and development for the future do not yield an immediate beneficial impact on our operating results and therefore could result in higher costs without a proportional increase in revenues.

The development of non-lithium battery technologies could adversely affect us.

The development and adoption of new battery technologies that rely on inputs other than lithium compounds could significantly impact our prospects and future revenues. Current and next generation high energy density batteries for use in electric vehicles rely on lithium compounds as a critical input. Alternative materials and technologies are being researched with the goal of making batteries lighter, more efficient, faster charging and less expensive, and some of these could be less reliant on lithium compounds. We cannot predict which new technologies may ultimately prove to be commercially viable and on what time horizon. Commercialized battery technologies that use no, or significantly less, lithium could materially and adversely impact our prospects and future revenues.

Downturns in our customers' industries, many of which are cyclical, could adversely affect our sales and profitability.

Downturns in the businesses that use our specialty chemicals may adversely affect our sales. Many of our customers are in industries, including the electronics, building and construction, oilfield and automotive industries, are cyclical in nature, or which are subject to secular market downturns or may face adverse effects of evolving regulatory regimes. Historically, cyclical or secular industry downturns have resulted in diminished demand for our products, excess manufacturing capacity and lower average selling prices, and we may experience similar problems in the future. Additionally, certain of these industries are subject to regulatory schemes that may shift with changes in the political climate. The results of elections in the United States (including the November 2024 presidential election) or other countries in which our customers are located may result in consequent changes to these regulatory regimes that could cause a decline within these industries, leading to a diminished demand for our products. A decline in our customers' industries may have a material adverse effect on our sales and profitability.

Our results are subject to fluctuation because of irregularities in the demand for our HPC catalysts and certain of our agrichemicals.

Our HPC catalysts are used by petroleum refiners in their processing units to reduce the quantity of sulfur and other impurities in petroleum products. The effectiveness of HPC catalysts diminishes with use, requiring the HPC catalysts to be replaced, on average, once every one to four years. The sales of our HPC catalysts, therefore, are largely dependent on the useful life cycle of the HPC catalysts in the processing units and may vary materially by quarter. In addition, the timing and profitability of HPC catalysts sales can have a significant impact on revenue and profit in any one quarter. Sales of our agrichemicals are also subject to fluctuation as demand varies depending on climate and other environmental conditions, which may prevent or reduce farming for extended periods. In addition, crop pricing and the timing of when farms alternate from one crop to another crop in a particular year can also alter sales of agrichemicals.

Regulation, or the threat of regulation, of some of our products could have an adverse effect on our sales and profitability.

We manufacture or market a number of products that are or have been the subject of attention by regulatory authorities and environmental interest groups. For example, over the past decade, there has been increasing scrutiny of certain brominated fire safety solutions by regulatory authorities, legislative bodies and environmental interest groups in various countries. We manufacture a broad range of brominated fire safety solution products, which are used in a variety of applications to protect people, property and the environment from injury and damage caused by fire. Concern about the impact of some of our products on human health or the environment may lead to regulation, or reaction in our markets independent of regulation, that could reduce or eliminate markets for such products.

Agencies in the European Union ("E.U.") continue to evaluate the risks to human health and the environment associated with certain brominated fire safety solutions such as tetrabromobisphenol A and decabromodiphenylethane, both of which we manufacture. Additional government regulations, including limitations or bans on the use of brominated flame retardants, could result in a decline in our net sales of brominated fire safety solutions and have an adverse effect on our sales and profitability. In addition, the threat of additional regulation or concern about the impact of brominated fire safety solutions on human health or the environment could lead to a negative reaction in our markets that could reduce or eliminate our markets for these products, which could have an adverse effect on our sales and profitability.

Our business and our customers are subject to significant requirements under REACH, which imposes obligations on E.U. manufacturers and importers of chemicals and other products into the E.U. to compile and file comprehensive reports, including testing data, on each chemical substance, and perform chemical safety assessments. Additionally, substances of high concern, as defined under REACH, are subject to an authorization process, which may result in restrictions in the use of products by application or even banning the product. REACH regulations impose significant additional burdens on chemical producers, importers, downstream users of chemical substances and preparations, and the entire supply chain. See "Regulation" in Item 1. Business. Our significant manufacturing presence and sales activities in the E.U. require significant compliance costs and may result in increases in the costs of raw materials we purchase and the products we sell. Increases in the costs of our products could result in a decrease in their overall demand; additionally, customers may seek products with lower regulatory compliance requirements, which could also result in a decrease in the demand of certain products subject to the REACH regulations.

The TSCA requires chemicals to be assessed against a risk-based safety standard and calling for the elimination of unreasonable risks identified during risk evaluation. This regulation and other pending initiatives at the U.S. state level, as well as initiatives in Canada, Asia and other regions, could potentially require toxicological testing and risk assessments of a wide variety of chemicals, including chemicals used or produced by us. These assessments may result in heightened concerns about the chemicals involved and additional requirements being placed on the production, handling, labeling or use of the subject chemicals. Such concerns and additional requirements could also increase the cost incurred by our customers to use our chemical products and otherwise limit the use of these products, which could lead to a decrease in demand for these products. Such a decrease in demand could have an adverse impact on our business and results of operations.

We could be subject to damages based on claims brought against us by our customers or lose customers as a result of the failure of our products to meet certain quality specifications.

Our products enable important performance attributes to our customers' products. If a product fails to perform in a manner consistent with quality specifications or has a shorter useful life than guaranteed, a customer of ours could seek the replacement of the product or damages for costs incurred as a result of the product failing to perform as guaranteed. These risks apply to our refinery catalysts in particular because, in certain instances, we sell our refinery catalysts under agreements that contain limited performance and life cycle guarantees. Also, because many of our products are integrated into our customers' products, we may be requested to participate in, or fund in whole or in part the costs of, a product recall conducted by a customer. For example, some of our businesses supply products to customers in the automotive industry. In the event one of these customers conducts a product recall that it believes is related to one of our products, we may be asked to participate in, or fund in whole or in part, such a recall.

Our customers often require our subsidiaries to represent that our products conform to certain product specifications provided by our customers. Any failure to comply with such specifications could result in claims or legal action against us.

A successful claim or series of claims against us could have a material adverse effect on our financial condition and results of operations and could result in our loss of one or more customers.

Our business is subject to hazards common to chemical and natural resource extraction businesses, any of which could injure our employees or other persons, damage our facilities or other properties, interrupt our production and adversely affect our reputation and results of operations.

Our business is subject to hazards common to chemical manufacturing, storage, handling and transportation, as well as natural resource extraction, including explosions, fires, severe weather, natural disasters, mechanical failure, unscheduled downtime, transportation interruptions, remediation, chemical spills, discharges or releases of toxic or hazardous substances or gases and other risks. These hazards can cause personal injury and loss of life to our employees and other persons, severe damage to, or destruction of, property and equipment and environmental contamination. In addition, the occurrence of disruptions, shutdowns or other material operating problems at our facilities due to any of these hazards may diminish our ability to meet our output goals. Accordingly, these hazards and their consequences could adversely affect our reputation and have a material adverse effect on our operations as a whole, including our results of operations and cash flows, both during and after the period of operational difficulties.

Our business could be adversely affected by environmental, health and safety laws and regulations.

The nature of our business, including historical operations at our current and former facilities, exposes us to risks of liability under environmental laws and regulations due to the production, storage, use, transportation and sale of materials that can cause contamination or personal injury if released into the environment. In the jurisdictions in which we operate, we are subject to numerous U.S. and non-U.S. national, federal, state and local environmental, health and safety laws and regulations, including those governing the discharge of pollutants into the air and water, the management and disposal of hazardous substances and wastes and the cleanup of contaminated properties. We currently use, and in the past have used, hazardous substances at many of our facilities, and we have in the past been, and may in the future be, subject to claims relating to exposure to hazardous materials. We also have generated, and continue to generate, hazardous wastes at a number of our facilities. Some of our facilities also have lengthy histories of manufacturing or other activities that may have resulted in site contamination. Liabilities associated with the investigation and cleanup of hazardous substances, as well as personal injury, property damages or natural resource damages arising from the release of, or exposure to, such hazardous substances, may be imposed in many situations without regard to violations of laws or regulations or other fault, and may also be imposed jointly and severally (so that a responsible party may be held liable for more than its share of the losses involved, or even the entire loss). Such liabilities may also be imposed on many different entities, including, for example, current and prior property owners or operators, as well as entities that arranged for the disposal of the hazardous substances. Such liabilities may be material and can be difficult to identify or quantify.

Further, some of the raw materials we handle are subject to government regulation. These regulations affect the manufacturing processes, handling, uses and applications of our products. In addition, our production facilities and a number of our distribution centers require numerous operating permits. Due to the nature of these requirements and changes in our operations, our operations may exceed limits under permits or we may not have the proper permits to conduct our operations. Ongoing compliance with such laws, regulations and permits is an important consideration for us and we incur substantial capital and operating costs in our compliance efforts.

Compliance with environmental laws generally increases the costs of manufacturing, registration/approval requirements, transportation and storage of raw materials and finished products, and storage and disposal of wastes, and could have a material adverse effect on our results of operations. For example, we may be subject to carbon pricing or taxation proposals in some jurisdictions where we operate. We may incur substantial costs, including fines, damages, criminal or civil sanctions and remediation costs, or experience interruptions in our operations, for violations arising under these laws or permit requirements. Additional information may arise in the future concerning the nature or extent of our liability with respect to identified sites, and additional sites may be identified for which we are alleged to be liable, that could cause us to materially increase our environmental accrual or the upper range of the costs we believe we could reasonably incur for such matters. Furthermore, environmental laws are subject to change and have become increasingly stringent in recent years. We expect this trend to continue and to require materially increased capital expenditures and operating and compliance costs.

We may be subject to indemnity claims and liable for other payments relating to properties or businesses we have divested.

In connection with the sale of certain properties and businesses, we have agreed to indemnify the purchasers of such properties for certain types of matters, such as certain breaches of representations and warranties, taxes and certain environmental matters. With respect to environmental matters, the discovery of contamination arising from properties that we have divested may expose us to indemnity obligations under the sale agreements with the buyers of such properties or cleanup obligations and other damages under applicable environmental laws. We may not have insurance coverage for such indemnity obligations or cash flows to make such indemnity or other payments. Further, we cannot predict the nature of and the amount of any indemnity or other obligations we may have to the applicable purchaser. Such payments may be costly and may adversely affect our financial condition and results of operations. For example, in 2021, we agreed to pay $665 million to settle claims related to a legacy Rockwood Holdings, Inc. (“Rockwood”) business sold to a third party prior to our acquisition of Rockwood in 2015.

At several of our properties where hazardous substances are known to exist (including some sites where hazardous substances are being investigated or remediated), we believe we are entitled to contractual indemnification from one or more former owners or operators; however, in the event we make a claim, the indemnifier may disagree with us regarding, or not have the financial capacity to fulfill, its indemnity obligation. If our contractual indemnity is not upheld or effective, our accrual and/or our costs for the investigation and cleanup of hazardous substances could increase materially.

We could be adversely affected by violations of the U.S. Foreign Corrupt Practices Act and similar foreign anti-corruption laws, and in the past have paid fines in order to resolve self-reported potential violations of such laws.

The U.S. Foreign Corrupt Practices Act (the “FCPA”) and similar foreign anti-corruption laws in other jurisdictions around the world generally prohibit companies and their intermediaries from making improper payments or providing anything of value to non-U.S. government officials for the purpose of obtaining or retaining business or securing an unfair advantage. We operate in some parts of the world that have experienced governmental corruption to some degree, and, in certain circumstances, strict compliance with anti-bribery laws may conflict with local customs and practices. Although we have established formal policies or procedures for prohibiting or monitoring this conduct, we cannot assure you that our employees or other agents will not engage in such conduct for which we might be held responsible. In the event that we believe or have reason to believe that our employees, agents or distributors have or may have violated applicable anti-corruption laws, including the FCPA, we may be required to investigate or have outside counsel investigate the relevant facts and circumstances, which can be expensive and require significant time and attention from senior management. If we are found to be liable for violations of the FCPA or other applicable anti-corruption laws (either due to our own acts or our inadvertence, or due to the acts or inadvertence of others, including employees of our joint ventures), we could suffer from civil and criminal penalties or other sanctions, which could have a material adverse effect on our business and results of operations.

In September 2023, following an internal investigation and voluntary self-reporting of potential violations of the FCPA, we finalized agreements with the U.S. Department of Justice (“DOJ”) and the SEC relative to improper payments made, prior to 2018, by third-party sales representatives of our Refining Solutions business (now Ketjen). In connection with this resolution, we entered into a non-prosecution agreement with the DOJ and an administrative resolution with the SEC, pursuant to which we paid a total of $218.5 million in aggregate fines, disgorgement, and prejudgment interest. We also agreed to certain ongoing compliance reporting obligations.

We are subject to extensive foreign government regulation that can negatively impact our business.

We are subject to government regulation in non-U.S. jurisdictions in which we conduct our business. The requirements for compliance with these laws and regulations may be unclear or indeterminate and may involve significant costs, including additional capital expenditures or increased operating expenses, or require changes in business practice, in each case that could result in reduced profitability for our business. Our having to comply with these foreign laws or regulations may provide a competitive advantage to competitors who are not subject to comparable restrictions or prevent us from taking advantage of growth opportunities. Determination of noncompliance can result in penalties or sanctions that could also adversely impact our operating results and financial condition.

Our inability to protect our intellectual property rights, or being accused of infringing on intellectual property rights of third parties, could have a material adverse effect on our business, financial condition and results of operations.

Protection of our proprietary processes, methods and compounds and other technology is important to our business. We generally rely on patent, trade secret, trademark and copyright laws of the U.S. and certain other countries in which our products are produced or sold, as well as licenses and nondisclosure and confidentiality agreements, to protect our intellectual property rights. The patent, trade secret, trademark and copyright laws of some countries, or their enforcement, may not protect our intellectual property rights to the same extent as the laws of the U.S. Failure to protect our intellectual property rights may result in the loss of valuable proprietary technologies. Additionally, some of our technologies are not covered by any patent or patent application and, even if a patent application has been filed, it may not result in an issued patent. If patents are issued to us, those patents may not provide meaningful protection against competitors or against competitive technologies. We cannot assure you that our intellectual property rights will not be challenged, invalidated, circumvented or rendered unenforceable.

We also conduct research and development activities with third parties and license certain intellectual property rights from third parties and we plan to continue to do so in the future. We endeavor to license or otherwise obtain intellectual property rights on terms favorable to us. However, we may not be able to license or otherwise obtain intellectual property rights on such terms or at all. Our inability to license or otherwise obtain such intellectual property rights could have a material adverse effect on our ability to create a competitive advantage and create innovative solutions for our customers, which will adversely affect our net sales and our relationships with our customers.

We could face patent infringement claims from our competitors or others alleging that our processes or products infringe on their proprietary technologies. If we are found to be infringing on the proprietary technology of others, we may be liable for damages and we may be required to change our processes, redesign our products partially or completely, pay to use the technology of others, stop using certain technologies or stop producing the infringing product entirely. Even if we ultimately prevail in an infringement suit, the existence of the suit could prompt customers to switch to products that are not the subject of infringement suits. We may not prevail in intellectual property litigation and such litigation may result in significant legal costs or otherwise impede our ability to produce and distribute key products.

We also rely upon unpatented proprietary manufacturing expertise, continuing technological innovation and other trade secrets to develop and maintain our competitive position. While we generally enter into confidentiality agreements with our employees and third parties to protect our intellectual property, we cannot assure you that our confidentiality agreements will not be breached, that they will provide meaningful protection for our trade secrets and proprietary manufacturing expertise or that adequate remedies will be available in the event of an unauthorized use or disclosure of our trade secrets or manufacturing expertise. In addition, our trade secrets and know-how may be improperly obtained by other means, such as a breach of our information technologies security systems or direct theft.

Our inability to acquire or develop additional lithium reserves that are economically viable could have a material adverse effect on our future profitability.

Our lithium reserves will, without acquiring or developing additional reserves, decline as we continue to extract these raw materials. Accordingly, our future profitability depends upon our ability to acquire additional lithium reserves that are economically viable to replace the reserves we will extract. Exploration and development of lithium resources are highly speculative in nature. Exploration projects involve many risks, require substantial expenditures and may not result in the discovery of sufficient additional resources that can be extracted profitably. Once a site with potential resources is discovered, it may take several years of development until production is possible, during which time the economic viability of production may change. Substantial expenditures are required to establish recoverable proven and probable reserves and to construct extraction and production facilities. As a result, there is no assurance that current or future exploration programs will be successful and there is a risk that depletion of reserves will not be offset by discoveries or acquisitions.

We utilize feasibility studies to estimate the anticipated economic returns of an exploration project. The actual project profitability or economic feasibility may differ from such estimates as a result of factors such as, but not limited to, changes in volumes, grades and characteristics of resources to be mined and processed; changes in labor costs or availability of adequate and skilled labor force; the quality of the data on which engineering assumptions were made; adverse geotechnical conditions; availability, supply and cost of water and power; fluctuations in inflation and currency exchange rates; delays in obtaining environmental or other government permits or approvals or changes in the laws and regulations related to our operations or project development; changes in royalty agreements, laws and/or regulations around royalties and other taxes; and weather or severe climate impacts.

For our existing operations, we utilize geological and metallurgical assumptions, financial projections and price estimates. These estimates are periodically updated to reflect changes in our operations, including modifications to our proven and probable reserves and mineralized material, revisions to environmental obligations, changes in legislation and/or social, political or economic environment, and other significant events associated with natural resource extraction operations. There are numerous uncertainties inherent in estimating quantities and qualities of lithium and costs to extract recoverable reserves, including many factors beyond our control, that could cause results to differ materially from expected financial and operating results or result in future impairment charges. In addition, it cannot be assumed that any part or all of the inferred mineral resources will ever be converted into mineral reserves, as defined by the SEC. See Item 2. Properties, for a discussion and quantification of our current mineral resources and reserves.

There is risk to the growth of lithium markets.

Our lithium business is significantly dependent on the development and adoption of new applications for lithium batteries and the growth in demand for plug-in hybrid electric vehicles and battery electric vehicles. As such, our business results inherently depend on decarbonization of the global economy. To the extent that such development, adoption, decarbonization and growth do not occur in the volume and/or manner that we contemplate, including for reasons described under the heading “The development of non-lithium battery technologies could adversely affect us,” above, the long-term growth in the markets for lithium products may be adversely affected, which would have a material adverse effect on our business, financial condition and operating results.

Demand and market prices for lithium will greatly affect the value of our investment in our lithium resources and our revenues and profitability generally.

Our ability to successfully develop our lithium resources and generate a return on investment will be affected by changes in the demand for and market price of lithium-based end products, such as lithium hydroxide. The market price of these products can fluctuate and is affected by numerous factors beyond our control, primarily world supply and demand. Such external economic factors are influenced by changes in international investment patterns, various political developments and macro-economic circumstances.

In addition, the price of lithium products is impacted by their purity and performance. We may not be able to effectively mitigate against such fluctuations; although some of our long-term agreements include higher pricing, we are also party to index-referenced and variable-priced contracts. In 2023, lithium prices significantly decreased by approximately 75% to 85% from their high in January 2023 to the end of the year, which adversely impacted our financial results. High volatility or further declines in the lithium prices could have a material and adverse effect on the revenues and profitability of our Lithium business and on our company generally. In addition, a further decrease in lithium prices may lead to additional inventory valuation charges in the valuation period prior to when the goods are sold, such as the $604.1 million charge recorded in the year ended December 31, 2023 to reduce the value of certain spodumene and finished goods to their net realizable value.

Following the Wodgina acquisition in 2019, the Wodgina mine idled production of spodumene until market demand supported bringing the mine back into production. We have since resumed spodumene concentrate production at the Wodgina mine in 2022, but there are no assurances that we will not idle production at the Wodgina mine or one of our other mines in the future due to lack of market demand or for other reasons.

If we are unable to retain key personnel or attract new skilled personnel, it could have an adverse effect on our business.

Our success depends on our ability to attract and retain key personnel including our management team. In light of the specialized and technical nature of our business, our performance is dependent on the continued service of, and on our ability to attract and retain, qualified management, scientific, technical, marketing and support personnel. Competition for such personnel is intense, and we may be unable to continue to attract or retain such personnel. In addition, because of our reliance on our senior management team, the unanticipated departure of any key member of our management team could have an adverse effect on our business. Our future success depends, in part, on our ability to identify and develop or recruit talent to succeed our senior management and other key positions throughout the organization. If we fail to identify and develop or recruit successors, we are at risk of being harmed by the departures of these key employees. Effective succession planning is also important to our long-term success. Failure to ensure effective transfer of knowledge and smooth transitions involving key employees could hinder our strategic planning and execution. In addition, the U.S. and other regions in which we operate are experiencing an acute workforce shortage for skilled workers, which in turn has created a hyper-competitive wage environment that may impact our ability to attract and retain employees.

Some of our employees are unionized, represented by works councils or are employed subject to local laws that are less favorable to employers than the laws of the U.S.

As of December 31, 2023, we had approximately 9,000 employees, including employees of our consolidated joint ventures. Approximately 26% of these employees are represented by unions or works councils. In addition, a large number of our employees are employed in countries in which employment laws provide greater bargaining or other rights to employees than the laws of the U.S. Such employment rights require us to work collaboratively with the legal representatives of those employees to effect any changes to labor arrangements. For example, most of our employees in Europe are represented by works councils that must approve any changes in conditions of employment, including salaries and benefits and staff changes, and may impede efforts to restructure our workforce. Although we believe that we have a good working relationship with our employees, a strike, work stoppage, slowdown or significant dispute with our employees could result in a significant disruption of our operations or higher labor costs.

Our joint ventures may not operate according to their business plans if our partners fail to fulfill their obligations, which may adversely affect our results of operations and may force us to dedicate additional resources to these joint ventures.

We currently participate in a number of joint ventures and may enter into additional joint ventures in the future. The nature of a joint venture requires us to share control with unaffiliated third parties. If our joint venture partners do not fulfill their obligations, the affected joint venture may not be able to operate according to its business plan. In that case, our results of operations may be adversely affected and we may be required to materially change the level of our commitment to the joint venture. Also, differences in views among joint venture participants may result in delayed decisions or failures to agree on major issues. If these differences cause the joint ventures to deviate from their business plans, our results of operations could be adversely affected.

Risks Related to Our Financial Condition

Our required capital expenditures can be complex, may experience delays or other difficulties, and the costs may exceed our estimates.

Our capital expenditures generally consist of expenditures to maintain and improve existing equipment, facilities and properties, and substantial investments in new or expanded equipment, facilities and properties. Execution of these capital expenditures can be complex, and commencement of production requires start-up, commission and certification of product quality by our customers, which may impact the expected output and timing of sales of product from such facilities. Construction of large chemical operations is subject to numerous risks and uncertainties, including, among others, the ability to complete a project on a timely basis and in accordance with the estimated budget for such projects and our ability to estimate future demand for our products. In addition, our returns on these capital expenditures may not meet our expectations.

Future capital expenditures may be significantly higher, depending on the investment requirements of each of our business lines, and may also vary substantially if we are required to undertake actions to compete with new technologies in our industry. We may not have the capital necessary to undertake these capital investments. If we are unable to do so, we may not be able to effectively compete in some of our markets.

We will need a significant amount of cash to service our indebtedness and our ability to generate cash depends on many factors beyond our control.

Our ability to generate sufficient cash flow from operations or use existing cash balances to make scheduled payments on our debt depends on a range of economic, competitive and business factors, many of which are outside our control. Our business may not generate sufficient cash flow from operations to service our debt obligations. If we are unable to service our debt obligations, we may need to refinance all or a portion of our indebtedness on or before maturity, reduce or delay capital expenditures, sell assets or raise additional equity. We may not be able to refinance any of our indebtedness, sell assets or raise additional equity on commercially reasonable terms or at all, which could cause us to default on our obligations and impair our liquidity. Our inability to generate sufficient cash flow or use existing cash balances to satisfy our debt obligations, or to refinance our obligations on commercially reasonable terms, could have a material adverse effect on our business and financial condition.

Because a significant portion of our operations is conducted through our subsidiaries and joint ventures, our ability to service our debt may be dependent on our receipt of distributions or other payments from our subsidiaries and joint ventures.

A significant portion of our operations is conducted through our subsidiaries and joint ventures. As a result, our ability to service our debt may be partially dependent on the earnings of our subsidiaries and joint ventures and the payment of those earnings to us in the form of dividends, loans or advances and through repayment of loans or advances from us. Payments to us by our subsidiaries and joint ventures are contingent upon our subsidiaries' or joint ventures' earnings and other business considerations and may be subject to statutory or contractual restrictions. In addition, there may be significant tax and other legal restrictions on the ability of our non-U.S. subsidiaries or joint ventures to remit money to us.

Restrictive covenants in our debt instruments may adversely affect our business.

Our senior credit facilities and the indentures governing our senior notes contain select restrictive covenants. These covenants provide constraints on our financial flexibility. The failure to comply with these or other covenants governing other indebtedness, including indebtedness incurred in the future, could result in an event of default, which, if not cured or waived, could have a material adverse effect on our business, financial condition and results of operations, including cross-defaults to other debt facilities. See "Financial Condition and Liquidity—Long-Term Debt" in Item 7. Management's Discussion and Analysis of Financial Condition and Results of Operations.

Changes in credit ratings issued by nationally recognized statistical rating organizations could adversely affect our cost of financing, the market price of our securities and our debt service obligations.

Credit rating agencies rate our debt securities on factors that include our operating results, actions that we take, their view of the general outlook for our industry and their view of the general outlook for the economy. Actions taken by the rating agencies can include maintaining, upgrading or downgrading the current rating or placing us on a watch list for possible future downgrades. Downgrading the credit rating of our debt securities or placing us on a watch list for possible future downgrades would likely increase our cost of future financing, limit our access to the capital markets and have an adverse effect on the market price of our securities.

Borrowings under a portion of our debt facilities bear interest at floating rates, and are subject to adjustment based on the ratings of our senior unsecured long-term debt. The downgrading of any of our ratings or an increase in any of the benchmark interest rates would result in an increase of the interest expense on our variable rate borrowings.

We are exposed to fluctuations in currency exchange rates, which may adversely affect our operating results and net income.

We conduct our business and incur costs in the local currency of most of the countries in which we operate. Changes in exchange rates between foreign currencies and the U.S. Dollar will affect the recorded levels of our assets, liabilities, net sales, cost of goods sold and operating margins and could result in exchange losses. The primary currencies to which we have exposure are the Chinese Renminbi, Euro, Australian Dollar, Chilean Peso and Japanese Yen. Exchange rates between these currencies and the U.S. Dollar in recent years have fluctuated significantly and may do so in the future. With respect to our potential exposure to foreign currency fluctuations and devaluations, for the year ended December 31, 2023, approximately 28% of our net sales were denominated in currencies other than the U.S. Dollar. Significant changes in these foreign currencies relative to the U.S. Dollar could also have an adverse effect on our ability to meet interest and principal payments on any foreign currency-denominated debt outstanding. In addition to currency translation risks, we incur currency transaction risks whenever one of our operating subsidiaries or joint ventures enters into either a purchase or a sales transaction using a different currency from its functional currency. Our operating results and net income may be affected by any volatility in currency exchange rates and our ability to manage effectively our currency transaction and translation risks.

Significant or prolonged periods of higher interest rates may have an adverse effect on our results of operations, financial condition and cash flows.

Interest rates may have a direct impact on our business to the extent we borrow under our unsecured credit facility, utilize our commercial paper program, or incur other forms of variable rate indebtedness or new indebtedness based on current interest rates. Borrowings under our unsecured credit facility bear interest at variable rates based on a benchmark rate depending on the currency in which the loans are denominated, plus an applicable margin, which ranges from 0.910% to 1.375%, depending on the Company’s credit rating. In May 2013, we entered into agreements to initiate a commercial paper program under which we may issue unsecured commercial paper notes from time-to-time in a maximum aggregate principal amount outstanding at any time of up to $1.5 billion (up from $750 million prior to the May 2023 increase).

In a rising interest rate environment, debt financing will become more expensive and may have higher transactional and servicing costs. For example, our interest expense on debt instruments in fiscal 2023 increased compared to fiscal 2022 driven by an increase in our weighted average interest rate on our variable rate debt. Although we may take steps to limit our exposure to variable rate debt, if interest rates remain relatively high or increase in the future, we could see increases in our borrowing costs which could have a material adverse effect on our results of operations, financial condition and cash flows.

Inflationary trends in the price of our input costs, such as raw materials, transportation and energy, could adversely affect our business and financial results.

We have experienced, and may continue to experience, volatility and increases in the price of certain raw materials and in transportation and energy costs as a result of global market and supply chain disruptions and the broader inflationary environment.

If we are unable to increase the prices to our customers of our products to offset inflationary cost trends, or if we are unable to achieve cost savings to offset such cost increases, we could fail to meet our cost expectations, and our profits and operating results could be adversely affected. Our ability to price our products competitively to timely reflect higher input costs is critical to maintain and grow our sales. Increases in prices of our products to customers or the impact of the broader inflationary environment on our customers and may lead to declines in demand and sales volumes. Further, we may not be able to accurately predict the volume impact of price increases, especially if our competitors are able to more successfully adjust to such input cost volatility. Increasing our prices to our customers could result in long-term sales declines or loss of market share if our customers find alternative suppliers or purchase less of our products, which could have an adverse long-term impact on our results of operations.

Changes in, or the interpretation of, tax legislation or rates throughout the world could materially impact our results.

Our effective tax rate and related tax balance sheet attributes could be impacted by changes in tax legislation throughout the world. Recent changes in the U.S. include the Inflation Reduction Act of 2022 (the “Inflation Reduction Act”), enacted August 16, 2022, which, among other items, imposes a 15% alternative minimum tax on corporations with three-year average annual adjusted financial statement income exceeding $1 billion and introduces or extends a number of tax credits to promote clean energy development. We continue to monitor the effects of the Inflation Reduction Act and other regulatory developments on our financial condition, operating results, and income tax rate. Currently, the majority of our net sales are generated from customers located outside the U.S., and a substantial portion of our assets and employees are located outside of the U.S.

We have not accrued income taxes or foreign withholding taxes on undistributed earnings for most non-U.S. subsidiaries, because those earnings are intended to be indefinitely reinvested in the operations of those subsidiaries. Certain tax proposals with respect to such earnings could substantially increase our tax expense, which would substantially reduce our income and have a material adverse effect on our results of operations and cash flows from operating activities.

Our future effective tax rates could be affected by changes in the mix of earnings in countries with differing statutory tax rates, expirations of tax holidays or rulings, changes in the assessment regarding the realization of the valuation of deferred tax assets, or changes in tax laws and regulations or their interpretation. Recent developments, including the European Commission's investigations on illegal state aid, as well as the Organisation for Economic Co-operation and Development ("OECD") project on Base Erosion and Profit Shifting may result in changes to long-standing tax principles, which could adversely affect our effective tax rates or result in higher cash tax liabilities. The OECD developed a global tax framework inclusive of a 15% global minimum tax under the Pillar Two Global Anti-Base Erosion Rules ("Pillar Two"). On December 15, 2022, the Council of the E.U. formally adopted the OECD's framework to achieve a coordinated implementation amongst E.U. Member States consistent with E.U. law. The E.U.'s Pillar Two Directive has an effective date of January 1, 2024 for certain aspects of the directive, with the remaining aspects effective on January 1, 2025. Other major jurisdictions are actively considering and implementing changes to their tax laws to adopt certain parts of the OECD's proposals. We have assessed this framework and determined, based upon available guidance, that these changes could have a material impact to our results of operations, but it is dependent on our mix of earnings beginning in 2024. Any future changes in OECD guidance or interpretations, including local country tax legislative changes thereof could impact our initial assessment; therefore, we will continue to monitor and refine our assessment as further guidance is made available.

We are subject to the regular examination of our income tax returns by various tax authorities. Examinations in material jurisdictions or changes in laws, rules, regulations or interpretations by local taxing authorities could result in impacts to tax years open under statute or to foreign operating structures currently in place. We regularly assess the likelihood of adverse outcomes resulting from these examinations or changes in laws, rules, regulations or interpretations to determine the adequacy of our provision for taxes. It is possible the outcomes from these examinations will have a material adverse effect on our financial condition and operating results.

Future events may impact our deferred tax asset position and U.S. deferred federal income taxes on undistributed earnings of international affiliates that are considered to be indefinitely reinvested.

We evaluate our ability to utilize deferred tax assets and our need for valuation allowances based on available evidence. This process involves significant management judgment about assumptions that are subject to change from period to period based on changes in tax laws or variances between future projected operating performance and actual results. We are required to establish a valuation allowance for deferred tax assets if we determine, based on available evidence at the time the determination is made, that it is more likely than not that some portion or all of the deferred tax assets will not be utilized. In making this determination, we evaluate all positive and negative evidence as of the end of each reporting period. Future adjustments (either increases or decreases) to the deferred tax asset valuation allowance are determined based upon changes in the expected realization of the net deferred tax assets. The utilization of our deferred tax assets ultimately depends on the existence of sufficient taxable income in either the carry-back or carry-forward periods under the applicable tax law. Due to significant estimates used to establish the valuation allowance and the potential for changes in facts and circumstances, it is reasonably possible that we will be required to record adjustments to the valuation allowance in future reporting periods. Changes to the valuation allowance or the amount of deferred tax liabilities could have a materially adverse effect on our business, financial condition and results of operations. Further, should we change our assertion regarding the permanent reinvestment of the undistributed earnings in foreign operations, a deferred tax liability may need to be established.

Our business and financial results may be adversely affected by various legal and regulatory proceedings.

We are involved from time to time in legal and regulatory proceedings, which may be material in the future. The outcome of proceedings, lawsuits and claims may differ from our expectations, leading us to change estimates of liabilities and related insurance receivables.

Legal and regulatory proceedings, whether with or without merit, and associated internal investigations, may be time-consuming and expensive to prosecute, defend or conduct, may divert management's attention and other resources, inhibit our ability to sell our products, result in adverse judgments for damages, injunctive relief, penalties and fines, and otherwise negatively affect our business.

Although our pension plans currently meet minimum funding requirements, events could occur that would require us to make significant contributions to the plans and reduce the cash available for our business.

We have several defined benefit pension plans around the world, including in the U.S., U.K., Germany, Belgium and Japan. We are required to make cash contributions to our pension plans to the extent necessary to comply with minimum funding requirements imposed by the various countries' benefit and tax laws. The amount of any such required contributions will be determined annually based on an actuarial valuation of the plans as performed by the plans' actuaries.

In previous years, we have made voluntary contributions to our U.S. qualified defined benefit pension plans. We anticipate approximately $11 million of required cash contributions during 2024 for our defined benefit pension plans. Additional voluntary pension contributions in and after 2024 may vary depending on factors such as asset returns, interest rates, and legislative changes. The amounts we may elect or be required to contribute to our pension plans in the future may increase significantly. These contributions could be substantial and would reduce the cash available for our business.

Further, an economic downturn or recession or market disruption in the capital and credit markets may adversely impact the value of our pension plan assets, our results of operations, our statement of changes in stockholders' equity and our liquidity. Our funding obligations could change significantly based on the investment performance of the pension plan assets and changes in actuarial assumptions for local statutory funding valuations. Any deterioration of the capital markets or returns available in such markets may negatively impact our pension plan assets and increase our funding obligations for one or more of these plans and negatively impact our liquidity. We cannot predict the impact of this or any further market disruption on our pension funding obligations.

We may not be able to consummate future acquisitions or integrate acquisitions into our business, which could result in unanticipated expenses and losses.

We believe that our customers are increasingly looking for strong, long-term relationships with a few key suppliers that help them improve product performance, reduce costs, and support new product development. To satisfy these growing customer requirements, our competitors have been consolidating within product lines through mergers and acquisitions.

As part of our business growth strategy, we have acquired businesses and entered into joint ventures in the past and intend to pursue acquisitions and joint venture opportunities in the future. Our ability to implement this component of our growth strategy will be limited by our ability to identify appropriate acquisition or joint venture candidates and our financial resources, including available cash and borrowing capacity. The expense incurred in consummating acquisitions or entering into joint ventures, the time it takes to integrate an acquisition or our failure to integrate businesses successfully, could result in unanticipated expenses and losses. Furthermore, we may not be able to realize any of the anticipated benefits from acquisitions or joint ventures.

The process of integrating acquired operations into our existing operations may result in unforeseen operating difficulties and may require significant financial resources that would otherwise be available for the ongoing development or expansion of existing operations. Some of the risks associated with the integration of acquisitions include:

- potential disruption of our ongoing business and distraction of management;
- unforeseen claims and liabilities, including unexpected environmental exposures and litigation arising from acquisitions;
- unforeseen adjustments, charges and write-offs;
- problems enforcing the indemnification obligations of sellers of businesses or joint venture partners for claims and liabilities;
- unexpected losses of customers of, or suppliers to, the acquired business;
- difficulty in conforming the acquired businesses' standards, processes, procedures and controls with our operations;
- in the case of foreign acquisitions, the need to integrate operations across different cultures and languages and to address the particular economic, currency, political and regulatory risks associated with specific countries;
- variability in financial information arising from the implementation of purchase price accounting;
- inability to coordinate new product and process development;
- loss of senior managers and other critical personnel and problems with new labor unions and cultural challenges associated with integrating employees from the acquired company into our organization;
- diversion of management's attention from other business matters; and
- challenges arising from the increased scope, geographic diversity and complexity of our operations.

Any such integration failure could disrupt our business and have a material adverse effect on our consolidated financial condition and results of operations. Moreover, from time to time, we may enter into negotiations for a proposed acquisition, but be unable or unwilling to consummate the acquisition under consideration. This could cause significant diversion of management's attention and out-of-pocket expenses.

We may continue to expand our business through acquisitions and we may incur additional indebtedness, including indebtedness related to acquisitions.

We have historically expanded our business primarily through acquisitions. A part of our business strategy is to continue to grow through acquisitions that complement our existing technologies and accelerate our growth. Our credit facilities have limited financial maintenance covenants. In addition, the indenture and other agreements governing our senior notes do not limit our ability to incur additional indebtedness in connection with acquisitions or otherwise. As a result, we may incur substantial additional indebtedness in connection with acquisitions.

Any such additional indebtedness and the related debt service obligations (whether or not arising from acquisitions) could have important consequences and risks for us, including:

- reducing flexibility in planning for, or reacting to, changes in our businesses, the competitive environment and the industries in which we operate, and to technological and other changes;
- lowering credit ratings;
- reducing access to capital and increasing borrowing costs generally or for any additional indebtedness to finance future operating and capital expenses and for general corporate purposes;
- to the extent that our debt is subject to floating interest rates, increasing our vulnerability to fluctuations in market interest rates;
- reducing funds available for operations, capital expenditures, share repurchases, dividends and other activities; and
- creating competitive disadvantages relative to other companies with lower debt levels.

If our goodwill, intangible assets or long-lived assets become impaired, we may be required to record a significant charge to earnings.

Under U.S. Generally Accepted Accounting Principles ("GAAP"), we review our intangible assets and long-lived assets for impairment when events or changes in circumstances indicate the carrying value may not be recoverable. Goodwill is tested for impairment on October 31 of each year, or more frequently if required. Factors that may be considered a change in circumstances, indicating that the carrying value of our goodwill, intangible assets or long-lived assets may not be recoverable, include, but are not limited to, a decline in our stock price and market capitalization, reduced future cash flow estimates, and slower growth rates in our industry. We may be required to record a significant charge in our financial statements during the period in which any impairment of our goodwill, intangible assets or long-lived assets is determined, negatively impacting our results of operations and financial condition.

General Risk Factors

Adverse conditions in the economy, and volatility and disruption of financial markets can negatively impact our customers, suppliers and other business partners and therefore have a material adverse effect on our business and results of operations.

A global, regional or localized economic downturn may reduce customer demand or inhibit our ability to produce our products, negatively impacting our operating results. Our business and operating results have been and will continue to be sensitive to the many challenges that can affect national, regional and global economies, including economic downturns (including credit market tightness, which can impact our liquidity as well as that of our customers, suppliers and other business partners), declining consumer and business confidence, fluctuating commodity prices and volatile exchange rates. Our customers may experience deterioration of their businesses, cash flow shortages and difficulty obtaining financing, leading them to delay or cancel plans to purchase products, and they may not be able to fulfill their obligations in a timely fashion. Further, suppliers and other business partners may experience similar conditions, which could impact their ability to fulfill their obligations to us. Also, it could be difficult to find replacements for business partners without incurring significant delays or cost increases. Finally, any such adverse conditions in the economy and financial markets could make it difficult for us to raise debt or equity capital on favorable terms.

Our business and operations could suffer in the event of cybersecurity breaches, information technology system failures, or network disruptions.

We and our third-party service providers have been and will continue to be subject to advanced and persistent threats in the areas of information and operational technology security and fraud, which may become more sophisticated over time. These attempts, which might be related to industrial or other espionage, include covertly introducing malware to computers and networks and impersonating authorized users, among others. We seek to detect and investigate all security incidents and to prevent their recurrence, as well as work with third-party service providers on detection of, and alerting us to, any incidents affecting us, but in some cases we might be unaware of an incident or its magnitude and effects. The theft, unauthorized use or publication of our intellectual property and/or confidential business information could harm our competitive position, reduce the value of our investment in research and development and other strategic initiatives or otherwise adversely affect our business. To the extent that a cybersecurity breach results in inappropriate disclosure of our employees', customers' or licensees' confidential or personal information, we may incur liability as a result. The devotion of additional resources to the security of our information technology systems in the future could significantly increase the cost of doing business or otherwise adversely impact our financial results.

In addition, risks associated with information technology systems failures or network disruptions, including risks associated with upgrading our systems or in successfully integrating information technology and other systems in connection with the integration of businesses we acquire, or vulnerabilities in our third-party service providers' systems, could disrupt our operations by impeding our processing of transactions, financial reporting and our ability to protect our customer or company information, which could adversely affect our business and results of operations. Additionally, we face increased information technology security and fraud risks due to our increased reliance on working remotely during the COVID-19 pandemic and beyond, which may create additional information security vulnerabilities and/or magnify the impact of any disruption in information technology systems. Finally, we can provide no assurance that the networks and systems that our third-party service providers have established or use will be effective.

Although we have implemented certain processes, procedures and internal controls to help mitigate cybersecurity risks and cyber intrusions, these measures, as well as our increased awareness of the nature and extent of a risk of a cyber incident, do not guarantee that our financial results, operations or confidential information will not be negatively impacted by such an incident.

The occurrence or threat of extraordinary events, including domestic and international terrorist attacks, may disrupt our operations and decrease demand for our products.

Chemical-related assets may be at greater risk of future terrorist attacks than other possible targets in the U.S. and around the world. As a result, we are subject to existing federal rules and regulations (and may be subject to additional legislation or regulations in the future) that impose site security requirements on chemical manufacturing facilities, which increase our overhead expenses.

We are also subject to federal regulations that have heightened security requirements for the transportation of hazardous chemicals in the U.S. We believe we have met these requirements but additional federal and local regulations that limit the distribution of hazardous materials are being considered. We ship and receive materials that are classified as hazardous. Bans on movement of hazardous materials through cities, like Washington, D.C., could affect the efficiency of our logistical operations. Broader restrictions on hazardous material movements could lead to additional investment to produce hazardous raw materials and change where and what products we manufacture.

The Chemical Facility Anti-Terrorism Standards program ("CFATS Program"), which is administered by the Department of Homeland Security ("DHS"), identifies and regulates chemical facilities to ensure that they have security measures in place to reduce the risks associated with potential terrorist attacks on chemical plants located in the U.S. DHS has enacted rules under the CFATS Program that impose comprehensive federal security regulations for high-risk chemical facilities in possession of specified quantities of chemicals of interest. These rules establish risk-based performance standards for the security of the U.S.'s chemical facilities. They require covered chemical facilities to prepare Security Vulnerability Assessments, which identify facility security vulnerabilities, and to develop and implement Site Security Plans, which include measures that satisfy the identified risk-based performance standards. We have implemented all necessary changes to comply with the rules under the CFATS Program to date, however, we cannot determine with certainty any future costs associated with any additional security measures that DHS may require.

The occurrence of extraordinary events, including future terrorist attacks and the outbreak or escalation of hostilities, cannot be predicted, and their occurrence can be expected to continue to negatively affect the economy in general, and the markets for our products in particular. The resulting damage from a direct attack on our assets, or assets used by us, could include loss of life and property damage. In addition, available insurance coverage may not be sufficient to cover all of the damage incurred or, if available, may be prohibitively expensive.

National or international disputes, political instability, terrorism war or armed hostilities, could impact our results of operations.

Geo-political events, national or international disputes, political instability, terrorism or other acts of violence, war or armed hostilities may cause damage or disruption to our operations, international commerce and the global economy. Such geo-political instability and uncertainty could have a negative impact on our ability to conduct business in certain regions based on trade restrictions, embargoes and export control law restrictions, and logistics restrictions, and could increase the costs, risks and adverse impacts from these new challenges. We may also be the subject of increased cybersecurity breaches arising from geo-political instability. Any such events may also have the effect of heightening many of the other risks described herein, such as those relating to capital markets, raw materials, energy and freight costs, our supply chain, information security and market conditions, any of which could negatively affect our businesses, financial condition, results of operations and cash flows.

The U.S. government and other nations have imposed significant restrictions on most companies' ability to do business in Russia as a result of the military conflict between Russia and Ukraine. It is not possible to predict the broader or longer-term consequences of this conflict, which could include further sanctions, embargoes, regional instability, energy shortages, geopolitical shifts and adverse effects on macroeconomic conditions, security conditions, currency exchange rates and financial markets.We currently do not sell our products into Russia nor have assets or any operations in the country, however, a significant escalation or expansion of economic disruption or the conflict's current scope could have a material adverse effect on our results of operations due to its impact in the countries in which we do conduct business.

At this time, the current situation in the Middle East has resulted in our business operations continuing as normal with some shipping and raw material delays. However, the geo-political climate remains volatile and a disruption could occur at any time, potentially causing a financial impact to our business.

Natural disasters or other unanticipated catastrophes could impact our operations and could have a material adverse effect on our results of operations, financial position, and cash flows.

The occurrence of natural disasters, such as hurricanes, floods, droughts, extreme heat, storms or earthquakes; pandemics, such as the COVID-19 pandemic; or other unanticipated catastrophes at any of the locations in which we or our key partners, suppliers, or customers do business could cause interruptions in our operations. Historically, major hurricanes have caused significant disruption to the operations on the U.S. Gulf Coast for many of our customers and certain of our suppliers of raw materials, which has had an adverse impact on volume and cost for some of our products. Our operations in Chile could be subject to significant rain events and earthquakes, and our operations in Asia could be subject to weather events such as typhoons. A global or regional pandemic or similar outbreak in a region in which we or our key partners, customers, or suppliers operate could disrupt business, depending on factors including, but not limited to, the duration and severity of the pandemic, government restrictions on businesses and individuals, impact on demand for our products, impact on the supply chain network, and the health and safety of our employees and the communities in which we do business. If similar or other weather events, natural disasters, or other catastrophic events occur in the future, they could negatively affect the results of operations at our sites in the affected regions as well as have adverse impacts on the global economy.

Our insurance may not fully cover all potential exposures.

We maintain property, business interruption, casualty, and other insurance, but such insurance may not cover all risks associated with the hazards of our business and is subject to limitations, including deductibles and coverage limits. We may incur losses beyond the limits, or outside the coverage, of our insurance policies, including liabilities for environmental remediation. In addition, from time to time, various types of insurance for companies in the specialty chemical industry have not been available on commercially acceptable terms or, in some cases, have not been available at all. We are potentially at additional risk if one or more of our insurance carriers fail. Additionally, severe disruptions in the domestic and global financial markets could adversely impact the ratings and survival of some insurers. Future downgrades in the ratings of enough insurers could adversely impact both the availability of appropriate insurance coverage and its cost. In the future, we may not be able to obtain coverage at current levels, if at all, and our premiums may increase significantly on coverage that we maintain.

We may be exposed to certain physical, transitional, regulatory and financial risks related to climate change.

Climate change includes changes in rainfall and in storm patterns and intensities, water shortages, significantly changing sea levels and increasing atmospheric and water temperatures, among others. For example, there have been concerns regarding the declining water level of the Dead Sea, from which our joint venture, JBC, produces bromine. Climate changes and unprecedented weather events may pose a risk to business operations in vulnerable areas. In some regions including China, extreme heat and drought conditions could also impact the availability of hydropower resulting in decreased production and/or increased costs. Storms could cause business interruptions, incur additional restoration costs, and impact product availability and pricing. Disruptions to the global supply chain due to climate related impacts or geopolitical events are possible and exist as external risk factors that we can respond to but not control. These events could limit the supply of key raw materials to us, or could have significant impacts to pricing. We work with numerous independent suppliers to mitigate lack of availability from a single supplier, however in some cases products with limited numbers of suppliers may become difficult to obtain.

Potential transition risks related to climate change include increased battery regulation, potential loss of customers due to climate-related performance, and increased costs related to carbon pricing. Growing concerns about climate change may result in the imposition of additional regulations or restrictions to which we may become subject. A number of governments or governmental bodies have introduced or are contemplating regulatory changes in response to climate change, including regulating greenhouse gas emissions. Potentially, additional U.S. federal regulation will be forthcoming with respect to greenhouse gas emissions (including carbon dioxide) and/or “cap and trade” legislation that could impact our operations. In addition, we have operations in the E.U., Brazil, China, Japan, Jordan, Saudi Arabia, Singapore and the United Arab Emirates, which have implemented, or may implement, measures to achieve objectives under the 2015 Paris Climate Agreement, an international agreement linked to the United Nations Framework Convention on Climate Change (“UNFCC”), which set targets for reducing greenhouse gas emissions. Significant regional or national differences in approaches to environmental laws and regulations could affect us disproportionately compared to our competitors and result in a competitive disadvantage to us.

The outcome of new legislation or regulation in the U.S. and other jurisdictions in which we operate may result in new or additional requirements, additional charges to fund energy efficiency activities, and fees or restrictions on certain activities. We may have heightened credit risk due to our exposure to climate risks. While certain climate change initiatives may result in new business opportunities for us in the area of alternative fuel technologies and emissions control, compliance with these initiatives may also result in additional costs to us, including, among other things, increased production costs, additional taxes, reduced emission allowances or additional restrictions on production or operations. Any adopted future climate change regulations could also negatively impact our ability to compete with companies situated in areas not subject to such limitations. Even without such regulation, increased public awareness and adverse publicity about potential impacts on climate change emanating from us or our industry could harm us. We may not be able to recover the cost of compliance with new or more stringent laws and regulations, which could adversely affect our business and negatively impact our growth. Furthermore, the potential impact of climate change and related regulation, market trends or litigation on the Company is highly uncertain and there can be no assurance that it will not have an adverse effect on our financial condition and results of operations.

Failure to meet environmental, social and governance (“ESG”) expectations or standards or achieve our ESG goals could adversely affect our business, results of operations, financial condition, or stock price.

In recent years, there has been an increased focus from stakeholders, regulators and the public in general on ESG matters, including greenhouse gas emissions and climate-related risks, renewable energy, water stewardship, waste management, diversity, equality and inclusion, responsible sourcing and supply chain, human rights, and social responsibility. Given our commitment to ESG, we actively manage these issues and have established and publicly announced certain goals, commitments, and targets which we may refine further in the future. These goals, commitments, and targets reflect our current plans and aspirations and are not guarantees that we will be able to achieve them. Evolving stakeholder expectations, regulatory obligations, economic conditions and our efforts to manage these issues, report on them, and accomplish our goals present numerous operational, regulatory, reputational, financial, legal, and other risks, any of which could have a material adverse impact, including on our reputation and stock price.

Meeting the ESG goals we have set and publicly disclosed will require significant resources and expenditures, and we may face pressure to make commitments, establish additional goals, and take actions to meet them beyond our current plans. If customers and potential customers are dissatisfied with our ESG goals or our progress towards meeting them, then they may choose not to buy our products and services, which could lead to reduced revenue, and our reputation could be harmed. In addition, we could experience reduced revenue and reputational harm if we are targeted by anti-ESG groups or influential individuals who disagree with our public positions on social or environmental issues. Additionally, lawsuits or regulatory actions based on allegations that certain public statements regarding ESG-related matters by companies are false and misleading “greenwashing” campaigns could adversely impact our operations and could have an adverse impact on our financial condition.

We may be unable to satisfactorily meet evolving standards, regulations and disclosure requirements related to ESG. Such matters can affect the willingness or ability of investors to make an investment in our Company, as well as our ability to meet regulatory requirements, including proposed rules related to greenhouse gas emissions. Any failure, or perceived failure, to meet evolving stakeholder expectations, additional regulations and industry standards or achieve our ESG goals, commitments, and targets could have an adverse effect on our business, results of operations, financial condition, or stock price.

Item 1B. Unresolved Staff Comments.

NONE

Item 1C. Cybersecurity.

Albemarle recognizes the importance of maintaining the security and integrity of our information systems and the data we collect, process, and store. We have implemented a comprehensive cybersecurity program based on the National Institute of Standards and Technology Cybersecurity Framework ("CSF"). As such, we map the CSF to corresponding legal, regulatory, and industry security practices, which guide our global policies and procedures to prevent, identify, protect, detect, respond, and recover from cybersecurity threats and incidents. Our cybersecurity program is overseen by our Chief Information Security Officer ("CISO"), and it is integrated into our overall enterprise risk management framework and thus is factored into our long-term strategy and business continuity plans. Our CISO is a Certified Information Systems Security Professional and a Certified Ethical Hacker with more than 25 years of experience as a cybersecurity professional working extensively with critical infrastructure partners to reduce cyber risk within traditional and operation technology networks.

Our leadership team receives monthly updates on security operations and governance functions as part of monthly Information Security Council meetings led by our CISO. The Audit and Finance Committee of our Board of Directors oversees information security matters and the Company's cybersecurity program. Our Chief Information Officer and CISO report on cybersecurity related matters, including the status of ongoing initiatives, incident reporting, compliance with regulatory requirements and industry standards, and emerging threats in global cybersecurity, on a periodic and as needed basis to the Audit and Finance Committee. The Audit and Finance Committee offers guidance on certain matters and approval for material initiatives. In addition, the full Board of Directors is updated on cybersecurity matters as needed depending on the nature and materiality of a cybersecurity matter.

All information assets are inventoried, classified, prioritized, and protected based on the respective risk, with appropriate cybersecurity controls applied to each. We have also implemented and maintain a documents management program which governs the classification, protection, and use of sensitive company data within the Albemarle environment.

All business-requested technologies and third-party service providers must successfully complete a thorough cybersecurity and contract review before being approved for use, after which they become part of our continuous risk monitoring program. Cybersecurity risks and potential costs are evaluated as a part of business operations, and the respective business impacts are continuously assessed to address evolving threats and vulnerabilities. We engage a third-party global firm to conduct an annual cyber assessment using the CSF, and we engage external vendors to validate our security controls and procedures through periodic penetration tests.

We follow a zero-trust architecture approach and enforce the use of multi-factor authentication and virtual private network technologies for all external access to provide secure support for our remote workers. Information security training is part of our compliance program, and includes mandatory security training for new hires, mandatory yearly security training for all staff, and regular phishing tests to raise awareness and response actions.

Our team of cybersecurity professionals are responsible for maintaining a global information systems environment that focuses on least privilege, least functionality, and network segmentation throughout the landscape using a layered approach (i.e. a defense-in-depth strategy). This includes a security operations center and cybersecurity engineers who provide 24/7 network monitoring.

As further discussed in Item 1A. Risk Factors, a material cybersecurity incident could significantly increase the cost of doing business or otherwise adversely impact our financial results and condition. To date we have not had a cybersecurity incident that has had, or is reasonably likely to have, a material effect on our financial results or business operations; however, we monitor and work to continuously improve our cybersecurity program as threats become more frequent and sophisticated.

All our manufacturing sites have formal business continuity plans that address site-specific priority responses, each determined through business impact analyses that integrate within our overall corporate crisis management response plan and enterprise risk management program. We also conduct frequent drills and exercises of formal cyber response procedures and business continuity plans. Lessons learned from the outcomes of these exercises are then assessed and used to inform and improve our formal cyber response procedures and business continuity plans.

In the event of, or the reasonably likely threat of, a cybersecurity incident, our cyber response procedures outline the tasks and timeline for the escalation of the incident to key members of the organization, including the information technology team, business unit management, and Albemarle executives and other key management. These individuals would participate in a special event management plan activation meeting to gain an understanding as to how the incident was detected and analysis of the incident. Each member of management involved would be responsible for assessing the risks, impact, and necessary response as determined by their role. The procedures include key considerations each manager should consider in their assessment as well as their responsibility for involvement in remediation efforts and post-incident strategic reviews. Specific legal and executive role procedures include the assessment of necessary internal communication and external reporting. The Chief Executive Officer, with the support of other executive officers, is responsible for approval of incident reporting and informing and updating the Board of Directors.

Item 2. Properties.

We operate globally, with our principal executive offices located in Charlotte, North Carolina and regional shared services offices located in Budapest, Hungary and Dalian, China. Each of these properties are leased. We and our affiliates also operate regional sales and administrative offices in various locations throughout the world, which are generally leased.

We believe that our production facilities, research and development facilities, and sales and administrative offices are generally well maintained, effectively used and are adequate to operate our business. During 2023, the Company’s manufacturing plants operated at approximately 75% capacity, in the aggregate.

Set forth below is information regarding our production facilities operated by us and our affiliates. Additional details regarding our significant mineral properties can be found below the table.

Location	Principal Use	Owned/Leased
Energy Storage		
Chengdu, China	Production of lithium carbonate and technical and battery-grade lithium hydroxide	Owned
Greenbushes, Australia[a]	Production of lithium spodumene minerals and lithium concentrate	Owned[c]
Kemerton, Australia	Production of lithium carbonate and technical and battery-grade lithium hydroxide	Owned
Kings Mountain, NC	Production of technical and battery-grade lithium hydroxide, lithium salts and battery-grade lithium metal products	Owned
La Negra, Chile	Production of technical and battery-grade lithium carbonate and lithium chloride	Owned
Qinzhou, China	Production of lithium carbonate and technical and battery-grade lithium hydroxide	Owned
Salar de Atacama, Chile[a]	Production of lithium brine and potash	Owned[d]
Silver Peak, NV[a]	Production of lithium brine, technical-grade lithium carbonate and lithium hydroxide	Owned
Wodgina, Australia[a]	Production of lithium spodumene minerals and lithium concentrate	Owned and leased[c]
Xinyu, China	Production of lithium carbonate and technical and battery-grade lithium hydroxide	Owned
Specialties		
Baton Rouge, LA	Research and product development activities, and production of fire safety solutions	Leased
Langelsheim, Germany	Production of butyllithium, lithium chloride, specialty products, lithium hydrides, cesium and special metals	Owned
Magnolia, AR[a]	Production of fire safety solutions, bromine, inorganic bromides, agricultural intermediates and tertiary amines	Owned
New Johnsonville, TN	Production of butyllithium and specialty products	Owned
Safi, Jordan[a]	Production of bromine and derivatives and fire safety solutions	Owned and leased[c]
Taichung, Taiwan	Production of butyllithium	Owned
Twinsburg, OH	Production of bromine-activated carbon	Leased
Ketjen		
Amsterdam, the Netherlands	Production of refinery catalysts, research and product development activities	Owned
Bitterfeld, Germany	Refinery catalyst regeneration, rejuvenation, and sulfiding	Owned[c]
La Voulte, France	Refinery catalysts regeneration and treatment, research and development activities	Owned[c]

Location	Principal Use	Owned/Leased
McAlester, OK	Refinery catalyst regeneration, rejuvenation, pre-reclaim burn off, as well as specialty zeolites and additives marketing activities	Owned(c)
Niihama, Japan	Production of refinery catalysts	Leased(c)
Pasadena, TX(b)	Production of aluminum alkyls, orthoalkylated anilines, refinery catalysts and other specialty chemicals; refinery catalysts regeneration services and research and development activities	Owned
Santa Cruz, Brazil	Production of catalysts, research and product development activities	Owned(c)
Takaishi City, Osaka, Japan	Production of aluminum alkyls	Owned(c)

(a) See below for further discussion of these significant mineral extraction facilities.
(b) The Pasadena, Texas location includes three separate manufacturing plants, primarily utilized by Ketjen, that are owned, including one plant that is owned by an unconsolidated joint venture.
(c) Owned or leased by joint venture.
(d) Ownership will revert to the Chilean government once we have sold all remaining amounts under our contract with the Chilean government pursuant to which we obtain lithium brine in Chile.

Mineral Properties

Set forth below are details regarding our mineral properties operated by us and our affiliates, which have been prepared in accordance with the requirements of subpart 1300 of Regulation S-K issued by the SEC. The following terms used in this Annual Report on Form 10-K are defined and used in accordance with subpart 1300 of Regulation S-K:

Mineral resource - a concentration or occurrence of material of economic interest in or on the Earth's crust in such form, grade or quality, and quantity that there are reasonable prospects for economic extraction.

Measured mineral resource - that part of a mineral resource for which quantity and grade or quality are estimated on the basis of conclusive geological evidence and sampling. The level of geological certainty associated with a measured mineral resource is sufficient to allow a qualified person to apply modifying factors in sufficient detail to support detailed mine planning and final evaluation of the economic viability of the deposit.

Indicated mineral resource - that part of a mineral resource for which quantity and grade or quality are estimated on the basis of adequate geological evidence and sampling. The level of geological certainty associated with an indicated mineral resource is sufficient to allow a qualified person to apply modifying factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit.

Inferred mineral resource - that part of a mineral resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. The level of geological uncertainty associated with an inferred mineral resource is too high to apply relevant technical and economic factors likely to influence the prospects of economic extraction in a manner useful for evaluation of economic viability.

Mineral reserve - an estimate of tonnage and grade or quality of indicated and measured mineral resources that, in the opinion of the qualified person, can be the basis of an economically viable project.

Proven mineral reserve - the economically mineable part of a measured mineral resource and can only result from conversion of a measured mineral resource.

Probable mineral reserve – the economically mineable part of an indicated and, in some cases, a measured mineral resource.

Cutoff grade - the grade (i.e., the concentration of metal or mineral in rock) that determines the destination of the material during mining. For purposes of establishing "prospects of economic extraction," the cut-off grade is the grade that distinguishes material deemed to have no economic value from material deemed to have economic value.

Under subpart 1300 of Regulation S-K, mineral resources may not be classified as "mineral reserves" unless the determination has been made by a qualified person ("QP") that the mineral resources can be the basis of an economically viable project.

Except for that portion of mineral resources classified as mineral reserves, mineral resources do not have demonstrated economic value. Inferred mineral resources are estimates based on limited geological evidence and sampling and have a too high of a degree of uncertainty as to their existence to apply relevant technical and economic factors likely to influence the prospects of economic extraction in a manner useful for evaluation of economic viability. Estimates of inferred mineral resources may not be converted to a mineral reserve. It cannot be assumed that all or any part of an inferred mineral resource will ever be upgraded to a higher category. A significant amount of exploration must be completed in order to determine whether an inferred mineral resource may be upgraded to a higher category. Therefore, it cannot be assumed that all or any part of an inferred mineral resource exists, that it can be the basis of an economically viable project, that it will ever be upgraded to a higher category, or that all or any part of the mineral resources will ever be converted into mineral reserves. See risk factor - "Our inability to acquire or develop additional reserves that are economically viable could have a material adverse effect on our future profitability," in Item 1A. Risk Factors.

Overview

At December 31, 2023, we had the following mineral extraction facilities:

Location	Business Segment	Ownership %	Extraction Type	Stage
Australia				
Greenbushes	Energy Storage	49%	Hard rock	Production
Wodgina[(a)]	Energy Storage	50%	Hard rock	Production
Chile				
Salar de Atacama[(b)]	Energy Storage	100%	Brine	Production
Jordan				
Safi[(b)]	Specialties	50%	Brine	Production
United States				
Kings Mountain, NC	Energy Storage	100%	Hard rock	Development
Magnolia, AR[(b)]	Specialties	100%	Brine	Production
Silver Peak, NV[(b)]	Energy Storage	100%	Brine	Production

(a) Production of spodumene concentrate at the Wodgina mine resumed in the second quarter of 2022 after it had been idled in 2019, following the acquisition of our interest in Wodgina. On October 18, 2023, we completed the restructuring of our MARBL joint venture, which reduced our ownership percentage of Wodgina from 60% to 50%.

(b) Site includes on-site, or otherwise near-by, exclusive conversion facilities. See individual property disclosure below for further details.

Aggregate annual production from our mineral extraction facilities is shown in the below table. Amounts represent Albemarle's attributable portion based on ownership percentages noted above and are shown in thousands of metric tonnes of lithium metal and bromine production. Lithium and bromine is extracted as brine or hard rock concentrate at the extraction facilities. These are then further converted into various compounds and products at on-site processing facilities or other conversion facilities owned by Albemarle around the world. In addition, the brine or concentrate can be used by tolling entities for further processing.

	Aggregate Annual Production (metric tonnes in thousands) Year Ended December 31,		
	2023	**2022**	**2021**
Lithium (lithium metal)[(a)]			
Australia			
Greenbushes[(b)]	21	19	13
Wodgina[(c)]	7	3	—
Chile			
Salar de Atacama[(d)]	10	10	8
United States			
Silver Peak, NV	1	1	1
Total lithium metal	39	33	22
Bromine			
Jordan			
Safi[(e)(f)]	58	60	57
United States			
Magnolia, AR[(g)]	82	73	71
Total bromine	140	133	128

(a) Lithium production amounts shown as lithium metal. Conversion to LCE is 0.1878 metric tonne of lithium metal to 1 metric tonne of LCE.
(b) Production from Greenbushes represents 49% of production of the Greenbushes mine, which is attributable to the Company's interest in the Windfield joint venture.
(c) Production of spodumene concentrate at the Wodgina mine resumed in the second quarter of 2022 after it had been idled in 2019. Production amounts presented from Wodgina represent 60% of production of the Wodgina mine which is attributable to the Company's interest in the MARBL joint venture until October 18, 2023, when we reduced our ownership percentage to 50% following the restructuring of the MARBL joint venture with MRL. The above production amounts reflect that change in ownership percentage beginning on October 18, 2023.
(d) The Salar de Atacama operation also produces potash (potassium chloride), bichofite, halite and sylvinite as byproducts. However, the Company does not consider production of these byproducts as material to the economics of the operation.
(e) Production from Safi represents the 50% production by the Jordan Bromine Project, which is attributable to the Company's interest in the JBC joint venture.
(f) The Safi operation also produces potassium hydroxide ("KOH") as a byproduct. However, the Company does not consider production of this byproduct as material to the economics of the operation.
(g) In addition, elemental sulfur and sodium hydrosulfide solution ("NaHS") are manufactured from the sour gas produced by the Magnolia operation. However, the Company does not consider these products as material to the economics of the operation.

See individual property disclosure below for further details regarding mineral rights, titles, property size, permits and other information for our significant mineral extraction properties. The extracted brine or hard rock is processed at facilities on location (as described below) or processed, or further processed, at other facilities throughout the world.

The following table provides a summary of our mineral resources, exclusive of reserves, at December 31, 2023. The below mineral resource amounts are rounded and shown in thousands of metric tonnes. Where applicable, the amounts represent Albemarle's attributable portion based on ownership percentages noted. The relevant technical information supporting mineral resources for each material property is included in the "Material Individual Properties" section below, as well as in the technical report summaries filed as Exhibits 96.1 to 96.6 to this report.

	Measured Mineral Resources		Indicated Mineral Resources		Measured and Indicated Mineral Resources		Inferred Mineral Resources	
	Amount (‘000s metric tonnes)	Grade (Li_2O%)	Amount (‘000s metric tonnes)	Grade (Li_2O%)	Amount (‘000s metric tonnes)	Grade (Li_2O%)	Amount (‘000s metric tonnes)	Grade (Li_2O%)
Lithium - Hard Rock:								
Australia								
Greenbushes[(a)]	—	—	37,100	1.48%	37,100	1.48%	5,800	1.19%
Wodgina[(b)]	—	—	8,800	1.31%	8,800	1.31%	81,700	1.12%
United States								
Kings Mountain, NC	—	—	46,816	1.37%	46,816	1.37%	42,869	1.10%
	Amount (‘000s metric tonnes)	Concentration (mg/L)	Amount (‘000s metric tonnes)	Concentration (mg/L)	Amount (‘000s metric tonnes)	Concentration (mg/L)	Amount (‘000s metric tonnes)	Concentration (mg/L)
Lithium - Brine:								
Chile								
Salar de Atacama	471	2,390	363	1,943	834	2,195	237	1,617
United States								
Silver Peak, NV	14	153	36	144	50	146	90	121

(a) Through our Windfield joint venture, we own a 49% interest in the Greenbushes mine. We are therefore reporting 49% of Greenbushes’ mineral resources.
(b) Through our MARBL joint venture, we own a 50% interest in Wodgina. We are therefore reporting 50% of Wodgina’s mineral resources.

The feedstock for the Safi, Jordan site, owned 50% by Albemarle through its JBC joint venture, is drawn from the Dead Sea, a nonconventional reservoir owned by the nations of Israel and Jordan. As such, there are no specific resources owned by JBC, but Albemarle’s joint venture partner, Arab Potash Company (“APC”) has exclusive rights granted by the Hashemite Kingdom of Jordan to withdraw brine from the Dead Sea and process it to extract minerals. The measured resource of bromide ion attributable to Albemarle’s 50% interest in its JBC joint venture is estimated to be approximately 175.69 million metric tonnes. JBC is extracting approximately 1 percent of the bromine available in Jordan’s share of the Dead Sea. Bromide concentration in the Dead Sea is estimated to average approximately 5,000 parts per million (“ppm”).

There are no mineral resource estimates at the Magnolia, AR bromine extraction site. All bromine mineral accumulations of economic interest and with reasonable prospects for eventual economic extraction within the Magnolia production lease area are either currently on production or subject to an economically viable future development plan and are classified as mineral reserves.

The following table provides a summary of our mineral reserves at December 31, 2023. The below mineral reserve amounts are rounded and shown in thousands of metric tonnes. The amounts represent Albemarle’s attributable portion based on ownership percentages noted above. The relevant technical information supporting mineral reserves for each material property is included in the “Material Individual Properties” section below, as well as the in the technical report summaries referenced in Exhibits 96.1 to 96.6 to this report.

	Proven Mineral Reserves		Probable Mineral Reserves		Total Mineral Reserves	
	Amount (‘000s metric tonnes)	Grade (Li_2O%)	Amount (‘000s metric tonnes)	Grade (Li_2O%)	Amount (‘000s metric tonnes)	Grade (Li_2O%)
Lithium - Hard Rock[(a)]:						
Australia						
Greenbushes[(b)]	—	—	71,800	1.82%	71,800	1.82%
	Amount (‘000s metric tonnes)	Concentration (mg/L)	Amount (‘000s metric tonnes)	Concentration (mg/L)	Amount (‘000s metric tonnes)	Concentration (mg/L)
Lithium - Brine:						
Chile						
Salar de Atacama	321	2,354	210	2,050	531	2,226
United States						
Silver Peak, NV	14	94	54	95	68	95
Bromine:						
United States						
Magnolia, AR[(c)]	2,706		611		3,317	

(a) The Wodgina mine is at an initial assessment level, and as a result, contains no mineral reserves. Mineral reserve estimates are not applicable for the Kings Mountain site.
(b) Through our Windfield joint venture, we own a 49% interest in the Greenbushes mine. We are therefore reporting 49% of Greenbushes’ mineral reserves.
(c) The concentration of bromine at the Magnolia site varies based on the physical location of the field and can range over 6,000 mg/L.

All bromine reserves reported by Albemarle for the JBC project are classified as proven mineral reserves. The mineral reserve estimate for the Safi, Jordan bromine site attributable to Albemarle’s 50% interest in its JBC joint venture is approximately 2.07 million metric tonnes of bromine from the Dead Sea. This estimate is based on the time available under the concession agreement with the Hashemite Kingdom of Jordan and the processing capability of the JBC plant. As only approximately one percent of the available resource is consumed from the Dead Sea, as noted above, the reserve estimate is based on the amount the JBC plant can produce over until the end of 2058, when the APC concession agreement ends. Bromine concentration used to calculate the reserve estimate from the Dead Sea was approximately 7,645 ppm based on historical pumping.

Mineral resource and reserve estimates were prepared by a QP with an effective date provided in the individual technical report summaries referenced in Exhibits 96.1 to 96.6 to this report. Differences between the amounts in the table above and those amounts in the technical report summaries represent estimated depletion from the effective date of the report until December 31, 2023, and in the case of Wodgina, the decrease in ownership interest to 50% from 60%. Our mineral resource and reserve estimates are based on many factors, including the area and volume covered by our mining rights, assumptions regarding our extraction rates based upon an expectation of operating the mines on a long-term basis and the quality of in-place reserves.

Internal Controls

The modeling and analysis of our mineral resources and reserves was developed by our site personnel and reviewed by several levels of internal management, as well as the QP for each site. The development of such resources and reserves estimates, including related assumptions, were prepared by a QP.

When determining resources and reserves, as well as the differences between resources and reserves, management developed specific criteria, each of which must be met to qualify as a resource or reserve, respectively. These criteria, such as demonstration of economic viability, points of reference and grade, are specific and attainable. The QP and management agree on the reasonableness of the criteria for the purposes of estimating resources and reserves. Calculations using these criteria are reviewed and validated by the QP.

Estimations and assumptions were developed independently for each significant mineral location. All estimates require a combination of historical data and key assumptions and parameters. When possible, resources and data from public information and generally accepted industry sources, such as governmental resource agencies, were used to develop these estimations.

Each site has developed quality control and quality assurance ("QC/QA") procedures, which were reviewed by the QP, to ensure the process for developing mineral resource and reserve estimates were sufficiently accurate. QC/QA procedures include independent checks (duplicates) on samples by third party laboratories, blind blank/standard insertion into sample streams, duplicate sampling, among others. In addition, the QPs reviewed the consistency of historical production at each site as part of their analysis of the QC/QA procedures. See details of the controls for each site in the technical summary reports filed as Exhibits 96.1 to 96.6 to this report.

We recognize the risks inherent in mineral resource and reserve estimates, such as the geological complexity, the interpretation and extrapolation of field and well data, changes in operating approach, macroeconomic conditions and new data, among others. The capital, operating and economic analysis estimates rely on a range of assumptions and forecasts that are subject to change. In addition, certain estimates are based on mineral rights agreements with local and foreign governments. Any changes to these access rights could impact the estimates of mineral resources and reserves calculated in these reports. Overestimated resources and reserves resulting from these risks could have a material effect on future profitability.

Material Individual Properties

Greenbushes, Australia

The Greenbushes mine is a hard rock, open pit mine (latitude 33° 52´S, longitude 116° 04´ E) located approximately 250km south of Perth, Western Australia, 90km southeast of the port of Bunbury, a major bulk-handling port in the southwest of Western Australia. The lithium mining operation is near the Greenbushes townsite located in the Shire of Bridgetown-

Greenbushes. Access to the Greenbushes Mine is via the paved South Western Highway between Bunbury and Bridgetown to Greenbushes Township and via the paved Maranup Ford Road to the Greenbushes Mine.

Lithium production from the Greenbushes Mine has been undertaken continuously for more than 20 years. Modern exploration has been undertaken on the property since the mid-1980s, first by Greenbushes Limited, then by Lithium Australia Ltd and in turn by Sons of Gwalia prior to the acquisition of Greenbushes by Talison in 2007. Initial exploration focused largely on tantalum, with the emphasis changing to lithium from around 2000. In 2014, Rockwood acquired a 49% ownership interest in Windfield, which owns 100% of Talison, from Sichuan Tianqi Lithium Industries Inc. This 49% ownership in Windfield was assumed by Albemarle in 2015 as part of the acquisition of Rockwood. We purchase lithium concentrate from Windfield, and our investment in the joint venture is reported as an unconsolidated equity investment on our balance sheet.

About 55% of the tenements held by Talison are covered by Western Australia's State Forest, which is under the authority of the Western Australia Department of Biodiversity, Conservation and Attractions. The majority of the remaining land is private land that covers about 40% of the surface rights. The remaining ground comprises crown land, road reserves and other miscellaneous reserves. The tenements cover a total area of approximately 10,000 hectares and include the historic Greenbushes tin, tantalum and current lithium mining areas. See section 3 of the Greenbushes technical report summary, filed as Exhibit 96.1 to this report, for a listing of tenements held by the Greenbushes site. Talison holds the mining rights for all lithium minerals on these tenements. The operating open pit lithium mining and processing plant area covers approximately 3,500 hectares comprising three mining leases. All lithium mining activities, including tailings storage, processing plant operations, open pits and waste rock dumps, are currently carried out within the boundaries of the three mining leases plus two general purpose leases. In order to keep the granted tenements in good standing, Talison is required to maintain permits, make an annual contribution to the statutory Mining Rehabilitation Fund and pay a royalty on concentrate sales for lithium mineral production as prescribed under the Mining Act 1978 in Western Australia. There are no private royalties that apply to the Greenbushes property. Talison continues to review all tenements on an annual basis and ensures compliance with relevant regulatory requirements and fees for maintenance of these tenements.

The Greenbushes pegmatite deposit consists of a primary pegmatite intrusion (Central Lode) with a smaller, sub-parallel pegmatite to the east (Kapanga). The primary intrusion and its subsidiary dikes and pods are concentrated within shear zones within a metamorphic belt consisting of granofels, ultramafic schists and amphibolites. The pegmatites are crosscut by mafic dolerite dikes. The Central Lode pegmatite is over 3 kilometers long (north by northwest), up to 300 meters wide (normal to dip), strikes north to north-west and dips moderately to steeply west to south-west. The Kapanga deposit sits approximately 300 m to the east of the Central Lode deposit with strike length of 1.8 km, thickness averaging 150 meters and dips between 40º and 60º toward the west. Current drilling has defined the Kapanga deposit to approximately 450 meters depth below surface. The major minerals from the Greenbushes pegmatite are quartz, spodumene, albite and K-feldspar.

The main lithium-bearing minerals are spodumene (containing approximately 8% lithium oxide) and varieties kunzite and hiddenite. Minor to trace lithium minerals include lepidolite mica, amblygonite and lithiophilite. Lithium is readily leached in the weathering environment and thus is virtually non-existent in weathered pegmatite. Exploration drilling at Greenbushes has been ongoing for over 40 years using reverse circulation and diamond drill holes.

Three lithium mineral processing plants are currently operating on the Greenbushes site, two chemical grade plants and a technical grade plant. Tailings are discharged to the tailings storage facility without the need for any neutralization process. Additional infrastructure on site includes power and water supply facilities, a laboratory, administrative offices, occupational health/safety/training offices, dedicated mines rescue area, stores, storage sheds, workshops and engineering offices. The Greenbushes site also leases production drills, excavators, trucks and various support equipment to extract the ore deposit by open pit methods. Talison's power is delivered by a local distribution system and reticulated and metered within the site. Water is sourced from rainfall and stored in several process dams located on site. We consider the condition of all of our plants, facilities and equipment to be suitable and adequate for the businesses we conduct, and we maintain them regularly. As of December 31, 2023, our 49% ownership interest of the gross asset value of the facilities at the Greenbushes site was approximately $803.5 million. Greenbushes is currently constructing a new chemical grade plant with a target completion in 2025 and is developing plans for a fourth chemical grade plant to be constructed in 2027. Other planned upgrades to the infrastructure include a new mine service area, a new mine access road, expansions of warehouse and laboratories and the expansion of tailings facilities.

Talison ships the chemical-grade lithium concentrate in vessels to our facilities in Meishan and Xinyu, China, and by land transport to our Kemerton, Australia facility, to process into battery-grade lithium hydroxide. In addition, the output from Talison can be used by tolling entities in China to produce both lithium carbonate and lithium hydroxide.

A summary of the Greenbushes facility's lithium mineral resources, exclusive of reserves, and reserves as of December 31, 2023 is shown in the following tables. SRK Consulting (U.S.) Inc. ("SRK"), a third-party firm comprising mining experts in accordance with Item 1302(b)(1) of Regulation S-K, served as the QP and prepared the estimates of lithium mineral resources and reserves at the Greenbushes facility, with an effective date of December 31, 2023. A copy of the QP's most recent technical report summary with respect to the lithium mineral resource and reserve estimates at the Greenbushes facility, dated February 9, 2024, with an effective date of June 30, 2023, is filed as Exhibit 96.1 to this report. The amounts represent Albemarle's attributable portion based on a 49% ownership percentage, and are presented as metric tonnes of lithium ore in thousands.

The Greenbushes mineral resources, exclusive of reserves, estimates with depletion from production from the effective date of the report through December 31, 2023 are summarized in the following table:

	Amount ('000s metric tonnes)	Grade (Li_2O%)
Indicated mineral resources	37,100	1.48%
Inferred mineral resources	5,800	1.19%

- Albemarle's attributable portion of mineral resources is 49%.
- Mineral resources are reported exclusive of mineral reserves. Mineral resources are not mineral reserves and do not have demonstrated economic viability.
- Mineral resources have been reported as in situ (hard rock within an optimized pit shell and above the effective cutoff grade).
- Mineral resources have been categorized subject to the opinion of the QP based on the quality of informing data for the estimate, consistency of geological/grade distribution, and data quality.
- Mineral resources which are contained within the mineral reserves pit design may be excluded from mineral reserves due to an Inferred classification.
- All indicated stockpiled resources have been converted to mineral reserves.
- Open pit mineral resources are reported considering a nominal set of assumptions for reporting purposes:
  - Chemical grade plant weight recovery (mass yield) varies as a function of Li2O% grade. The mass yield equation used for reasonable prospects for economic extraction pit optimization is Mass Yield %=9.362 x Li2O%^1.319 - 1.5, subject to a 97% recovery limitation when the Li2O grade exceeds 5.8%. Recovery is set to zero when the mass yield equation result for a block is less than zero.
  - Derivation of economic cutoff grade for mineral resources is based on the mine gate pricing of $1,525/t of 6% Li_2O concentrate. The mine gate price is based on $1,650/t-conc CIF less $125/t-conc for government royalty and transportation to China.
  - Costs estimated in Australian Dollars ("AUD") were converted to U.S. dollars based on an exchange rate of AUD1.00:$0.68.
  - The economic cutoff grade calculation is based on $2.67/t-ore incremental ore mining cost, $31.90/t-ore processing cost, $9.24/t-ore G&A cost, and $2.35/t-ore sustaining capital cost. Incremental ore mining costs are the costs associated with the run-of-mine loader, stockpile rehandling, grade control assays and rockbreaker.
  - The price, cost and mass yield parameters produce a calculated resource economic cutoff grade of 0.576% Li_2O. However, due to the internal constraints of the current operations, an elevated mineral resource cutoff grade of 0.7% Li_2O has been applied. SRK notes actual economic cutoff grade is lower, but it is the QP's opinion to use a 0.7% Li_2O cutoff grade to align with current site practices.
  - An overall 40° (east side) and 47° (west side) pit slope angle, 0% mining dilution, and 100% mining recovery.
  - Mineral resources were reported above the assigned 0.7% Li_2O cutoff grade and are constrained by an optimized 0.90 revenue factor pit shell.
  - No infrastructure movement capital costs have been added to the optimization.
- Mineral resources tonnage and contained metal have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding.

The Greenbushes indicated mineral resources of 37.1 million metric tonnes at December 31, 2023 increased by 70% from 21.8 million metric tonnes at December 31, 2022. The Greenbushes inferred mineral resources of 5.8 million metric tonnes at December 31, 2023 decreased by 80% from 28.3 million metric tonnes at December 31, 2022. The overall decrease in mineral resources was primarily driven by an update of the resource model as a result of the availability of new drilling data as well as mine depletion during 2023.

The Greenbushes mineral reserve estimates with depletion from production from the effective date of the report through December 31, 2023 are summarized in the following table:

	Amount (‘000s metric tonnes)	**Grade (Li_2O%)**
Probable mineral reserves:		
Reserve Pit	70,400	1.81%
Stockpiles	1,400	2.51%

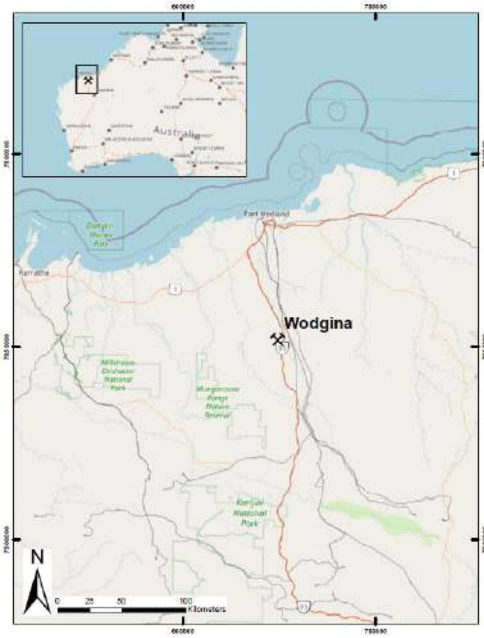
- Albemarle’s attributable portion of mineral resources and mineral reserves is 49%.
- Mineral reserves are reported exclusive of mineral resources.
- Indicated in situ resources have been converted to Probable reserves.
- Indicated stockpile resources have been converted to Probable mineral reserves.
- Mineral reserves are reported considering a nominal set of assumptions for reporting purposes:
    - Mineral reserves are based on a mine gate price of $1,383/metric tonne of chemical grade concentrate (6% Li_2O).
    - Mineral reserves assume 93% global mining recovery.
    - Mineral reserves are diluted at approximately 5% at zero grade for all mineral reserve blocks in addition to internal dilution built into the resource model (2.8% with the assumed selective mining unit of 5 meter x 5 meter x 5 meter).
    - The mass yield for reserves processed through the chemical grade plants is estimated based on mass yield formulas that vary depending on the Li2O% grade of the plant feed. For chemical grade plant 1, the formula is Mass Yield %=9.362 x Li2O%^1.319, subject to a 97% recovery limitation when the Li2O grade exceeds 5.5%. For chemical grade plant 2, chemical grade plant 3 and chemical grade plant 4, the formula is Mass Yield %=9.362 x Li2O%^1.319 - 1.5 subject to a 97% recovery limitation when the Li2O grade exceeds 5.8%. The weighted average life of mine mass yield for the four chemical grade plants is 19.5%.
    - The formula for mass yield for reserves processed through the technical grade plant is Mass Yield %=26.629 x Li2O% - 60.455. There is approximately 3.2 million metric tonnes of technical grade plant feed at 3.7% Li2O. The average life of mine mass yield for the technical grade plant is 38.0%.
    - Although Greenbushes produces a technical grade product from the current operation, it is assumed that the reserves reported herein will be sold as a chemical grade product. This assumption is necessary because feed for the technical grade plant is currently only defined at the grade control or blasting level. Therefore, it is conservatively assumed that concentrate produced by the technical grade plant will be sold at the chemical grade product price.
    - Derivation of economic cutoff grade for reserves is based on mine gate pricing of $1,383/t of 6% Li_2O concentrate. The mine gate price is based on $1,500/t-conc CIF less $117/t-conc for government royalty and transportation.
    - Costs estimated in AUD were converted to U.S. dollars based on an exchange rate of AUD1.00:$0.68.
    - The economic cutoff grade calculation is based on US$2.67/t-ore incremental ore mining cost, $31.90/t-ore processing cost, $9.24/t-ore G&A cost, and $2.35/t-ore sustaining capital cost. Incremental ore mining costs are the costs associated with the run-of-mine loader, stockpile rehandling, grade control assays and rockbreaker
    - The price, cost and mass yield parameters produce a calculated economic cutoff grade of 0.606% Li_2O. However, due to the internal constraints of the current operations, an elevated Mineral Reserves cutoff grade of 0.7% Li_2O has been applied.
    - The cutoff grade of 0.7% Li_2O was applied to reserves that are constrained by the ultimate pit design and are detailed in a yearly mine schedule.
    - Stockpile reserves have been previously mined and are reported at a 0.7% Li_2O cutoff grade.
- Waste tonnage within the reserve pit is 716.6 million metric tonnes at a strip ratio of 4.93:1 (waste to ore – not including mineral reserve stockpiles).
- Mineral reserve tonnage, grade and mass yield have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding. Mineral reserves metric tonnes are rounded to the nearest hundred thousand tonnes.

The Greenbushes total mineral reserves of 71.8 million metric tonnes at December 31, 2023 decreased by 7% from 77.0 million metric tonnes at December 31, 2022. The decrease in total mineral reserves was primarily driven by a different mineral resources block model, a higher strip ratio, an increase in estimated operating costs and 2023 mine depletion from 2023 production.

The life of mine sustaining capital cost of $2.35/metric tonne of ore was used only for the purposes of pit optimization and cut-off grade calculation. This sustaining capital cost was based on estimates of life of mine annual sustaining capital costs for Greenbushes that were included in the 2024 budget. Subsequent to pit optimization, design and scheduling, a detailed estimate of life of mine sustaining capital costs was prepared.

Additional information about key assumptions and parameters relating to the lithium mineral resources and reserves at the Greenbushes facility is discussed in sections 11 and 12, respectively, of the Greenbushes technical report summary.

Wodgina, Australia



The Wodgina property, which includes a hard rock, open pit mine (latitude -21° 11' 25"S, longitude 118° 40' 25"E) is located approximately 110 km south-southeast of Port Hedland, Western Australia between the Turner and Yule Rivers. The area includes multiple prominent greenstone ridges up to 180 m above mean sea level surrounded by granitic plains and lowlands. The property is accessible via National Highway 1 to National highway 95 to the Wodgina camp road. All roads to site are paved. The nearest large regional airport is in Port Hedland which also hosts an international deep-water port facility. In addition, a site dedicated all-weather airstrip is located near to site, capable of landing certain aircrafts.

The Wodgina pegmatite deposits were discovered in 1902. Since then, the pegmatite-hosted deposits have been mined for tin, tantalum, beryl, and lithium by various companies. Mining occurred sporadically until Goldrim Mining formed a new partnership with Pan West Tantalum Pty Ltd., who opened open pit mining at the site in 1989 and progressively expanded during the 1990s. Active mining at the Mt. Cassiterite pit has been started and stopped regularly between 2008 and the present. The mine was placed on care and maintenance in 2008, 2012, and most recently in 2019. In 2016, MRL acquired the mine and upgraded the processing facilities and site infrastructure to 750ktpa spodumene plant producing 6% spodumene concentrate, completed in 2019. On October 31, 2019, we completed the acquisition of a 60% interest in this hard rock lithium mine project and formed an unincorporated joint venture with MRL, named MARBL. We formed MARBL for the exploration, development, mining, processing and production of lithium and other minerals (other than iron ore and tantalum) from Wodgina. Production of spodumene concentrate from the first and second trains at the Wodgina mine was achieved in May and July of 2022, respectively, after it had been idled following its acquisition in 2019. On October 18, 2023, we closed on the restructuring of the MARBL joint venture with MRL, which resulted in the reduction of our ownership interest in Wodgina to 50% from 60%.

Wodgina holds mining tenements within the Karriyarra native title claim and are subject to the Land Use Agreement dated March 2001 between the Karriyarra People and Gwalia Tantalum Ltd (now Wodgina Lithium, a 100% subsidiary of MRL, our MARBL joint venture partner). See section 3 of the Wodgina technical report summary, filed as Exhibit 96.2 to this report, for a listing of all mining and exploration land tenements, which are in good standing and without any known impediments. Certain tenements are due for renewal in 2026 and another in 2030. Drilling and exploration activities have been conducted throughout the mining life of the Wodgina property.

The Wodgina mine is a pegmatite lithium deposit with spodumene the dominant mineral. The lithium mineralization occurs as 10 - 30 cm long grey-white spodumene crystals within medium grained pegmatites comprising primarily of quartz, feldspar, spodumene, and muscovite. Typically, the spodumene crystals are oriented orthogonal to the pegmatite contacts.

The facilities at Wodgina consist of a three stage crushing plant, the spodumene concentration plant, administrative offices, an accommodation camp, a power station, gas pipeline, three mature and reliable water bore fields, extension for future tailing storage and a fleet of owned and leased mine production equipment. The gas pipeline feeds the site power station to provide the power to the facilities. Water is obtained from the dedicated water bore fields. We consider the condition of all of our plants, facilities and equipment to be suitable and adequate for the businesses we conduct, and we maintain them regularly. As of December 31, 2023, our 50% ownership interest of the gross asset value of the facilities at our Wodgina site was approximately $271.0 million.

A summary of the Wodgina facility's lithium mineral resources as of December 31, 2023 is shown in the following table. SRK served as the QP and prepared the estimates of lithium mineral resources at the Wodgina facility, with an effective date of December 31, 2023. No reserves have been declared at Wodgina. A copy of the QP's most recent technical report summary with respect to the lithium mineral resource estimates at the Wodgina facility, dated February 14, 2023, with an effective date of December 31, 2022, is filed as Exhibit 96.2 to this report. The mineral resource economic assumptions remain unchanged from December 31, 2022. The December 31, 2022 resource has been depleted for actual production and adjusted for the new 50% ownership percentage noted above, and is reported as of December 31, 2023 in the below table. Mineral resources represent 50% interest in Wodgina, which is attributable to the Company's interest in the MARBL joint venture. Amounts are presented as metric tonnes of lithium ore in thousands.

The Wodgina mineral resources, exclusive of reserves, estimates with depletion from production from the effective date of the report through December 31, 2023 are summarized in the following table:

	Amount ('000s metric tonnes)	**Grade (Li_2O%)**
Indicated mineral resources	8,800	1.31%
Inferred mineral resources	81,700	1.12%

- The summary mineral resources attributable tonnes reflects Albemarle's 50% ownership percentage in Wodgina.
- All significant figures are rounded to reflect the relative accuracy of the estimates.
- The mineral resource estimate has been classified in accordance with SEC S-K 1300 guidelines and definitions.
- The Cassiterite Deposit comprises the historically mined Mt. Cassiterite pit and undeveloped North Hill areas.
- Mineral resources are not mineral reserves and do not have demonstrated economic viability. Inferred mineral resources have a high degree of uncertainty as to their economic and technical feasibility. It cannot be assumed that all or any part of an inferred mineral resources can be upgraded to measured or indicated mineral resources.
- Metallurgical recovery of lithium has been estimated on a block basis at a consistent 65% based on documentation from historical plant production.
- To demonstrate reasonable prospects for eventual economic extraction of Mineral Resources, a cut-off grade of 0.5% Li2O based on metal recoverability assumptions, long-term price assumptions of $584 per metric tonne, variable mining costs averaging $3.40/metric tonne, processing costs and G&A costs totaling $23/metric tonne.
- Mass yield is defined as (Li_2O%*metallurgical recovery) / concentrate grade where Li_2O% = lithium oxide grade in percent, metallurgical recovery = 65% and concentrate grade = 6%.
- The mineral resources are constrained by an economic pit shell using an overall 43° pit slope angle, 0% mining dilution, and 100% mining recovery.
- There are no known legal, political, environmental, or other risks that could materially affect the potential development of the Mineral Resources based on the level of study completed for this property.

The Wodgina indicated mineral resources of 8.8 million metric tonnes at December 31, 2023 decreased by 30% from 12.6 million metric tonnes at December 31, 2022. The Wodgina inferred mineral resources of 81.7 million metric tonnes at December 31, 2023 decreased by 17% from 98.3 million metric tonnes at December 31, 2022. The decrease in mineral resources was driven by the change in ownership interest in Wodgina from 60% to 50% as a result of the restructuring of the MARBL joint venture agreement, and depletion during the year. There were no changes to the model.

The Wodgina mine is at an initial assessment level, and as a result, contains no mineral reserves. Additional information about key assumptions and parameters relating to the lithium mineral resources at the Wodgina facility is discussed in section 11 of the Wodgina technical report summary.

Salar de Atacama/La Negra, Chile

The Salar de Atacama is located in the commune of San Pedro de Atacama, with the operations approximately 100 kilometers to the south of this commune, in the extreme east of the Antofagasta Region and close to the border with the republics of Argentina and Bolivia. Access to the property is on the major four-lane paved Panamericana Route 5 north from Antofagasta, Chile approximately 60 km northeast to B-385. On B-385, a two-lane paved highway, the Albemarle Salar de Atacama project (latitude 23°38'31.52"S, longitude 68°19'30.31"W) is approximately 175 km to the east. The site has a small private airport that serves the project. A small paved runway airport is also located near San Pedro de Atacama and a large international airport is located in Antofagasta. The La Negra plant (latitude 23°45'20.31"S, longitude 70°18'36.92"W) has direct access roads and located approximately 20 km by paved four lane highway Route 28 southeast of Antofagasta turning north approximately 3 km on Route 5.

In the early 1960s, water with high concentrations of salts was discovered in the Salar de Atacama Basin. In January 1975, one of our predecessors, Foote Mineral Company, signed a long-term contract with the Chilean government for mineral rights with respect to the Salar de Atacama consisting exclusively of the right to access lithium brine, covering an area of approximately 16,700 hectares. See section 3 of the Salar de Atacama technical report summary, filed as Exhibit 96.3 to this report, for a listing of mining concessions at the Salar de Atacama site. The contract originally permitted the production and sale of up to 200,000 metric tons of lithium metal equivalent (“LME”), a calculated percentage of LCE. In 1981, the first construction of evaporation ponds in the Salar de Atacama began. The following year, the construction of the lithium carbonate plant in La Negra began. In 1990, the facilities at the Salar de Atacama were expanded with a new well system and the capacity of the lithium carbonate plant in the La Negra plant was expanded. In 1998, the lithium chloride plant in La Negra began operating, the same year that Chemetall purchased Foote Mineral Company. Subsequently, in 2004, Chemetall was acquired by Rockwood, and in 2015, Rockwood was acquired by Albemarle. Effective January 1, 2017, the Chilean government and Albemarle entered into an annex to the original agreement through which its duration was modified, extending it until the balance of: (a) the original 200,000 metric tons of LME and an additional 262,132 metric tons of LME granted through this annex have been exploited, processed, and sold, or (b) on January 1, 2044, whichever comes first. In addition, the amended agreement provides for commission payments to the Chilean government based on sales price/metric ton on the amounts sold under the additional quota granted, our support of research and development in Chile of lithium applications and solar energy, and our support of local communities in Northern Chile. Albemarle currently operates its extraction and production facilities in Chile under this mineral rights agreement with the Chilean government.

The Salar de Atacama is a salt flat, the largest in Chile, located in the Atacama Desert in northern Chile, which is the driest place on the planet and thus has an extremely high annual rate of evaporation and extremely low annual rainfall. Our extraction through evaporation process works as follows: snow in the Andes Mountains melts and flows into underground pools of water containing brine, which generally have high concentrations of lithium. We then pump the water containing brine above ground through a series of pumps and wells into a network of large evaporation ponds. Over the course of approximately eighteen months, the desert sun evaporates the water causing other salts to precipitate and leaving behind concentrated lithium brine. If weather conditions are not favorable, the evaporation process may be prolonged. After we obtain the lithium brine from the Salar de Atacama, we process it into lithium carbonate and lithium chloride at our manufacturing facilities in nearby La Negra, Chile.

The filling materials of the Salar de Atacama Basin are dominated by the Vilama Formation and the more recently, in geologic time, by evaporitic and clastic materials that are currently being deposited in the basin. These units house the basin's aquifer system and are composed of evaporitic chemical sediments that include carbonate, gypsum and halite intervals interrupted by volcanic deposits of large sheets of ignimbrite, volcanic ash and smaller classical deposits. Lithium-rich brines are extracted from the halite aquifer that is located within the nucleus of the salt flat. The Salar de Atacama basin contains a continental system of lithium-rich brine. These types of systems have six common (global) characteristics: arid climate; closed basin that contains a salt flat (salt crust), a salt lake, or both; igneous and/or hydrothermal activity; tectonic subsidence; suitable sources of lithium; and sufficient time to concentrate the lithium in the brine.

In the Salar de Atacama basin, lithium-rich brines are found in a halite aquifer. Carbonate and sulfates are found near the edges of the basin. The average, minimum and maximum concentrations of lithium in the Salar de Atacama basin are approximately 1,400, 900 and 7,000 mg/L, respectively. From 2017 through 2019, two drilling campaigns were carried out in order to obtain geological and hydrogeological information at the Albemarle mining concession.

The facilities at the Salar de Atacama consist of extraction wells, evaporation and concentration ponds, leaching plants, a potash plant, a drying plant, a salar yield improvement plant, services and general areas, including salt stockpiles, as well as a fleet of owned and leased equipment. In addition, the site includes administrative offices, an operations building and a laboratory. The extracted concentrated lithium brine is sent to the La Negra plant by truck for processing. The Salar de Atacama has its own powerhouse that generates the energy necessary for the entire operation of the facilities. We also have permanent and continuous groundwater exploitation rights for two wells that are for industrial use and to supply the Salar de Atacama facilities. The La Negra facilities consist of a boron removal plant, a calcium and magnesium removal plant, two lithium carbonate conversion plants, a lithium chloride plant, evaporation-sedimentation ponds, an offsite area where the raw materials are housed and the inputs that are used in the process are prepared, a dry area where the various products are prepared, as well as a fleet of owned and leased equipment. La Negra is supplied electricity from a local company and has rights to a well in the Peine community for its water supply. We completed construction of the third lithium carbonate conversion plant in late 2022. We consider the condition of all of our plants, facilities and equipment to be suitable and adequate for the businesses we conduct, and we maintain them regularly. As of December 31, 2023, the combined gross asset value of our facilities at the Salar de Atacama and in La Negra, Chile (not inclusive of construction in process) was approximately $1.9 billion.

A summary of the Salar de Atacama facility's lithium mineral resources, exclusive of reserves, and reserves as of December 31, 2023 are shown in the following tables. SRK served as the QP and prepared the estimates of lithium mineral resources (exclusive of reserves) and reserves at the Salar de Atacama facility, with an effective date of December 31, 2023. A copy of the QP's most recent technical report summary with respect to the lithium mineral resource and reserve estimates at the Salar de Atacama facility, dated February 14, 2023, with an effective date of August 31, 2022, is filed as Exhibit 96.3 to this report. The mineral resource economic assumptions remain unchanged from August 31, 2022. The August 31, 2022 resource has been depleted for actual production and is reported as of December 31, 2023 in the below table. The amounts represent Albemarle's attributable portion based on a 100% ownership percentage, and are presented as metric tonnes of lithium metal in thousands.

The Salar de Atacama mineral resource, exclusive of reserves, estimates with depletion from production from the effective date of the report to December 31, 2023 are summarized in the following table:

	Amount ('000s metric tonnes)	Li Concentration (mg/L)
Measured mineral resources	471	2,390
Indicated mineral resources	363	1,943
Measured and Indicated mineral resources	834	2,195
Inferred mineral resources	237	1,617

- Mineral resources are reported exclusive of mineral reserves. Mineral resources are not mineral reserves and do not have demonstrated economic viability.
- Given the dynamic reserve versus the static resource, a direct measurement of resources post-reserve extraction is not practical. Therefore, as a simplification, to calculate mineral resources, exclusive of reserves, the quantity of lithium pumped in the life of mine plan was subtracted from the overall resource without modification to lithium concentration. Measured and indicated resource were deducted proportionate to their contribution to the overall mineral resource.
- Resources are reported on an in situ basis.
- Resources are reported above the elevation of 2,200 meters above sea level. Resources are reported as lithium metal.
- Resources have been categorized subject to the opinion of a QP based on the amount/robustness of informing data for the estimate, consistency of geological/grade distribution, survey information.
- Resources have been calculated using drainable porosity estimated from measured values in Upper Halite and Volcano-sedimentary units, and bibliographical values based on the lithology and QP's experience in similar deposits.
- The estimated economic cutoff grade utilized for resource reporting purposes is 800 mg/l lithium, based on the following assumptions:
  - A technical grade lithium carbonate price of $22,000/metric tonne CIF La Negra. This is a 10% premium to the price utilized for reserve reporting purposes. The 10% premium applied to the resource versus the reserve was selected to generate a resource larger than the reserve, ensuring the resource fully encompassed the reserve while still maintaining reasonable prospect for eventual economic extraction.
  - Recovery factors for the salar operation increase gradually over the span of 4 years, from 40% in 2022 to the proposed salar yield improvement program 65% recovery in 2025. After that point, evaporation pond recovery is relatively constant at 65%. An additional recovery factor of 80% lithium recovery is applied to the La Negra lithium carbonate plant.
  - An average annual brine pumping rate of 414 L/s is assumed to meet drawdown constraint consistent with Albemarle's permit conditions.
  - Operating cost estimates are based on a combination of fixed brine extraction, G&A and plant costs and variable costs associated with raw brine pumping rate or lithium production rate. Average life of mine operating cost is calculated at approximately $4,155/metric tonne CIF Asia.
  - Sustaining capital costs are included in the cut-off grade calculation and post the salar yield improvement program installation, average around $98 million per year.
- Mineral Resources tonnage and contained metal have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding.

The Salar de Atacama measured and indicated mineral resources, exclusive of reserves, as of December 31, 2023 did not change from the reported balances as of December 31, 2022 as all 2023 production was depleted from the reserves.

The Salar de Atacama reserve estimates with depletion from production from the effective date of the report through December 31, 2023 are summarized in the following table:

	Amount ('000s metric tonnes)	Concentration (mg/L)
Proven mineral reserves:		
In Situ	297	2,316
In Process	24	2,841
Probable mineral reserves:		
In Situ	210	2,050
Total mineral reserves:		
In Situ	507	2,198
In Process	24	2,841

- In process reserves quantify the prior 24 months of pumping data and reflect the raw brine, at the time of pumping. These reserves represent the first 24 months of feed to the lithium process plant in the 2022 economic model.

- Proven reserves have been estimated as the lithium mass pumped during Years 2024 through 2033 of the proposed life of mine plan.
- Probable reserves have been estimated as the lithium mass pumped from 2034 until the end of the proposed life of mine plan (2041).
- The ratio of in situ proven to probable reserves has remained consistent through depletion since the development of the reserve model in 2022 with approximately 57% of the reserve designated as probable and 43% of the reserve designated as proven.
- Reserves are reported as lithium metal
- This mineral reserve estimate was derived based on a production pumping plan truncated in December 31, 2041 (i.e., approximately 19 years). This plan was truncated to reflect the projected depletion of Albemarle's authorized lithium production quota.
- The 2022 reserve model used as the basis for depletion has not been updated. The following assumptions were used in developing that model:
    - The estimated economic cut-off grade for the Project is 858 mg/l lithium, based on the assumptions discussed below. The truncated production pumping plan remained well above the economic cut-off grade (i.e., the economic cut-off grade did not result in a limiting factor to the estimation of the reserve).
    - A technical grade lithium carbonate price of $20,000/metric tonne CIF Asia.
    - Recovery factors for the salar operation increase gradually over the span of 4 years, from 40% in 2022 to the proposed salar yield improvement program 65% recovery in 2025. After that point, evaporation pond recovery remains relatively constant at 65%, An additional recovery factor of 80% lithium recovery is applied to the La Negra lithium carbonate plant.
    - A fixed average annual brine pumping rate of 414 L/s is assumed to meet consistent with Albemarle's permit conditions.
    - Operating cost estimates are based on a combination of fixed brine extraction, G&A and plant costs and variable costs associated with raw brine pumping rate or lithium production rate. Average life of mine operating cost is calculated at approximately $4,155/metric tonne CIF Asia.
    - Sustaining capital costs are included in the cut-off grade calculation and post the salar yield improvement program installation, average around $98 million per year.
- Mineral reserve tonnage, grade and mass yield have been rounded to reflect the accuracy of the estimate and numbers may not add due to rounding.

The Salar de Atacama total mineral reserves of 531,000 metric tonnes at December 31, 2023 decreased by 6% from 566,000 metric tonnes at December 31, 2022. The decrease in total mineral reserves was driven by depletion during the year as there were no changes to the model.

Additional information about key assumptions and parameters relating to the lithium mineral resources and reserves at the Salar de Atacama facility is discussed in sections 11 and 12, respectively, of the Salar de Atacama technical report summary.

Silver Peak, Nevada

The Silver Peak site (latitude 37.751773°N, longitude 117.639027°W) is located in a rural area approximately 30 miles southwest of Tonopah, in Esmeralda County, Nevada. It is located in the Clayton Valley, an arid valley historically covered with dry lake beds (playas). The operation borders the small, unincorporated town of Silver Peak, Nevada. Albemarle uses the Silver Peak site for the production of lithium brines, which are used to make lithium carbonate and, to a lesser degree, lithium hydroxide. Access to the site is off of the paved highway SR-265 in the town of Silver Peak, Nevada. The administrative offices are located on the south side of the road. The process facility is on the north side of the road and the brine operations are located approximately three miles east of Silver Peak on Silver Peak Road and occupy both the north and south sides of the road. In addition, access to the site is also possible via gravel/dirt roads from Tonopah, Nevada and Goldfield, Nevada.

Lithium brine extraction in the Clayton Valley began in the mid-1960's by one of our predecessors, the Foote Mineral Company. Since that time, lithium brine operations have been operated on a continuous basis. In 1998, Chemetall purchased Foote Mineral Company. Subsequently, in 2004, Chemetall was acquired by Rockwood, and in 2015, Rockwood was acquired by Albemarle. Our mineral rights in Silver Peak consist of our right to access lithium brine pursuant to our permitted and certified senior water rights, a settlement agreement with the U.S. government, originally entered into in June 1991, and our patented and unpatented land claims. Pursuant to the 1991 agreement, our water rights and our land claims, we have rights to all lithium that we can remove economically from the Clayton Valley Basin in Nevada. See section 3 of the Silver Peak technical report summary, filed as Exhibit 96.4 to this report, for a listing of patented and unpatented claims at the Silver Peak site. We have been operating at the Silver Peak site since 1966. Our Silver Peak site covers a surface of over 13,500 acres, more than 10,500 acres of which we own through a subsidiary. The remaining acres are owned by the U.S. government from whom we lease the land pursuant to unpatented land claims that are renewed annually. Actual surface disturbance associated with the operations is 7,390 acres, primarily associated with the evaporation ponds. The manufacturing and administrative activities are confined to an area approximately 20 acres in size.

We extract lithium brine from our Silver Peak site through substantially the same evaporation process we use at the Salar de Atacama. We process the lithium brine extracted from our Silver Peak site into lithium carbonate at our plant in Silver Peak. It is hypothesized that the current levels of lithium dissolved in brine originate from relatively recent dissolution of halite by meteoric waters that have penetrated the playa in the last 10,000 years. The halite formed in the playa during the aforementioned climatic periods of low precipitation and that the concentrated lithium was incorporated as liquid inclusions into the halite crystals. There are no current exploration activities on the Silver Peak lithium operation. However, in January 2021, we announced that we will expand capacity in Silver Peak and begin a program to evaluate clays and other available Nevada resources for commercial production of lithium. As previously announced, we are investing in our Silver Peak site with the goal of doubling the current production in Silver Peak by 2025 by making full use of the brine water rights.

The facilities at Silver Peak consist of extraction wells, evaporation and concentration ponds, a lithium carbonate plant, a lithium anhydrous plant, a lithium hydroxide plant, a new liming plant, wellfield and mill maintenance, a shipping and packaging facility and administrative offices, as well as a fleet of owned and leased equipment. Silver Peak is supplied electricity from a local company and we currently have two operating fresh water wells nearby that supply water to the facilities. We consider the condition of all of our plants, facilities and equipment to be suitable and adequate for the businesses we conduct, and we maintain them regularly. As of December 31, 2023, the gross asset value of our facilities at our Silver Peak site was approximately $139.1 million.

A summary of the Silver Peak facility's lithium mineral resources, exclusive of reserves, and reserves as of December 31, 2023 is shown in the following tables. SRK served as the QP and prepared the estimates of lithium mineral resources (exclusive of reserves) and reserves at the Silver Peak facility, with an effective date of December 31, 2023. A copy of the QP's most recent technical report summary with respect to the lithium mineral resource and reserve estimates at the Silver Peak facility, dated February 14, 2023, with an effective date of September 30, 2022, is filed as Exhibit 96.4 to this report. The mineral resource economic assumptions remain unchanged from September 30, 2022. The September 30, 2022 resource has been depleted for actual production and is reported as of December 31, 2023 in the below table. The amounts represent Albemarle's attributable portion based on a 100% ownership percentage, and are presented as metric tonnes of lithium metal in thousands.

The Silver Peak mineral resources, exclusive of reserves, estimates with depletion from production from the effective date of the report through December 31, 2023 are summarized in the following table:

	Amount ('000s metric tonnes)	Concentration (mg/L)
Measured mineral resources	14	153
Indicated mineral resources	36	144
Measured and Indicated mineral resources	50	146
Inferred mineral resources	90	121

- Mineral resources are reported exclusive of mineral reserves. Mineral resources are not mineral reserves and do not have demonstrated economic viability.
- Given the dynamic reserve versus the static resource, a direct measurement of resources post-reserve extraction is not practical. Therefore, as a simplification, to calculate mineral resources, exclusive of reserves, the quantity of lithium pumped in the life of mine plan was subtracted from the overall resource without modification to lithium concentration. Measured and indicated resource were deducted proportionate to their contribution to the overall mineral resource.
- Resources are reported on an in situ basis.
- Resources are reported as lithium metal.
- The resources have been calculated from the block model above 740 meters above sea level.
- Resources have been categorized subject to the opinion of a QP based on the amount/robustness of informing data for the estimate, consistency of geological/grade distribution, survey information.
- Resources have been calculated using drainable porosity estimated from bibliographical values based on the lithology and QP's experience in similar deposits.
- The estimated economic cutoff grade utilized for resource reporting purposes is 50 mg/l lithium, based on the following assumptions:
  - A technical grade lithium carbonate price of $22,000/metric tonne CIF North Carolina. This is a 10% premium to the price utilized for reserve reporting purposes. The 10% premium applied to the resource versus the reserve was selected to generate a resource larger than the reserve, ensuring the resource fully encompassed the reserve while still maintaining reasonable prospect for eventual economic extraction.
  - Recovery factors for the wellfield are = -206.23*(Li wellfield feed)2 +7.1903*(wellfield Li feed)+0.4609. An additional recovery factor of 78% lithium recovery is applied to the lithium carbonate plant.
  - A fixed brine pumping rate of 20,000 acre feet per year, ramped up from 2022 levels over a period of five years.

    - Operating cost estimates are based on a combination of fixed brine extraction, G&A and plant costs and variable costs associated with raw brine pumping rate or lithium production rate. Average life of mine operating costs is calculated at approximately $6,200/metric tonne lithium carbonate CIF North Carolina.
    - Sustaining capital costs are included in the cut-off grade calculation and include a fixed component at $7.0 million per year and an additional component tied to the estimated number of wells replaced per year and other planned capital programs.
- Mineral Resources tonnage and contained metal have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding.

The Silver Peak measured and indicated mineral resources, exclusive of reserves, as of December 31, 2023 did not change from the reported balances as of December 31, 2022 as all 2023 production was depleted from the reserves.

The Silver Peak reserve estimates with depletion from production from the effective date of the report through December 31, 2023 are summarized in the following table:

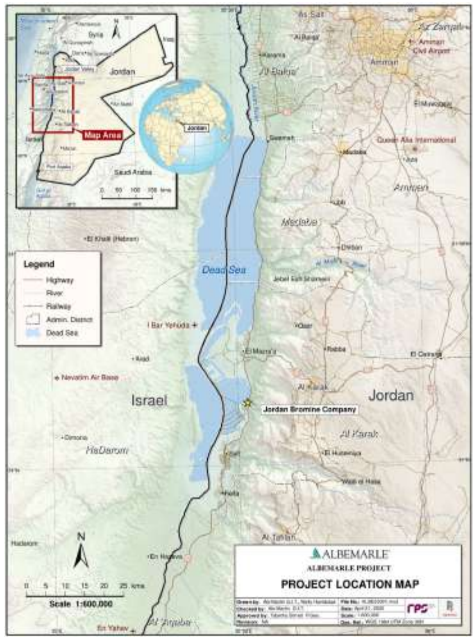
	Amount (‘000s metric tonnes)	Concentration (mg/L)
Proven mineral reserves:		
In Situ	12	93
In Process	1	101
Probable mineral reserves:		
In Situ	54	95
Total mineral reserves:		
In Situ	66	95
In Process	1	101

- In process reserves quantify the prior 24 months of pumping data and reflect the raw brine, at the time of pumping. These reserves represent the first 24 months of feed to the lithium process plant in the 2022 economic model.
- Proven reserves have been estimated as the lithium mass pumped during the years 2024 through 2028 of the proposed life of mine plan.
- Probable reserves have been estimated as the lithium mass pumped from 2029 until the end of the proposed life of mine plan (2052).
- The ratio of in situ proven to probable reserves has remained consistent through depletion since the development of the reserve model in 2022 with approximately 82% of the reserve designated as Probable and 18% of the reserve designated as Proven.
- Reserves are reported as lithium metal.
- This mineral reserve estimate was derived based on a production pumping plan truncated at the end of year 2052 (i.e., approximately 29.5 years). This plan was truncated to reflect the QP’s opinion on uncertainty associated with the production plan as a direct conversion of measured and indicated resource to proven and probable reserve is not possible in the same way as a typical hard-rock mining project.
- The 2022 reserve model used as the basis for depletion has not been updated. The following assumptions were used in developing that model:
    - The estimated economic cut-off grade for the Silver Peak project is 57 mg/l lithium, based on the assumptions discussed below. The production pumping plan was truncated due to technical uncertainty inherent in long-term production modeling and remained well above the economic cut-off grade (i.e., the economic cut-off grade did not result in a limiting factor to the estimation of the reserve).
    - A technical grade lithium carbonate price of $20,000/metric tonne CIF North Carolina.
    - Recovery factors for the wellfield are = -206.23*(Li wellfield feed)^2 +7.1903*(wellfield Li feed) + 0.4609. An additional recovery factor of 78% lithium recovery is applied to the lithium carbonate plant.
    - A fixed brine pumping rate of 20,000 acre feet per year, ramped up from 2022 levels over a period of five years.
    - Operating cost estimates are based on a combination of fixed brine extraction, G&A and plant costs and variable costs associated with raw brine pumping rate or lithium production rate. Average life of mine operating costs is calculated at approximately $6,200/metric tonne LC CIF North Carolina.
    - Sustaining capital costs are included in the cut-off grade calculation and include a fixed component at $7.0 million per year and an additional component tied to the estimated number of wells replaced per year and other planned capital programs.
- Mineral reserve tonnage, grade and mass yield have been rounded to reflect the accuracy of the estimate (thousand tonnes), and numbers may not add due to rounding.

The Silver Peak total mineral reserves of 67,500 metric tonnes at December 31, 2023 decreased by 2% from 69,100 metric tonnes at December 31, 2022. The decrease in total mineral reserves was driven by depletion during the year as there were no changes to the model.

Additional information about key assumptions and parameters relating to the lithium mineral resources and reserves at the Silver Peak facility is discussed in sections 11 and 12, respectively, of the Silver Peak technical report summary.

Safi, Jordan



Our 50% interest in JBC, a consolidated joint venture established in 1999, with operations in Safi, Jordan, acquires bromine that is originally sourced from the Dead Sea. JBC processes the bromine at its facilities into a variety of end products. The JBC operation (latitude 31°8'34.85"N , longitude 35°31'34.68"E) is located in Safi, Jordan, and is located on a 26-hectare area on the southeastern edge of the Dead Sea, about 6 kilometers north of the of the APC plant. JBC also has a 2-hectare storage facility within the free-zone industrial area at the Port of Aqaba. The Jordan Valley Highway/Route 65 is the primary method of access for supplies and personnel to JBC. The Port of Aqaba is the main entry point for supplies and equipment for JBC, where imported shipping containers are offloaded from ships and are transported by truck to JBC via the Jordan Valley Highway. Aqaba is approximately 205 km south of JBC via Highway 65. Major international airports can be readily accessed either at Amman or Aqaba. Jordan’s railway transport runs north-south through Jordan and is not used to transport JBC employees and product.

In 1958, the Government of the Hashemite Kingdom of Jordan granted APC a concession for exclusive rights to exploit the minerals and salts from the Dead Sea brine until 2058; at that time, APC factories and installations would become the property of the Government. APC was granted its exclusive mineral rights under the Concession Ratification Law No. 16 of 1958. APC produces potash from the brine extracted from the Dead Sea. A concentrated bromide-enriched brine extracted from APC’s evaporation ponds is the feed material for the JBC plant. Following the formation of the joint venture, the JBC bromine plant began operations in 2002. Expansion of the facilities to double its bromine production capacity went into operation in 2017.

The climate, geology and location provide a setting that makes the Dead Sea a valuable large-scale natural resource for potash and bromine. Today, the Dead Sea has a surface area of 583 km^2 and a brine volume of 110 km^3. The Dead Sea is the world’s saltiest natural lake, containing high concentrations of ions compared to that of regular seawater and an unusually high amount of magnesium and bromine. There is an estimated 900 million tonnes of bromine in the Dead Sea.

Mining methods consist of all activities necessary to extract brine from the Dead Sea and extract Bromine. The low rainfall, low humidity and high temperatures in the Dead Sea area provide ideal conditions for recovering potash from the brine by solar evaporation. JBC obtains its feedbrine from APC's evaporation pond and this supply is intimately linked to the APC operation. As evaporation takes place the specific gravity of the brine increases until its constituent salts progressively crystallize and precipitate out of solution, starting with sodium chloride (common salt) precipitating out to the bottom of the ponds (pre-carnallite ponds). Brine is transferred to other pans in succession where its specific gravity increases further, ultimately precipitating out of the sodium chloride. Carnallite precipitation takes place at the evaporation pond where it is harvested from the brine and pumped as slurry to a process plant (where the potassium chloride is separated from the magnesium chloride). JBC extracts the bromide-rich, "carnallite-free" brine through a pumping station. This brine feeds the bromine and magnesium plants. There is no exploration as typically conducted for the characterization of a mineral deposit.

Infrastructure and facilities to support the operation of the bromine production plant at the Safi site is compact and contained in an approximately 33 hectare area. JBC ships product in bulk through a storage terminal in Aqaba. There are above ground storage tanks as well as pumps and piping for loading these products onto ships. JBC main activities at Aqaba are raw material/product storing, importing, and exporting. An evaporation pond collects the waste streams from pipe flushing, housekeeping, and other activities. Fresh water is sources from the Mujib Reservoir, a man-made reservoir. JBC is supplied electricity from the National Electric Power Company of Jordan. We consider the condition of all of our plants, facilities and equipment to be suitable and adequate for the businesses we conduct, and we maintain them regularly. As of December 31, 2023, our 50% ownership interest of the gross asset value of the facilities at the Safi, Jordan site was approximately $243.7 million.

A summary of the Safi facility's bromine mineral resources and reserves as of December 31, 2023 is provided below. RPS Energy Canada Ltd ("RPS"), a third-party firm comprising mining experts in accordance with Item 1302(b)(1) of Regulation S-K, served as the QP and prepared the estimates of bromine mineral resources and reserves at the Safi facility, with an effective date of December 31, 2023. A copy of the QP's amended technical report summary with respect to the bromine mineral resource and reserve estimates at the Safi facility, dated February 14, 2024, is filed as Exhibit 96.5 to this report.

The feedstock is drawn from the Dead Sea, a nonconventional reservoir owned by the nations of Israel and Jordan. As such, there are no specific resources owned by JBC, but Albemarle's joint venture partner, APC, has exclusive rights granted by the Hashemite Kingdom of Jordan to withdraw brine from the Dead Sea and process it to extract minerals. Revenues are based on a forecast bromine price ranging from $1,938 to $3,525 per metric tonne and the operating cost ranges between $648 and $972 per metric tonne. The measured resource of bromide ion attributable to Albemarle's 50% interest in its JBC joint venture is estimated to be approximately 175.69 million metric tonnes. JBC is extracting approximately 1 percent of the bromine available in Jordan's share of the Dead Sea. Bromide concentration in the Dead Sea is estimated to average approximately 5,000 ppm. The cut-off grade of the Albemarle bromine operations has been estimated to be at 1,000 ppm. The bromide ion concentration in the brine extracted which feeds the bromine plants, significantly exceeds the selected cut-off grade.

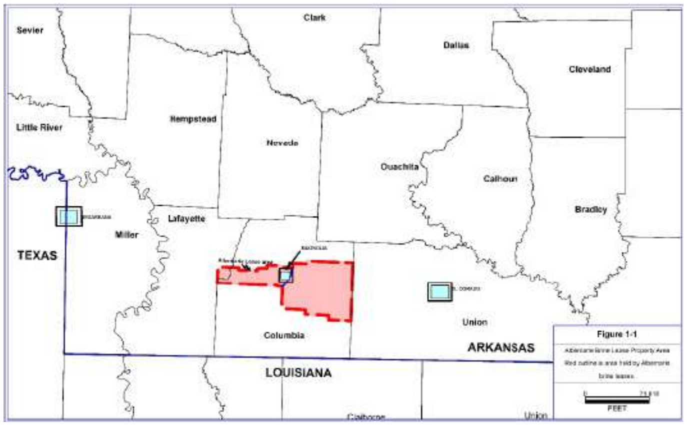
The Safi measured mineral reserves of 175.69 million metric tonnes at December 31, 2023 decreased by 1% from 178.3 million metric tonnes at December 31, 2022. The decrease in measured mineral resources was driven by depletion and evaporation in the Dead Sea during 2023. The end date of the forecast remained unchanged due to the concession agreement.

All bromine reserves reported by Albemarle for the JBC project are classified as proven mineral reserves. The mineral reserve estimate attributable to Albemarle's 50% interest in its JBC joint venture is approximately 2.07 million metric tonnes of bromine from the Dead Sea. This estimate is based on the time available under the concession agreement with the Hashemite Kingdom of Jordan and the processing capability of the JBC plant. As only approximately one percent of the available resource is consumed from the Dead Sea, as noted above, the reserve estimate is based on the amount the JBC plant can produce over until the end of 2058, when the APC concession agreement ends. Revenues are based on a forecast bromine price ranging from $1,938 to $3,525 per metric tonne and the operating cost ranges between $648 and $972 per metric tonne. At the plant process recovery of 90 to 95 percent (bromine from bromide), product bromine is estimated at approximately 118,000 metric tonnes per year. Bromine concentration used to calculate the reserve estimate from the Dead Sea was approximately 7,645 ppm based on historical pumping. The cut-off grade of the Albemarle bromine operations has been estimated to be at 1,000 ppm. The bromide ion concentration in the brine extracted which feeds the bromine plants, significantly exceeds the selected cut-off grade.

The Safi total mineral reserves of 2.07 million metric tonnes at December 31, 2023 decreased by 13% from 2.38 million metric tonnes at December 31, 2022. The decrease in total mineral reserves was driven by depletion and evaporation in the Dead Sea during 2023. The end date of the forecast remained unchanged due to the concession agreement.

Additional information about key assumptions and parameters relating to the bromine mineral resources and reserves at the Safi facility is discussed in sections 11 and 12, respectively, of the Safi technical report summary.

Magnolia, Arkansas



Magnolia is located in the southwest Arkansas, north of the center of Columbia County, approximately 50 miles east of Texarkana and 135 miles south of Little Rock. Our facilities include two separate production plants, the South Plant and the West Plant. The South Plant (latitude 33.1775°N, longitude 93.2161°W) is accessible via U.S. Route 79 and paved local roads. The West Plant (latitude 33.2648°N, longitude 93.3151°W) is accessible by U.S. Route 371 and paved local roads. The decentralized well sites around the brine fields are accessed via paved Arkansas Highway 19, 98, 160 and 344.

In Magnolia, bromine is recovered from underground brine wells and then processed into a variety of end products at the plant on location. Albemarle has more than 50 brine production and injection wells that are currently active on the property. Albemarle's area of bromine operation is comprised of over 9,500 individual leases with local landowners comprising a total area of over 99,500 acres. The leases have been acquired over time as field development extended across the field. Each lease continues for a period of 25 years or longer until after a two year period where brine is not injected or produced from/to a well within two miles of lease land areas, as long as lease rentals are continuing to be paid. See section 3 of the Magnolia technical report summary, filed as Exhibit 96.6 to this report, for a map of leases and burdens on those leases at the Magnolia site.

Bromine extraction began in Magnolia in 1965 as the first brine supply well was drilled, and additional wells were put into production over the next few years. In 1987, a predecessor company took over operations of certain brine supply and injection wells, which Albemarle continues to operate to this day. In 2019, Albemarle completed, and put into production, two new brine production supply wells in Magnolia.

In Magnolia, bromine exists as sodium bromide in the formation waters or brine of the Jurassic age Smackover Formation, a geological formation in Arkansas, in the subsurface at 7,000 to 8,500 feet below sea level. The mineralization occurs within the highly saline Smackover Formation waters or brine where the bromide has an abnormally rich composition. The bromine concentration is more than twice as high as that found in normal evaporated seawater. The bromine mineralization of the brine is distributed throughout the porous intervals of the upper and middle Smackover on the property. The strong permeability and porosity of the Smackover grainstones provide excellent continuity of the bromine mineralization within the brine.

The facilities at Magnolia consist of brine production and injection wells, brine ponds, two bromine processing plants, pipelines between the plants and wells, a laboratory, storage and warehouses, administrative offices, as well as a fleet of owned and leased equipment. Our Magnolia facilities are supplied electricity from a local company and we currently have several operating freshwater wells nearby that supply water to the facilities. In addition, both plants have dedicated rail spurs that provide access to several rail lines to transport product throughout the country. We consider the condition of all of our plants, facilities and equipment to be suitable and adequate for the businesses we conduct, and we maintain them regularly. As of December 31, 2023, the gross asset value of our facilities at our Magnolia site was approximately $932.5 million.

A summary of the Magnolia facility's bromine mineral reserves as of December 31, 2023 is shown in the following table. RPS served as the QP and prepared the estimates of bromine mineral reserves at the Magnolia facility, with an effective date of December 31, 2023. A copy of the QP's most recent technical report summary with respect to the bromine mineral resource and reserve estimates at the Magnolia facility, dated February 14, 2023, with an effective date of December 31, 2023, is filed as Exhibit 96.6 to this report. The amounts represent Albemarle's attributable portion based on a 100% ownership percentage, and are presented as metric tonnes in thousands.

There are no mineral resource estimates at the Magnolia, AR bromine extraction site. All bromine mineral accumulations of economic interest and with reasonable prospects for eventual economic extraction within the Magnolia production lease area are either currently on production or subject to an economically viable future development plan and are classified as mineral reserves.

	Amount ('000s metric tonnes)
Proven mineral reserves	2,706
Probable mineral reserves	611
Total mineral reserves	3,317

- Reserves are reported as bromine, on an in situ basis.
- The estimated economic cutoff grade utilized for reserve reporting purposes is 1,000 mg/L bromine, with a bromine price ranging from $1,938 to $3,525 per metric tonne and operating costs ranging from $1,328 to $1,992 per metric tonne.
- Recovery factors for the Magnolia are 82% and 88% for the proven mineral reserves and total mineral reserves, respectively.
- The concentration of bromine at the Magnolia site varies based on the physical location of the field and can range up to over 6,000 mg/L.

The Magnolia total mineral reserves of 3.3 million metric tonnes at December 31, 2023 increased by 11% from 3.0 million metric tonnes at December 31, 2022. The increase in total mineral reserves was driven by an update of the reserve model for expanded leasing, partially offset by depletion of the reserve during 2023.

Additional information about key assumptions and parameters relating to the bromine mineral reserves at the Magnolia facility is discussed in section 12 of the Magnolia technical report summary.

Item 3. Legal Proceedings.

We are involved in litigation incidental to our business and are a party to a number of legal actions and claims, various governmental proceedings and private civil lawsuits, including, but not limited to, those related to environmental and hazardous material exposure matters, product liability and breach of contract. Some of the legal proceedings include claims for compensatory as well as punitive damages. While the final outcome of these matters cannot be predicted with certainty, considering, among other things, the legal defenses available and liabilities that have been recorded along with applicable insurance, it is currently the opinion of management that none of these pending items will have a material adverse effect on our financial condition, results of operations or liquidity.

In addition, the information set forth under Note 17, "Commitments and Contingencies – Litigation" to the Consolidated Financial Statements of this Annual Report on Form 10-K is incorporated herein by reference.

An unexpected adverse resolution of one or more of these items, however, could have a material adverse effect on our financial condition, results of operations or liquidity in that particular period.

Item 4. Mine Safety Disclosures.

NONE

Executive Officers of the Registrant.

On November 6, 2023, Scott Tozier transitioned from the role of Executive Vice President and Chief Financial Officer to become a strategic advisor to the Chief Executive Officer.

The names, ages and biographies of our executive officers, as of February 15, 2024, are set forth below. The term of office of each officer is until the meeting of the Board of Directors following the next annual shareholders' meeting in May 2024.

Name	Age	Position
J. Kent Masters	63	Chairman, President and Chief Executive Officer
Neal R. Sheorey	47	Executive Vice President, Chief Financial Officer
Melissa Anderson	59	Senior Vice President, Chief Human Resources Officer
John C. Barichivich III	56	Vice President, Corporate Controller, Chief Accounting Officer
Kristin M. Coleman	55	Executive Vice President, General Counsel and Corporate Secretary
Jacobus G. Fourie	48	Chief Capital Projects Officer
Netha Johnson	53	President, Specialties Global Business Unit
Cynthia Lima	62	Senior Vice President, Chief External Affairs and Communications Officer
Eric Norris	57	President, Energy Storage Global Business Unit
Michael Simmons	60	President, Ketjen Global Business Unit

J. Kent Masters has served as Chairman, President and Chief Executive Officer in April 2020. He joined the Albemarle board of directors in 2015 and served as Lead Independent Director from 2018 until April 2020. Prior to joining Albemarle, Mr. Masters served as Operating Partner of Advent International, an international private equity group. Prior to Advent, he served as Chief Executive Officer of Foster Wheeler AG, a global engineering and construction contractor and power equipment supplier, when Foster Wheeler AG was acquired by Amec plc to form Amec Foster Wheeler plc. He is also a former member of the executive board of Linde AG, a global leader in manufacturing and sales of industrial gases, with responsibility for the Americas, Africa, and the South Pacific.

Neal R. Sheorey joined Albemarle in November 2023 as Executive Vice President and Chief Financial Officer. Prior to joining Albemarle, Mr. Sheorey served for more than 20 years in progressive finance, business and corporate leadership roles at The Dow Chemical Company ("Dow"), most recently serving as vice president of Dow's Coatings and Performance Monomers business unit from February 2020 to November 2023. Previously, Mr. Sheorey served as Dow's Vice President of Investor Relations from January 2016 to February 2020, Senior Director of Corporate Development from 2015 to 2016 and Global Finance Director for the Chemicals business group from 2012 to 2015.

Melissa Anderson joined Albemarle as Senior Vice President, Chief Human Resources Officer in January 2021. Prior to joining Albemarle, Ms. Anderson served as Executive Vice President, Administration and Chief Human Resources Officer at Duke Energy, an American electric power holding company based in North Carolina, from January 2015 to August 2020. Previous to that role, she held the role of Senior Vice President, Human Resources, for Domtar Corporation in South Carolina. Her previous experience also includes 17 years with IBM in progressive Human Resources leadership roles. Ms. Anderson serves on the board of Vulcan Materials and as Chair of the Society of Human Resource Management (SHRM), the world's largest HR professional association. She is also a member of the advisory board for the Center for Executive Succession at the University of South Carolina's Darla Moore School of Business.

John C. Barichivich III was appointed Vice President, Corporate Controller and Chief Accounting Officer effective November 2019. Mr. Barichivich has worked for Albemarle since 2007, holding various staff and leadership positions of increasing responsibility. Most recently, Mr. Barichivich served as Chief Financial Officer and Vice President Finance, Purchasing, and S&OP Catalysts global business unit from February 2019 to November 2019. Between January 2016 and February 2019, Mr. Barichivich acted as Vice President - Finance, Bromine Specialties global business unit, and he previously served as Vice President of Finance, Catalysts global business unit from September 2012 until December 2015. Mr. Barichivich was also the Director of Finance for the Albemarle shared service centers and he started his career with Albemarle as the Operations Controller for the Polymer Solutions business. Prior to Albemarle, Mr. Barichivich held a number of positions, including Director of Finance at the Home Depot, CFO Sensors SBE at PerkinElmer, and Manager of FP&A at General Electric. Mr. Barichivich began his career at Georgia Pacific, where he worked as an internal auditor and was a financial analyst supporting the restructuring of the Distribution Division.

Kristin M. Coleman joined Albemarle in November of 2022 as Executive Vice President, General Counsel and Corporate Secretary. Ms. Coleman has nearly 30 years of legal experience, previously serving as Executive Vice President, General Counsel, and Chief Compliance Officer at US Foods from February 2017 to November 2022. She also served as Senior Vice President, General Counsel, and Corporate Secretary of Sears Holdings Corporation from 2014 to 2017 and as Vice President, General Counsel, and Corporate Secretary for Brunswick Corporation from 2009 to 2014. Before moving in-house, she worked in private practice with Sidley Austin LLP. Ms. Coleman founded the Chicago General Counsel Forum and is a member of the Economic Club of Chicago. She serves as a Board Member Emeritus for the Center for Enriched Living.

Jacobus G. Fourie has served as Chief Capital Projects Officer since June 2021. He joined Albemarle in January 2019 as Vice President, Engineering and Project Execution. Prior to joining Albemarle, Mr. Fourie served as Senior Vice President of Capital Projects for Barrick Gold Corporation from May 2017 to November 2018, where he was responsible for projects in the U.S., Chile, Argentina and Saudi Arabia. Previously, Mr. Fourie spent 16 years with BHP Billiton where he held various leadership roles in projects, operations, marketing and business development. As VP Projects - Iron Ore, he oversaw a portfolio of major capital projects and sustaining capital projects in Western Australia. As Head of Group Business Management Systems, he was responsible for implementing a large SAP system project for BHP Billiton, while based in Singapore. Prior to this, he was Asset President of BHP Billiton's New Mexico Coal business.

Netha Johnson joined Albemarle as President, Bromine (now Specialties) global business unit in 2018. Mr. Johnson has more than 20 years of diverse leadership experience, both domestically and internationally, including having worked extensively in Singapore, Malaysia, Taiwan, Japan and Germany. Prior to joining Albemarle, Mr. Johnson served in several progressive leadership roles with 3M Company. Most recently, he served as Vice President and General Manager, Electrical Markets Division, where he was directly responsible for 3M's electrical and renewable energy solutions. Prior to that, he served as 3M's Vice President, Advanced Materials Division. In this role, he was responsible for three distinct businesses comprising the Advanced Material division, which provided world-leading, innovative solutions in fluoropolymer chemicals, advanced ceramics and light-weighting materials. Preceding his business career, Mr. Johnson served as a U.S. Naval Officer. Mr. Johnson has served as a member of the board of directors of Xcel Energy, Inc. since March 2020.

Cynthia Lima was appointed Senior Vice President, Chief External Affairs and Communications Officer of Albemarle in November 2023. Ms. Lima joined Albemarle in February 2023 as Chief Communications Officer. Prior to joining Albemarle, Ms. Lima founded C-Suite Communications, a communications and public affairs consultancy, in 2010. She held senior positions at domestic and global public relations agencies, including serving as a senior partner at SP Consulting from December 2014 to February 2023 and serving as Senior Vice President of Fleishman-Hillard Inc. from 2005 to 2010. Previously, Ms. Lima served in the U.S. Department of State from 2001 to 2003 and U.S. Department of Veterans Affairs from 2003 to 2005, where she was a senate-confirmed presidential appointee.

Eric Norris was appointed President, Lithium (now Energy Storage) global business unit in August 2018. Mr. Norris joined Albemarle in January 2018 as Chief Strategy Officer. Prior to joining Albemarle, Mr. Norris served as President of Health and Nutrition for FMC Corporation from 2015 to November 2017. Following FMC's announcement to acquire DuPont Agricultural Chemical assets, he led the divestiture of FMC Health and Nutrition to DuPont. Previously, Mr. Norris served as Vice President and Global Business Director for FMC Health and Nutrition, and Vice President and Global Business Director for FMC Lithium. During his 16-year FMC career, he served in additional leadership roles including Investor Relations, Corporate Development and Director of FMC Healthcare Ventures. Prior to FMC, Mr. Norris founded and led an internet-based firm offering formulation and design tools to the chemical industry. Previously, he served in a variety of roles for Rohm and Haas Company including sales, marketing, strategic planning and investor relations. Norris is a member of the board of directors of Communities in Schools of Charlotte-Mecklenburg and served as a member of the board of directors of The Zero Emission Transportation Association (ZETA) from 2021 to 2023.

Michael Simmons joined Albemarle as President, Ketjen global business unit in June 2023. Mr. Simmons has more than 30 years of experience as an operating executive, including serving as a senior partner at Vantage Consulting, a business advisory service specializing in strategy, execution and leadership for energy, financial, and medical clients, from January 2018 to June 2023, and serving as a group president at Shawcor from 2012 to 2017. He served as a private equity partner for Q Investments from 2006 to 2021. He began his career at GE, becoming Chief Executive Officer of the PII Pipeline Solutions unit of GE Oil & Gas from 2005 to 2007.

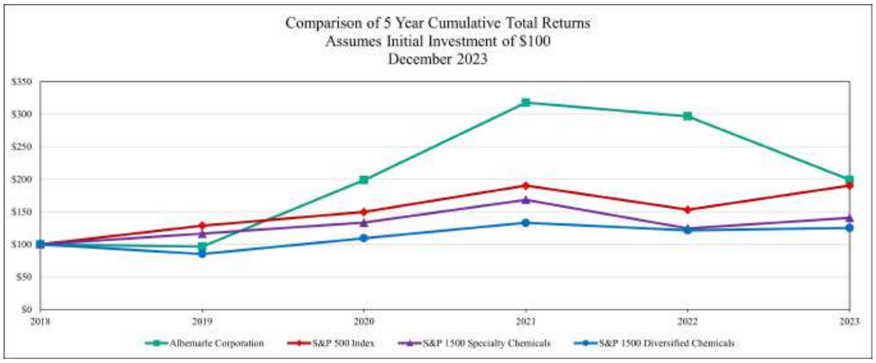
PART II

Item 5. Market for the Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities.

Our common stock trades on the New York Stock Exchange ("NYSE") under the symbol "ALB." There were 117,402,949 shares of common stock held by 2,039 shareholders of record as of February 7, 2024. On each of February 23, 2023, May 2, 2023, July 18, 2023, and October 23, 2023, we declared a dividend of $0.40 per share. In each quarter of 2022, we declared a dividend of $0.395 per share and, in each quarter of 2021, we declared a dividend of $0.39 per share. We expect to continue to declare and pay comparable dividends to our shareholders in the future, however, dividends are declared solely at the discretion of our Board of Directors and there is no guarantee that the Board of Directors will continue to declare dividends in the future.

Stock Performance Graph

The graph below shows the cumulative total shareholder return assuming the investment of $100 in our common stock on December 31, 2018 and the reinvestment of all dividends thereafter. The information contained in the graph below is furnished and therefore not to be considered “filed” with the SEC, and is not incorporated by reference into any document that incorporates this Annual Report on Form 10-K by reference.



Item 6. [Reserved]

Item 7. Management’s Discussion and Analysis of Financial Condition and Results of Operations.

Forward-looking Statements

Some of the information presented in this Annual Report on Form 10-K, including the documents incorporated by reference herein, may constitute forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Such forward-looking statements are based on our current expectations, which are in turn based on assumptions that we believe are reasonable based on our current knowledge of our business and operations. We have used words such as “anticipate,” “believe,” “could,” “estimate,” “expect,” “intend,” “may,” “should,” “would,” “will” and variations of such words and similar expressions to identify such forward-looking statements.

These forward-looking statements are not guarantees of future performance and involve certain risks, uncertainties and assumptions, which are difficult to predict and many of which are beyond our control. There can be no assurance that our actual results will not differ materially from the results and expectations expressed or implied in the forward-looking statements. Factors that could cause actual results to differ materially from the outlook expressed or implied in any forward-looking statement include, without limitation, information related to:

- changes in economic and business conditions;
- product development;
- changes in financial and operating performance of our major customers and industries and markets served by us;
- the timing of orders received from customers;
- the gain or loss of significant customers;
- fluctuations in lithium market pricing, which could impact our revenues and profitability particularly due to our increased exposure to index-referenced and variable-priced contracts for battery grade lithium sales;
- inflationary trends in our input costs, such as raw materials, transportation and energy, and their effects on our business and financial results;
- changes with respect to contract renegotiations;

- potential production volume shortfalls;
- competition from other manufacturers;
- changes in the demand for our products or the end-user markets in which our products are sold;
- limitations or prohibitions on the manufacture and sale of our products;
- availability of raw materials;
- increases in the cost of raw materials and energy, and our ability to pass through such increases to our customers;
- technological change and development;
- changes in our markets in general;
- fluctuations in foreign currencies;
- changes in laws and government regulation impacting our operations or our products;
- the occurrence of regulatory actions, proceedings, claims or litigation (including with respect to the U.S. Foreign Corrupt Practices Act and foreign anti-corruption laws);
- the occurrence of cyber-security breaches, terrorist attacks, industrial accidents or natural disasters;
- the effects of climate change, including any regulatory changes to which we might be subject;
- hazards associated with chemicals manufacturing;
- the inability to maintain current levels of insurance, including product or premises liability insurance, or the denial of such coverage;
- political unrest affecting the global economy, including adverse effects from terrorism or hostilities;
- political instability affecting our manufacturing operations or joint ventures;
- changes in accounting standards;
- the inability to achieve results from our global manufacturing cost reduction initiatives as well as our ongoing continuous improvement and rationalization programs;
- changes in the jurisdictional mix of our earnings and changes in tax laws and rates or interpretation;
- changes in monetary policies, inflation or interest rates that may impact our ability to raise capital or increase our cost of funds, impact the performance of our pension fund investments and increase our pension expense and funding obligations;
- volatility and uncertainties in the debt and equity markets;
- technology or intellectual property infringement, including cyber-security breaches, and other innovation risks;
- decisions we may make in the future;
- future acquisition and divestiture transactions, including the ability to successfully execute, operate and integrate acquisitions and divestitures and incurring additional indebtedness;
- expected benefits from proposed transactions;
- timing of active and proposed projects;
- impact of any future pandemics;
- impacts of the situation in the Middle East and the military conflict between Russia and Ukraine, and the global response to it;
- performance of our partners in joint ventures and other projects;
- changes in credit ratings;
- the inability to realize the benefits of our decision to retain our Ketjen business as a wholly-owned subsidiary and to realign our Lithium and Bromine global business units into a new corporate structure, including Energy Storage and Specialties business units; and
- the other factors detailed from time to time in the reports we file with the SEC.

We assume no obligation to provide any revisions to any forward-looking statements should circumstances change, except as otherwise required by securities and other applicable laws. The following discussion should be read together with our consolidated financial statements and related notes included in this Annual Report on Form 10-K.

The following is a discussion and analysis of our results of operations for the years ended December 31, 2023, 2022 and 2021. A discussion of our consolidated financial condition and sources of additional capital is included under a separate heading “Financial Condition and Liquidity.”

Overview

We are a leading global developer, manufacturer and marketer of highly-engineered specialty chemicals that are designed to meet our customers' needs across a diverse range of end markets. Our corporate purpose is making the world safe and sustainable by powering the potential of people. The end markets we serve include energy storage, petroleum refining, consumer electronics, construction, automotive, lubricants, pharmaceuticals and crop protection. We believe that our commercial and geographic diversity, technical expertise, access to high-quality resources, innovative capability, flexible, low-cost global manufacturing base, experienced management team and strategic focus on our core base technologies will enable us to maintain leading positions in those areas of the specialty chemicals industry in which we operate.

Secular trends favorably impacting demand within the end markets that we serve combined with our diverse product portfolio, broad geographic presence and customer-focused solutions will continue to be key drivers of our future earnings growth. We continue to build upon our existing green solutions portfolio and our ongoing mission to provide innovative, yet commercially viable, clean energy products and services to the marketplace to contribute to our sustainable revenue. For example, our Energy Storage business contributes to the growth of clean miles driven with electric vehicles and more efficient use of renewable energy through grid storage; Specialties enables the prevention of fires starting in electronic equipment, greater fuel efficiency from rubber tires and the reduction of emissions from coal fired power plants; and our Ketjen business creates efficiency of natural resources through more usable products from a single barrel of oil, enables safer, greener production of alkylates used to produce more environmentally-friendly fuels, and reduced emissions through cleaner transportation fuels. We believe our disciplined cost reduction efforts and ongoing productivity improvements, among other factors, position us well to take advantage of strengthening economic conditions as they occur, while softening the negative impact of the current challenging global economic environment.

2023 Highlights

- In the first quarter of 2023, we increased our quarterly dividend for the 29th consecutive year, to $0.40 per share.
- We announced the official brand launch of Ketjen, a wholly owned subsidiary, previously known as the Catalysts reportable segment.
- We realigned our Lithium and Bromine global business units into a new corporate structure designed to better meet customer needs and foster talent required to deliver in a competitive global environment. This resulted in the following three reportable segments: (1) Energy Storage; (2) Specialties; and (3) Ketjen.
- We entered into a definitive agreement with Ford Motor Company to deliver battery-grade lithium hydroxide to support the automaker's ability to scale electric vehicle ("EV") production. Albemarle will supply more than 100,000 metric tons of battery-grade lithium hydroxide for approximately three million future Ford EV batteries. The five-year supply agreement starts in 2026 and continues through 2030.
- We announced a $90 million critical materials award from the U.S. Department of Defense to support the restart of Kings Mountain, N.C. mine. This award is in addition to the previously announced nearly $150 million grant from the U.S. Department of Energy to support the construction of a new, commercial-scale U.S.-based lithium concentrator facility at Kings Mountain, N.C.
- We signed agreements with Caterpillar Inc. to collaborate on solutions to support the full circular battery value chain and sustainable mining operations. The collaboration aims to support our effort to establish Kings Mountain, N.C. as the first-ever zero-emissions lithium mine site in North America. It also makes our North-American-produced lithium available for use in Caterpillar battery production.
- We amended the MARBL lithium joint venture with MRL to acquire the remaining 40% ownership of the Kemerton lithium hydroxide processing facility in Australia that was jointly owned with MRL through the MARBL joint venture. Following this restructuring, Albemarle and MRL each own 50% of Wodgina, and MRL operates the Wodgina mine on behalf of the joint venture. In connection with this restructuring, we paid MRL approximately $380 million in cash.
- Our Meishan, China lithium conversion plant achieved mechanical completion in December 2023 and has moved to the commissioning phase.
- We recorded net sales of $9.6 billion during 2023, an increase of 31% from the prior year.
- Cash flows from operations in 2023 were $1.3 billion.

Outlook

The current global business environment presents a diverse set of opportunities and challenges in the markets we serve. In particular, we believe that the market for lithium battery and energy storage, particularly for EVs, remains strong, providing the opportunity to continue to develop high quality and innovative products while managing the high cost of expanding capacity. The other markets we serve continue to present various opportunities for value and growth as we have positioned ourselves to manage the impact on our business of changing global conditions, such as slow and uneven global growth, currency exchange volatility, crude oil price fluctuation, a dynamic pricing environment, an ever-changing landscape in electronics, the continuous need for cutting edge catalysts and technology by our refinery customers and increasingly stringent environmental standards. During the course of 2023, lithium index pricing dropped significantly. Amidst these dynamics, and despite recent downward lithium price pressure, we believe our business fundamentals are sound and that we are strategically well-positioned as we remain focused on increasing sales volumes, optimizing and improving the value of our portfolio primarily through pricing and product development, managing costs and delivering value to our customers and shareholders. We believe that our businesses remain well-positioned to capitalize on new business opportunities and long-term trends driving growth within our end markets and to respond quickly to changes in economic conditions in these markets. At this time, the current situation in the Middle East has resulted in our business operations continuing as normal with some shipping and raw material delays. We are monitoring the situation and will continue to make efforts to protect the safety of our employees and the health of our business.

Beginning in the first quarter of 2023, the chief operating decision maker evaluated performance, forecasting and making resource allocation decisions based on our previously announced realignment of the Lithium and Bromine global business units. The new corporate structure was designed to better meet customer needs and foster talent required to deliver in a competitive global environment. The realignment resulted in the following three reportable segments: (1) Energy Storage; (2) Specialties; and (3) Ketjen.

Energy Storage: We expect Energy Storage net sales and profitability to decrease year-over-year in 2024 if lithium market prices remain at their low current levels. Due to many of our contracts being index-referenced and variable-priced, our business is more aligned with changes in market and index pricing. The first part of 2023 saw record high lithium price levels which increased prior year results, helping drive the expected decrease in year-over-year comparisons. As a result, increases or further decreases in lithium market pricing could have a material impact on our results. We do expect the lower pricing to be partially offset by higher sales volume driven primarily by additional capacity from La Negra, Chile, Kemerton, Western Australia, and Qinzhou, China, as well as additional tolling volume supported by increased spodumene production out of Australia. The Meishan, China lithium conversion plant achieved mechanical completion and has moved to the commissioning phase. In addition, lower expected earnings are driven by higher variable costs, primarily due to the higher market pricing of salts and spodumene expected to be realized during the year. During the fourth quarter of 2023, we recorded a $604 million charge to reduce the value of certain spodumene and finished goods to their net realizable value following the decline in lithium market pricing at the end of the year. We could record additional inventory valuation charges in 2024 if lithium prices continue to deteriorate during the projected period of conversion and sale. While we ramp up our new capacity, we will continue to utilize tolling arrangements to meet growing customer demand. EV sales are expected to continue to increase over the prior year as the lithium battery market remains strong.

In addition, we completed the amendment of the MARBL joint venture in Australia. The restructured agreements, among other things, increase our interest in the first two conversion trains of the Kemerton processing plant from 60% to 100%. Following the transaction, we hold a 50% ownership interest in the Wodgina Lithium Mine Project.

On a longer-term basis, we believe that demand for lithium will continue to grow as new lithium applications advance and the use of plug-in hybrid EVs and full battery EVs increases. This demand for lithium is supported by a favorable backdrop of steadily declining lithium-ion battery costs, increasing battery performance, continuing significant investments in the battery and EV supply chain by cathode and battery producers and automotive OEMs and favorable global public policy toward e-mobility/renewable energy usage. Our outlook is also bolstered by long-term supply agreements with key strategic customers, reflecting our standing as a preferred global lithium partner, highlighted by our scale, access to geographically diverse, low-cost resources and long-term track record of reliability of supply and operating execution.

Specialties: We expect both net sales and profitability to be relatively flat in 2024 as we recover from reduced customer demand in certain markets, including consumer and industrial electronics, and maintain strong demand in other end-markets, such as pharmaceuticals, agriculture and oilfield services. We have taken measures to reduce the negative impact of lower demand, which we expect to show positive impacts in 2024.

On a longer-term basis, we continue to believe that improving global standards of living, widespread digitization, increasing demand for data management capacity and the potential for increasingly stringent fire safety regulations in developing markets are likely to drive continued demand for fire safety, bromine and lithium specialties products. We are focused on profitably growing our globally competitive production networks to serve all major bromine and lithium specialties consuming products and markets. The combination of our solid, long-term business fundamentals, strong cost position, product innovations and effective management of raw material costs should enable us to manage our business through end-market challenges and to capitalize on opportunities that are expected with favorable market trends in select end markets.

Ketjen: Total Ketjen results in 2024 are expected to increase year-over-year due to higher pricing, while raw material and energy costs stabilized during 2023. In addition, volume is expected to grow across each of the Ketjen businesses. The FCC market has recovered from the COVID-19 pandemic as a result of increased travel and depletion of global gasoline inventories. HPC demand tends to be lumpier than FCC demand, but we have seen increased demand as refineries are taking turnarounds. Additionally, we have signed an agreement to supply unique technologies to new markets, such as the hydrotreated vegetable oil market, which supports the energy transition for sustainable aviation fuels and supports our business growth. Our decision to retain this business as a separate, wholly-owned subsidiary is intended to better meet customer needs and foster the talent required to deliver in a competitive global environment.

On a longer-term basis, we believe increased global demand for transportation fuels, new refinery start-ups and ongoing adoption of cleaner fuels will be the primary drivers of growth in our Ketjen business. We believe delivering superior end-use performance continues to be the most effective way to create sustainable value in the refinery catalysts industry. We also believe our technologies continue to provide significant performance and financial benefits to refiners challenged to meet tighter regulations around the world, including those managing new contaminants present in North America tight oil, and those in the Middle East and Asia seeking to use heavier feedstock while pushing for higher propylene yields. Longer-term, we believe that the global crude supply will get heavier and more sour, a trend that bodes well for our catalysts portfolio. With superior technology and production capacities, and expected growth in end market demand, we believe that Ketjen remains well-positioned for the future. In PCS, we expect growth on a longer-term basis in our organometallics business due to growing global demand for plastics driven by rising standards of living and infrastructure spending.

Corporate: We continue to focus on cash generation, working capital management and process efficiencies. We expect our global effective tax rate will vary based on the locales in which income is actually earned and remains subject to potential volatility from changing legislation in the United States, such as the Inflation Reduction Act and the recently released Pillar II effective in 2024, and other tax jurisdictions. In January 2024 we announced that we are taking measures to unlock near term cash flow and generate long-term financial flexibility by re-phasing organic growth investments and optimizing our cost structure. This includes a reduction of planned capital expenditures in 2024 to focus on significantly progressed, near completion and in startup projects, while deferring spending on certain projects such as the previously announced mega-flex facility in Richburg, South Carolina and the Albemarle Technology Park in Charlotte, North Carolina. In addition, we announced that we are pursuing actions to optimize our cost structure, aiming to reduce costs by approximately $95 million annually, including a reduction in headcount and lower spending on contracted services.

Actuarial gains and losses related to our defined benefit pension and OPEB plan obligations are reflected in Corporate as a component of non-operating pension and OPEB plan costs under mark-to-market accounting. Results for the year ended December 31, 2023 include an actuarial gain of $10.2 million ($8.3 million after income taxes), as compared to a loss of $37.0 million ($26.5 million after income taxes) for the year ended December 31, 2022.

We remain committed to evaluating the merits of any opportunities that may arise for acquisitions or other business development activities that will complement our business footprint. Additional information regarding our products, markets and financial performance is provided at our website, *www.albemarle.com*. Our website is not a part of this document nor is it incorporated herein by reference.

Results of Operations

The following data and discussion provides an analysis of certain significant factors affecting our results of operations during the periods included in the accompanying consolidated statements of income.

With the exception of the segment results of operations for the realigned Energy Storage and Specialties segments, discussion of our results of operations for the year ended December 31, 2022 compared to the year ended December 31, 2021 can be found in Part II, Item 7 of our Annual Report on Form 10-K for the year ended December 31, 2022.

Comparison of 2023 to 2022

Net Sales

In thousands	2023		2022		$ Change		% Change
Net sales	$	9,617,203	$	7,320,104	$	2,297,099	31 %

- $1.5 billion of increase attributable to higher sales volume in Energy Storage and Ketjen, partially offset by lower sales volume in Specialties
- $875.0 million increase attributable to increased pricing primarily from Energy Storage
- $112.0 million of unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

Gross Profit

In thousands	2023		2022		$ Change		% Change
Gross profit	$	1,185,909	$	3,074,587	$	(1,888,678)	(61)%
Gross profit margin		12.3 %		42.0 %			

- Higher costs realized in the current period from sales of lithium resulting from the higher priced spodumene used during the lithium conversion process
- $604.1 million charge recorded in 2023 to reduce the value of certain spodumene and finished goods to their net realizable value following the decline in lithium market pricing at the end of the year
- Increased utility and material costs in each of our businesses
- Partially offset by higher sales volume and favorable pricing impacts over the full year in Energy Storage and Ketjen
- Unfavorable currency exchange impacts resulting from the stronger U.S. Dollar against various currencies

Selling, General and Administrative ("SG&A") Expenses

In thousands	2023		2022		$ Change		% Change
Selling, general and administrative expenses	$	919,493	$	524,145	$	395,348	75 %
Percentage of Net sales		9.6 %		7.2 %			

- $218.5 million legal accrual recorded for the agreements in principle to resolve a previously disclosed legal matter with the DOJ and SEC. See Note 17, "Commitments and Contingencies," for further details
- Higher compensation expenses across all businesses and Corporate
- Higher spending to support business growth, primarily in Energy Storage
- Partially offset by productivity improvements and a reduction in certain administrative costs

Research and Development Expenses

In thousands	2023		2022		$ Change		% Change
Research and development expenses	$	85,725	$	71,981	$	13,744	19 %
Percentage of Net sales		0.9 %		1.0 %			

- Increased research and development spending in each of our businesses

(Gain) Loss on Change in Interest in Properties/Sale of Business, Net

In thousands	2023		2022		$ Change		% Change
(Gain) loss on change in interest in properties/sale of business, net	$	(71,190)	$	8,400	$	(79,590)	

- Gain in 2023 resulting from the restructuring of the MARBL joint venture with MRL. See Note 10, "Investments," for further details.
- Loss in 2022 related to cost overruns for MRL's 40% interest in lithium hydroxide conversion assets being built in Kemerton, Western Australia

Interest and Financing Expenses

In thousands	2023	2022	$ Change	% Change
Interest and financing expenses	$ (116,072)	$ (122,973)	$ 6,901	(6)%

- 2022 included a $19.2 million loss on early extinguishment of debt, representing the tender premiums, fees, unamortized discounts, unamortized deferred financing costs and accelerated amortization of the interest rate swap balance from the redemption of debt during the second quarter of 2022
- 2022 also included an expense of $17.5 million related to the correction of out of period errors regarding overstated capitalized interest values in prior periods
- Increased average debt balance during 2023 compared to 2022 following the borrowing of commercial paper in 2023 in addition to $1.7 billion in senior notes issued in May 2022

Other Income (Expenses), Net

In thousands	2023	2022	$ Change	% Change
Other income (expenses), net	$ 110,929	$ 86,356	$ 24,573	28 %

- $39.9 million of foreign exchange gains recorded in 2023 compared to $21.8 million of foreign exchange losses in 2022
- $48.5 million increase attributable to interest income from higher cash balances in 2023
- $19.3 million of income recorded in 2023 from PIK dividends of preferred equity in a Grace subsidiary
- $49.1 million of a year over year decrease related to the fair value adjustments of equity securities in public companies
- $8.0 million of pension and OPEB credits (including mark-to-market actuarial gains of $10.2 million) in 2023 as compared to $57.0 million of pension and OPEB credits (including mark-to-market actuarial gains of $37.0 million) in 2022
    - The mark-to-market actuarial gain in 2023 is primarily attributable to a higher return on pension plan assets during the year than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was 11.21% versus an expected return of 6.66%. This was partially offset by a decrease in the weighted-average discount rate to 5.21% from 5.46% for our U.S. pension plans and to 3.73% from 4.04% for our foreign pension plans to reflect market conditions as of the December 31, 2023 measurement date.
    - The mark-to-market actuarial loss in 2022 is primarily attributable to a significant increase in the weighted-average discount rate to 5.46% from 2.86% for our U.S. pension plans and to 4.04% from 1.44% for our foreign pension plans to reflect market conditions as of the December 31, 2022 measurement date. This was partially offset by a lower return on pension plan assets in 2022 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was (17.94)% versus an expected return of 6.48%.

Income Tax Expense

In thousands	2023	2022	$ Change	% Change
Income Tax Expense	$ 430,277	$ 390,588	$ 39,689	10 %
Effective income tax rate	174.4 %	16.1 %		

- 2023 included tax impact of a non-deductible $218.5 million legal accrual recorded for the agreements to resolve a previously disclosed legal matter with the DOJ and SEC, a $96.5 million current year tax reserve related to an uncertain tax position in Chile, and an establishment of a valuation allowance on current year losses in one of our Chinese entities resulting in an income tax expense impact of $223.0 million
- 2022 includes a $91.8 million tax benefit resulting from the release of a valuation allowance in Australia, a $72.6 million benefit resulting from foreign-derived intangible income, partially offset by a $50.6 million current year tax reserve related to an uncertain tax position in Chile
- 2022 included a benefit from global intangible low-taxed income associated with a payment made in 2022 to settle a legacy legal matter
- Change in geographic mix of earnings

Equity in Net Income of Unconsolidated Investments

In thousands	2023	2022	$ Change	% Change
Equity in net income of unconsolidated investments	$ 1,854,082	$ 772,275	$ 1,081,807	140 %

- Increased earnings from strong pricing and volume increases from the Windfield joint venture
- $8.0 million increase attributable to favorable foreign exchange impacts from the Windfield joint venture

Net Income Attributable to Noncontrolling Interests

In thousands	2023	2022	$ Change	% Change
Net income attributable to noncontrolling interests	$ (97,067)	$ (125,315)	$ 28,248	(23)%

- Decrease in consolidated income related to our JBC joint venture primarily due to lower volume

Net Income Attributable to Albemarle Corporation

In thousands	2023	2022	$ Change	% Change
Net income attributable to Albemarle Corporation	$ 1,573,476	$ 2,689,816	$ (1,116,340)	(42)%
Percentage of Net Sales	16.4 %	36.7 %		
Basic earnings per share	$ 13.41	$ 22.97	$ (9.56)	(42)%
Diluted earnings per share	$ 13.36	$ 22.84	$ (9.48)	(42)%

- Higher costs realized in the current period from sales of lithium resulting from the higher priced spodumene used during the lithium conversion process
- $604.1 million charge recorded in 2023 to reduce the value of certain spodumene and finished goods to their net realizable value following the decline in lithium market pricing at the end of the year
- The establishment of a valuation allowance on current year losses in one of our Chinese entities resulting in an income tax expense impact of $223.0 million
- $218.5 million legal accrual recorded for the agreements in principle to resolve a previously disclosed legal matter with the DOJ, SEC and DPP. See Note 17, "Commitments and Contingencies," for further details
- Increased SG&A expenses, primarily related to increased compensation expense
- $49.1 million of a year over year decrease related to the fair value adjustments of equity securities in public companies
- Mark-to-market actuarial gains of $8.3 million, net of income taxes, recorded in 2023 compared to mark-to-market actuarial gains of $26.5 million, net of income taxes, recorded in 2022
- Favorable pricing impacts and higher sales volume in Energy Storage and Ketjen
- Increased earnings from Windfield joint venture
- $71.2 million gain in 2023 resulting from the restructuring of the MARBL joint venture with MRL
- $61.6 million increase attributable to foreign exchange impacts from gains recorded in 2023

Other Comprehensive Income (Loss), Net of Tax

In thousands	2023	2022	$ Change	% Change
Other comprehensive income (loss), net of tax	$ 32,254	$ (168,295)	$ 200,549	(119)%
• Foreign currency translation	$ 26,403	$ (171,295)	$ 197,698	(115)%
▪ 2023 included favorable movements in the Euro of approximately $41 million and the Brazilian Real of approximately $5 million, partially offset by unfavorable movements in the Chinese Renminbi of approximately $12 million, the Japanese Yen of approximately $8 million and a net unfavorable variance in various other currencies of approximately $1 million				
▪ 2022 included unfavorable movements in the Chinese Renminbi of approximately $74 million, the Euro of approximately $64 million, the Japanese Yen of approximately $14 million, the Taiwanese Dollar of approximately $9 million, the South Korean Won of approximately $5 million and the net unfavorable variance in other currencies totaling approximately $6 million				
• Cash flow hedge	$ 5,851	$ (4,399)	$ 10,250	(233)%
• Interest rate swap	$ —	$ 7,399	$ (7,399)	(100)%
▪ Accelerated the amortization of the remaining interest rate swap balance in 2022 as a result of the repayment of the 4.15% senior notes in 2024				

Segment Information Overview. We have identified three reportable segments according to the nature and economic characteristics of our products as well as the manner in which the information is used internally by the Company's chief operating decision maker to evaluate performance and make resource allocation decisions. Effective January 1, 2023 our reportable business segments consisted of: (1) Energy Storage, (2) Specialties and (3) Ketjen. The segment information for the prior year periods have been recast to conform to the current year presentation. The below segment information also includes a discussion of our segment net sales and adjusted EBITDA for the year ended December 31, 2022 compared to the year ended December 31, 2021 for the realigned Energy Storage and Specialties segments.

The Corporate category is not considered to be a segment and includes corporate-related items not allocated to the operating segments. Pension and OPEB service cost (which represents the benefits earned by active employees during the period) and amortization of prior service cost or benefit are allocated to the reportable segments, All Other, and Corporate, whereas the remaining components of pension and OPEB benefits cost or credit ("Non-operating pension and OPEB items") are included in Corporate. Segment data includes intersegment transfers of raw materials at cost and allocations for certain corporate costs.

Our chief operating decision maker uses adjusted EBITDA (as defined below) to assess the ongoing performance of the Company's business segments and to allocate resources. We define adjusted EBITDA as earnings before interest and financing expenses, income tax expense, depreciation and amortization, as adjusted on a consistent basis for certain non-operating, non-recurring or unusual items in a balanced manner and on a segment basis. These non-operating, non-recurring or unusual items may include acquisition and integration-related costs, gains or losses on sales of businesses, restructuring charges, facility divestiture charges, certain litigation and arbitration costs and charges, non-operating pension and OPEB items and other significant non-recurring items. In addition, management uses adjusted EBITDA for business planning purposes and as a significant component in the calculation of performance-based compensation for management and other employees. We have reported adjusted EBITDA because management believes it provides additional useful measurements to review the Company's operations, provides transparency to investors and enables period-to-period comparability of financial performance. Total adjusted EBITDA is a financial measure that is not required by, or presented in accordance with, the generally accepted accounting principles in the United States ("U.S. GAAP"). Total adjusted EBITDA should not be considered as an alternative to Net (loss) income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP, or any other financial measure reported in accordance with U.S. GAAP.

	Year Ended December 31,						Percentage Change	
	2023	%	2022	%	2021	%	2023 vs. 2022	2022 vs. 2021
	(In thousands, except percentages)							
Net sales:								
Energy Storage	$ 7,078,998	73.6 %	$ 4,660,945	63.7 %	$ 1,067,430	32.0 %	52 %	337 %
Specialties	1,482,425	15.4 %	1,759,587	24.0 %	1,424,197	42.8 %	(16)%	24 %
Ketjen	1,055,780	11.0 %	899,572	12.3 %	761,235	22.9 %	17 %	18 %
All Other	—	— %	—	— %	75,095	2.3 %	— %	(100)%
Total net sales	$ 9,617,203	100.0 %	$ 7,320,104	100.0 %	$ 3,327,957	100.0 %	31 %	120 %
Adjusted EBITDA:								
Energy Storage	$ 2,407,393	87.0 %	$ 3,032,260	87.2 %	$ 371,384	42.7 %	(21)%	716 %
Specialties	298,506	10.8 %	527,318	15.2 %	468,836	53.8 %	(43)%	12 %
Ketjen	103,872	3.8 %	28,732	0.8 %	106,941	12.3 %	262 %	(73)%
Total segment adjusted EBITDA	2,809,771	101.6 %	3,588,310	103.2 %	947,161	108.7 %	(22)%	279 %
All Other	—	— %	—	— %	29,858	3.4 %	— %	(100)%
Corporate	(43,486)	(1.6)%	(112,453)	(3.2)%	(106,045)	(12.2)%	(61)%	6 %
Total adjusted EBITDA	$ 2,766,285	100 %	$ 3,475,857	100.0 %	$ 870,974	100.0 %	(20)%	299 %

See below for a reconciliation of adjusted EBITDA, the non-GAAP financial measure, from Net income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP, (in thousands):

	Year ended December 31,		
	2023	**2022**	**2021**
Total segment adjusted EBITDA	$ 2,809,771	$ 3,588,310	$ 947,161
All other adjusted EBITDA	—	—	29,858
Corporate expenses, net	(43,486)	(112,453)	(106,045)
Depreciation and amortization	(429,944)	(300,841)	(254,000)
Interest and financing expenses[(a)]	(116,072)	(122,973)	(61,476)
Income tax expense	(430,277)	(390,588)	(29,446)
Gain (loss) on change in interest in properties/sale of business, net[(b)]	71,190	(8,400)	295,971
Acquisition and integration related costs[(c)]	(26,767)	(16,259)	(12,670)
Goodwill impairment[(d)]	(6,765)	—	—
Non-operating pension and OPEB items	7,971	57,032	78,814
Mark-to-market (loss) gain on public equity securities[(e)]	(44,732)	4,319	—
Legal accrual[(f)]	(218,510)	—	(657,412)
Albemarle Foundation contribution[(g)]	—	—	(20,000)
Indemnification adjustments[(h)]	—	—	(39,381)
Other[(i)]	1,097	(8,331)	(47,702)
Net income attributable to Albemarle Corporation	$ 1,573,476	$ 2,689,816	$ 123,672

(a) Included in Interest and financing expenses is a loss on early extinguishment of debt of $19.2 million and $29.0 million for the years ended December 31, 2022 and 2021, respectively. See Note 14, "Long-term Debt," for additional information. In addition, Interest and financing expenses for the year ended December 31, 2022 includes the correction of an out of period error of $17.5 million related to the overstatement of capitalized interest in prior periods.

(b) Gain recorded during the year ended December 31, 2023 resulting from the restructuring of the MARBL joint venture with MRL. See Note 10, "Investments," for further details. $8.4 million and $132.4 million of expense recorded during the years ended December 31, 2022 and 2021, respectively, as a result of revised estimates of the obligation to construct certain lithium hydroxide conversion assets in Kemerton, Western Australia, due to cost overruns from supply chain, labor and COVID-19 pandemic related issues. The corresponding obligation was initially recorded in Accrued liabilities prior to being transferred to MRL, which held a 40% ownership interest in these Kemerton assets during those periods. See Note 2, "Acquisitions," for additional information. In addition, the year ended December 31, 2021, includes a $428.4 million gain related to the FCS divestiture. See Note 3, "Divestitures," for additional information on this gain. In addition, includes a $132.4 million expense related to anticipated cost overruns for MRL's 40% interest in lithium hydroxide conversion assets being built in Kemerton.

(c) Costs related to the acquisition, integration and potential divestitures for various significant projects, recorded in SG&A.

(d) Goodwill impairment charge recorded in SG&A during the year ended December 31, 2023 related to our PCS business. See Note 12, "Goodwill and Other Intangibles," for further details.

(e) (Loss) gain recorded in Other income (expenses), net for the years ended December 31, 2023 and 2022 resulting from the change in fair value of investments in public equity securities.

(f) Loss recorded in SG&A for the agreements to resolve a previously disclosed legal matter with the DOJ and SEC during the year ended December 31, 2023. In addition, during the year ended December 31, 2021 the Company recorded a loss in Other income (expenses), net related to the settlement of an arbitration ruling for a prior legal matter. See Note 17, "Commitments and Contingencies," for further details on both matters.

(g) Included in SG&A is a charitable contribution, using a portion of the proceeds received from the FCS divestiture, to the Albemarle Foundation, a non-profit organization that sponsors grants, health and social projects, educational initiatives, disaster relief, matching gift programs, scholarships and other charitable initiatives in locations where the Company's employees live and the Company operates. This contribution is in addition to the normal annual contribution made to the Albemarle Foundation by the Company, and is significant in size and nature in that it is intended to provide more long-term benefits in these communities.

(h) Included in Other income (expenses), net to revise an indemnification estimate for an ongoing tax-related matter of a previously disposed business in Germany. A corresponding discrete tax benefit of $27.9 million was recorded in Income tax expense during the same period, netting to an expected cash obligation of approximately $11.5 million.

(i) Included amounts for the year ended December 31, 2023 recorded in:

- Cost of goods sold - $15.1 million loss recorded to settle an arbitration matter with a regulatory agency in Chile, partially offset by a $4.1 million gain from an updated cost estimate of an environmental reserve at a site not part of our operations.
- SG&A - $9.5 million of separation and other severance costs to employees in Corporate and the Ketjen business which are primarily expected to be paid out during 2023, $2.3 million of facility closure expenses related to offices in Germany, $1.9 million of charges primarily for environmental reserves at sites not part of our operations and $1.8 million of various expenses including for certain legal costs and shortfall contributions for a multiemployer plan financial improvement plan.
- Other income (expenses), net - $19.3 million gain from PIK dividends of preferred equity in a Grace subsidiary, a $7.3 million gain resulting from insurance proceeds of a prior legal matter and $5.5 million of gains from the sale of investments and the write-off of certain liabilities no longer required, partially offset by $3.6 million of charges for asset retirement obligations at a site not part of our operations and $0.9 million of a loss resulting from the adjustment of indemnification related to previously disposed businesses.

Included amounts for the year ended December 31, 2022 recorded in:

- Cost of goods sold - $2.7 million of expense related to one-time retention payments for certain employees during the Catalysts strategic review and business unit realignment, and $0.5 million related to the settlement of a legal matter resulting from a prior acquisition.
- SG&A - $4.3 million primarily related to facility closure expenses of offices in Germany, $2.8 million of charges for environmental reserves at sites not part of our operations, $2.8 million of shortfall contributions for our multiemployer plan financial improvement plan, $1.9 million of expense related to one-time retention payments for certain employees during the Catalysts strategic review, partially offset by $4.3 million of gains from the sale of legacy properties not part of our operations.
- Other income (expenses), net - $3.0 million gain from the reversal of a liability related to a previous divestiture, a $2.0 million gain relating to the adjustment of an environmental reserve at non-operating businesses we previously divested and a $0.6 million gain related to a settlement received from a legal matter in a prior period, partially offset by a $3.2 million loss resulting from the adjustment of indemnification related to previously disposed businesses.

Included amounts for the year ended December 31, 2021 recorded in:

- Cost of goods sold - $10.5 million of expense related to a legal matter as part of a prior acquisition in our Lithium business.
- SG&A - $11.5 million of legal fees related to a legacy Rockwood legal matter noted above, $9.8 million of expenses primarily related to non-routine labor and compensation related costs that are outside normal compensation arrangements, a $4.0 million loss resulting from the sale of property, plant and equipment, $3.8 million of charges for environmental reserves at a sites not part of our operations and $3.2 million of facility closure costs related to offices in Germany, and severance expenses in Germany and Belgium.
- Other income (expenses), net - $4.8 million of net expenses primarily related to asset retirement obligation charges to update of an estimate at a site formerly owned by Albemarle.

Energy Storage

In thousands	2023	2022	$ Change	% Change
Net sales	$ 7,078,998	$ 4,660,945	$ 2,418,053	52 %

- $1.5 billion increase attributable to higher sales volume, primarily driven by new capacity from La Negra III/IV in Chile and Qinzhou, China, as well as increased tolling
- $880.3 million increase attributable to favorable pricing impacts, reflecting tight market conditions in the first part of the year, primarily in battery- and tech-grade carbonate and hydroxide, as well as greater volumes sold under index-referenced and variable-priced contracts, and mix
- $105.9 million decrease attributable to unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

Adjusted EBITDA	$ 2,407,393	$ 3,032,260	$ (624,867)	(21)%

- Higher costs realized in the current period from sales of lithium resulting from the higher priced spodumene used during the lithium conversion process
- $604.1 million charge recorded in 2023 to reduce the value of certain spodumene and finished goods to their net realizable value following the decline in lithium market pricing at the end of the year
- Increased SG&A expenses from higher compensation and other administrative costs
- Increased utility and freight costs
- Increased spending for investments to support business growth
- Favorable pricing impacts and higher sales volume
- Increased equity in net income from the Windfield joint venture, driven by increased pricing and sales volume
- Savings from designed productivity improvements
- $59.5 million decrease attributable to unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

In thousands	2022	2021	$ Change	% Change
Net sales	$ 4,660,945	$ 1,067,430	$ 3,593,515	337 %

- $3.2 billion of favorable pricing impacts, reflecting tight market conditions, primarily in battery- and tech-grade carbonate and hydroxide, as well as greater volumes sold under index-referenced and variable-priced contracts, and mix
- $500.5 million of higher sales volume, driven by the La Negra III/IV expansion in Chile and increased tolling volume to meet growing customer demand
- $107.6 million of unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

Adjusted EBITDA	$ 3,032,260	$ 371,384	$ 2,660,876	716 %

- Favorable pricing impacts and higher sales volume
- Higher equity in net income from the Windfield joint venture, driven by increased pricing and sales volume
- Savings from designed productivity improvements
- Increased commission expenses in Chile resulting from the higher pricing in Lithium
- Increased SG&A expenses from higher compensation and other administrative costs
- Increased utility and freight costs
- Increased spending for investments to support business growth

Specialties

In thousands	2023	2022	$ Change	% Change
Net sales	$ 1,482,425	$ 1,759,587	$ (277,162)	(16)%

- $174.4 million decrease attributable to lower sales volumes related to decreased demand across all products
- $92.9 million decrease attributable to unfavorable pricing impacts across several divisions
- $10.0 million decrease attributable to unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

Adjusted EBITDA	$ 298,506	$ 527,318	$ (228,812)	(43)%

- Lower sales volume and unfavorable pricing impacts
- Increased manufacturing costs resulting from decreased production, increased utilities and material costs
- $14.0 million decrease attributable to unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

In thousands	2022	2021	$ Change	% Change
Net sales	$ 1,759,587	$ 1,424,197	$ 335,390	24 %

- $289.3 million of favorable pricing impacts, primarily in the fire safety solutions division
- $98.5 million of higher sales volume related to increased demand across all products
- $52.4 million of unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

Adjusted EBITDA	$ 527,318	$ 468,836	$ 58,482	12 %

- Favorable pricing impacts and higher sales volume
- Increased freight costs, partially due to trucker strikes in Jordan during the fourth quarter of 2022
- Increased utility costs and raw material prices, primarily due to the higher costs of bisphenol A (BPA)
- Increased SG&A expenses from higher compensation costs
- 2021 included higher production and utility costs of approximately $6 million resulting from the U.S. Gulf Coast winter storm
- $19.9 million of unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

Ketjen

In thousands	2023	2022	$ Change	% Change
Net sales	$ 1,055,780	$ 899,572	$ 156,208	17 %

- $87.6 million increase attributable to favorable pricing impacts, primarily in clean fuel technologies and PCS
- $64.7 million increase attributable to higher sales volume, primarily from the timing of clean fuel technologies sales
- $3.9 million increase attributable to favorable currency translation resulting from the weaker U.S. Dollar against various currencies

Adjusted EBITDA	$ 103,872	$ 28,732	$ 75,140	262 %

- Favorable pricing impacts, partially offset by lower sales volume
- $24 million gain recorded for insurance claim receipts
- Savings from designed productivity improvements
- Increase in incentive compensation costs

In thousands	2022	2021	$ Change	% Change
Net sales	$ 899,572	$ 761,235	$ 138,337	18 %

- $99.7 million of higher sales volume, primarily from the timing of clean fuel technologies sales, which has lumpier demand; sales volume was negatively affected by the impacts of a winter freeze in the U.S. during the fourth quarter of 2022
- $56.5 million of favorable pricing impacts, primarily in clean fuel technologies and PCS
- $17.8 million of unfavorable currency translation resulting from the stronger U.S. Dollar against various currencies

Adjusted EBITDA	$ 28,732	$ 106,941	$ (78,209)	(73)%

- Increased utility costs, primarily natural gas in Europe
- Increased raw material and freight costs
- Higher sales volume and favorable pricing impacts; adjusted EBITDA was negatively affected by the impacts of a winter freeze in the U.S. during the fourth quarter of 2022
- 2022 benefited from $7 million of government grants from the Netherlands in response to losses during the COVID-19 pandemic as compared to $19 million of these grants in 2021
- Recorded $10 million gain from contingent business interruption insurance settlements resulting from lost income during 2019 to 2022 due to multiple incidents at one of its customers
- 2021 included higher production and utility costs of approximately $16 million resulting from the U.S. Gulf Coast winter storm
- 2021 included a $3.1 million out-of-period adjustment expense recorded in Cost of goods sold to correct inventory foreign exchange values relating to prior year periods

Corporate

In thousands	2023	2022	$ Change	% Change
Adjusted EBITDA	$ (43,486)	$ (112,453)	$ 68,967	(61)%

- $69.6 million increase attributable to favorable currency exchange impacts, including a $8.0 million increase in foreign exchange impacts from our Windfield joint venture
- Increase in interest income due to higher cash balances in 2023
- Partially offset by higher compensation and other administrative costs

In thousands	2022	2021	$ Change	% Change
Adjusted EBITDA	$ (112,453)	$ (106,045)	$ (6,408)	6 %

- Increase in compensation costs, including incentive-based compensation
- $10.9 million decrease attributable to unfavorable currency exchange impacts, including a $10.9 million increase in foreign exchange impacts from our Windfield joint venture

Summary of Critical Accounting Policies and Estimates

Estimates and Assumptions

The preparation of financial statements in conformity with U.S. GAAP requires management to make estimates and assumptions that affect the reported amounts of revenues, expenses, assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Listed below are the estimates and assumptions that we consider to be critical in the preparation of our financial statements.

Property, Plant and Equipment. We assign the useful lives of our property, plant and equipment based upon our internal engineering estimates, which are reviewed periodically. The estimated useful lives of our property, plant and equipment range from two to sixty years and depreciation is recorded on the straight-line method, with the exception of our mineral rights and reserves, which are depleted on a units-of-production method. We evaluate the recovery of our property, plant and equipment by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized.

Acquisition Method of Accounting. We recognize the identifiable assets acquired, the liabilities assumed and any noncontrolling interest in the acquiree at their estimated fair values on the date of acquisition for acquired businesses. Determining the fair value of these items requires management's judgment and the utilization of independent valuation specialists and involves the use of significant estimates and assumptions with respect to the timing and amounts of future cash flows and discount rates, among other items. When acquiring mineral reserves, the fair value is estimated using an excess earnings approach, which requires management to estimate future cash flows, net of capital investments in the specific operation. Management's cash flow projections involved the use of significant estimates and assumptions with respect to the expected production of the mine over the estimated time period, sales prices, shipment volumes, and expected profit margins. The present value of the projected net cash flows represents the preliminary fair value assigned to mineral reserves. The discount rate is a significant assumption used in the valuation model. The judgments made in the determination of the estimated fair value assigned to the assets acquired, the liabilities assumed and any noncontrolling interest in the investee, as well as the estimated useful life of each asset and the duration of each liability, can materially impact the financial statements in periods after acquisition, such as through depreciation and amortization expense. For more information on our acquisitions and application of the acquisition method, see Note 2, "Acquisitions," to our consolidated financial statements included in Part II, Item 8 of this report.

Income Taxes. We assume the deductibility of certain costs in our income tax filings, and we estimate the future recovery of deferred tax assets, uncertain tax positions and indefinite investment assertions.

Inventory Valuation. Inventories are stated at lower of cost and net realizable value with cost determined primarily on the first-in, first-out basis. Cost is determined on the weighted-average basis for a small portion of our inventories at foreign plants and our stores, supplies and other inventory. A portion of our domestic produced finished goods and raw materials are determined on the last-in, first-out basis. If management estimates that the market value is below cost or determines that future demand was lower than current inventory levels, based on historical experience, current and projected market pricing and demand, current and projected volume trends and other relevant current and projected factors associated with the current economic conditions, a reduction in inventory cost to estimated net realizable value is recorded in an inventory reserve with an expense recorded to Cost of goods sold.

Environmental Remediation Liabilities. We estimate and accrue the costs required to remediate a specific site depending on site-specific facts and circumstances. Cost estimates to remediate each specific site are developed by assessing (i) the scope of our contribution to the environmental matter, (ii) the scope of the anticipated remediation and monitoring plan and (iii) the extent of other parties' share of responsibility.

Asset Retirement Obligations. Certain of our sites are subject to various laws and regulations, including legal and contractual obligations to reclaim, remediate, or otherwise restore properties at the time the property is removed from service. The fair value recorded is estimated based on cost information obtained both internally and externally. These estimates are inflated based the assumed timing of the obligation payments and discounted using on available risk-free discount rate at the time. We review our assumptions and estimates of these costs periodically or if we become aware of material changes to these obligations.

Actual results could differ materially from the estimates and assumptions that we use in the preparation of our financial statements.

Revenue Recognition

Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods or providing services, and is recognized when performance obligations are satisfied under the terms of contracts with our customers. A performance obligation is deemed to be satisfied when control of the product or service is transferred to our customer. The transaction price of a contract, or the amount we expect to receive upon satisfaction of all performance obligations, is determined by reference to the contract's terms and includes adjustments, if applicable, for any variable consideration, such as customer rebates, noncash consideration or consideration payable to the customer, although these adjustments are generally not material. Where a contract contains more than one distinct performance obligation, the transaction price is allocated to each performance obligation based on the standalone selling price of each performance obligation, although these situations are rare and are generally not built into our contracts. Any unsatisfied performance obligations are not material. Standalone selling prices are based on prices we charge to our customers, which in some cases are based on established market prices. Sales and other similar taxes collected from customers on behalf of third parties are excluded from revenue. Our payment terms are generally between 30 to 90 days, however, they vary by market factors, such as customer size, creditworthiness, geography and competitive environment.

All of our revenue is derived from contracts with customers, and almost all of our contracts with customers contain one performance obligation for the transfer of goods where such performance obligation is satisfied at a point in time. Control of a product is deemed to be transferred to the customer upon shipment or delivery. Significant portions of our sales are sold free on board shipping point or on an equivalent basis, while delivery terms of other transactions are based upon specific contractual arrangements. Our standard terms of delivery are generally included in our contracts of sale, order confirmation documents and invoices, while the timing between shipment and delivery generally ranges between 1 and 45 days. Costs for shipping and handling activities, whether performed before or after the customer obtains control of the goods, are accounted for as fulfillment costs. Such costs are immaterial.

The Company currently utilizes the following practical expedients, as permitted by Accounting Standards Codification (“ASC”) 606, *Revenue from Contracts with Customers*:

- All sales and other pass-through taxes are excluded from contract value;
- In utilizing the modified retrospective transition method, no adjustment was necessary for contracts that did not cross over the reporting year;
- We will not consider the possibility of a contract having a significant financing component (which would effectively attribute a portion of the sales price to interest income) unless, if at contract inception, the expected payment terms (from time of delivery or other relevant criterion) are more than one year;
- If our right to customer payment is directly related to the value of our completed performance, we recognize revenue consistent with the invoicing right; and
- We expense as incurred all costs of obtaining a contract incremental to any costs/compensation attributable to individual product sales/shipments for contracts where the amortization period for such costs would otherwise be one year or less.

Certain products we produce are made to our customer’s specifications where such products have no alternative use or would need significant rework costs in order to be sold to another customer. In management’s judgment, control of these arrangements is transferred to the customer at a point in time (upon shipment or delivery) and not over the time they are produced. Therefore, revenue is recognized upon shipment or delivery of these products.

Costs incurred to obtain contracts with customers are not significant and are expensed immediately as the amortization period would be one year or less. When the Company incurs pre-production or other fulfillment costs in connection with an existing or specific anticipated contract and such costs are recoverable through margin or explicitly reimbursable, such costs are capitalized and amortized to Cost of goods sold on a systematic basis that is consistent with the pattern of transfer to the customer of the goods or services to which the asset relates, which is less than one year. We record bad debt expense in specific situations when we determine the customer is unable to meet its financial obligation.

Goodwill and Other Intangible Assets

We account for goodwill and other intangibles acquired in a business combination in conformity with current accounting guidance, which requires goodwill and indefinite-lived intangible assets to not be amortized.

We test goodwill for impairment by comparing the estimated fair value of our reporting units to the related carrying value. Our reporting units are either our operating business segments or one level below our operating business segments for which discrete financial information is available and for which operating results are regularly reviewed by the business management. In applying the goodwill impairment test, the Company initially performs a qualitative test (“Step 0”), where it first assesses qualitative factors to determine whether it is more likely than not that the fair value of the reporting units is less than its carrying value. Qualitative factors may include, but are not limited to, economic conditions, industry and market considerations, cost factors, overall financial performance of the reporting units and other entity and reporting unit specific events. If after assessing these qualitative factors, the Company determines it is “more-likely-than-not” that the fair value of the reporting unit is less than the carrying value, the Company performs a quantitative test (“Step 1”). During Step 1, the Company estimates the fair value using a discounted cash flow model. Future cash flows for all reporting units include assumptions about revenue growth rates, adjusted EBITDA margins, discount rate as well as other economic or industry-related factors. The Company defines adjusted EBITDA as earnings before interest and financing expense, income tax expenses, depreciation and amortization, as adjusted on a consistent basis for certain non-operating, non-recurring or unusual items in a balanced manner and on a segment basis.For the Refining Solutions reporting unit, within the Ketjen segment, the revenue growth rates, adjusted EBITDA margins and the discount rate were deemed to be significant assumptions. Significant management judgment is involved in estimating these variables and they include inherent uncertainties since they are forecasting future events. The Company uses a Weighted Average Cost of Capital ("WACC") approach to determine our discount rate for goodwill recoverability testing. The WACC calculation incorporates industry-weighted average returns on debt and equity from a market perspective. The factors in this calculation are largely external to the Company and, therefore, are beyond its control. The Company performs a sensitivity analysis by using a range of inputs to confirm the reasonableness of these estimates being used in the goodwill impairment analysis. The Company tests its recorded goodwill for impairment in the fourth quarter of each year or upon the occurrence of events or changes in circumstances that would more likely than not reduce the fair value of its reporting units below their carrying amounts.

The Company performed its annual goodwill impairment test as of October 31, 2023. The PCS reporting unit, within the Ketjen segment, has experienced declining earnings from a changing market. During this annual impairment test, it was determined that it is expected to experience a continued decline in its foreseeable forecast, resulting in a fair value based on the present value future cash flows that was lower than its current carrying value. As a result, the Company recorded a $6.8 million impairment loss, representing the full value of goodwill associated with the PCS reporting unit. No evidence of impairment was noted for the other reporting units from the analysis. However, if the adjusted EBITDA or discount rate estimates for the Refining Solutions reporting unit negatively changed by 10%, the Refining Solutions fair value would be below its carrying value.

We assess our indefinite-lived intangible assets, which include trade names and trademarks, for impairment annually and between annual tests if events or changes in circumstances indicate that it is more likely than not that the asset is impaired. The indefinite-lived intangible asset impairment standard allows us to first assess qualitative factors to determine if a quantitative impairment test is necessary. Further testing is only required if we determine, based on the qualitative assessment, that it is more likely than not that the indefinite-lived intangible asset's fair value is less than its carrying amount. If we determine based on the qualitative assessment that it is more likely than not that the asset is impaired, an impairment test is performed by comparing the fair value of the indefinite-lived intangible asset to its carrying amount. During the year ended December 31, 2023, no evidence of impairment was noted from the analysis for our indefinite-lived intangible assets.

Definite-lived intangible assets, such as purchased technology, patents and customer lists, are amortized over their estimated useful lives generally for periods ranging from five to twenty-five years. Except for customer lists and relationships associated with the majority of our Lithium business, which are amortized using the pattern of economic benefit method, definite-lived intangible assets are amortized using the straight-line method. We evaluate the recovery of our definite-lived intangible assets by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized. See Note 12, "Goodwill and Other Intangibles," to our consolidated financial statements included in Part II, Item 8 of this report.

Pension Plans and Other Postretirement Benefits

Under authoritative accounting standards, assumptions are made regarding the valuation of benefit obligations and the performance of plan assets. As required, we recognize a balance sheet asset or liability for each of our pension and OPEB plans equal to the plan's funded status as of the measurement date. The primary assumptions are as follows:

- Discount Rate—The discount rate is used in calculating the present value of benefits, which is based on projections of benefit payments to be made in the future.
- Expected Return on Plan Assets—We project the future return on plan assets based on prior performance and future expectations for the types of investments held by the plans as well as the expected long-term allocation of plan assets for these investments. These projected returns reduce the net benefit costs recorded currently.
- Rate of Compensation Increase—For salary-related plans, we project employees' annual pay increases, which are used to project employees' pension benefits at retirement.
- Mortality Assumptions—Assumptions about life expectancy of plan participants are used in the measurement of related plan obligations.

Actuarial gains and losses are recognized annually in our consolidated statements of income in the fourth quarter and whenever a plan is determined to qualify for a remeasurement during a fiscal year. The remaining components of pension and OPEB plan expense, primarily service cost, interest cost and expected return on assets, are recorded on a monthly basis. The market-related value of assets equals the actual market value as of the date of measurement.

During 2023, we made changes to assumptions related to discount rates and expected rates of return on plan assets. We consider available information that we deem relevant when selecting each of these assumptions.

Our U.S. defined benefit plans for non-represented employees are closed to new participants, with no additional benefits accruing under these plans as participants' accrued benefits have been frozen. In selecting the discount rates for the U.S. plans, we consider expected benefit payments on a plan-by-plan basis. As a result, the Company uses different discount rates for each plan depending on the demographics of participants and the expected timing of benefit payments. For 2023, the discount rates were calculated using the results from a bond matching technique developed by Milliman, which matched the future estimated annual benefit payments of each respective plan against a portfolio of bonds of high quality to determine the discount rate. We believe our selected discount rates are determined using preferred methodology under authoritative accounting guidance and accurately reflect market conditions as of the December 31, 2023 measurement date.

In selecting the discount rates for the foreign plans, we look at long-term yields on AA-rated corporate bonds when available. Our actuaries have developed yield curves based on the yields of constituent bonds in the various indices as well as on other market indicators such as swap rates, particularly at the longer durations. For the Eurozone, we apply the Aon Hewitt yield curve to projected cash flows from the relevant plans to derive the discount rate. For the U.K., the discount rate is determined by applying the Aon Hewitt yield curve for typical schemes of similar duration to projected cash flows of Albemarle's U.K. plan. In other countries where there is not a sufficiently deep market of high-quality corporate bonds, we set the discount rate by referencing the yield on government bonds of an appropriate duration.

At December 31, 2023, the weighted-average discount rate for the U.S. and foreign pension plans decreased to 5.21% and 3.73%, respectively, from 5.46% and 4.04%, respectively, at December 31, 2022 to reflect market conditions as of the December 31, 2023 measurement date. The discount rate for the OPEB plans at December 31, 2023 and 2022 was 5.21% and 5.45%, respectively.

In estimating the expected return on plan assets, we consider past performance and future expectations for the types of investments held by the plan as well as the expected long-term allocations of plan assets to these investments. For the years 2023 and 2022, the weighted-average expected rate of return on U.S. pension plan assets was 6.88%, and the weighted-average expected rate of return on foreign pension plan assets was 4.86% and 3.85%, respectively. Effective January 1, 2024, the weighted-average expected rate of return on U.S. and foreign pension plan assets is 6.88% and 5.95%, respectively.

In projecting the rate of compensation increase, we consider past experience in light of changes in inflation rates. At December 31, 2023 and 2022, the assumed weighted-average rate of compensation increase was 3.67% and 3.67%, respectively, for our foreign pension plans.

For the purpose of measuring our U.S. pension and OPEB obligations at December 31, 2023 and 2022, we used the Pri-2012 Mortality Tables along with the MP-2021 Mortality Improvement Scale, respectively, published by the SOA.

At December 31, 2023, the assumed rate of increase in the pre-65 and post-65 per capita cost of covered health care benefits for U.S. retirees was zero as the employer-paid premium caps (pre-65 and post-65) were met starting January 1, 2013.

A variance in the assumptions discussed above would have an impact on the projected benefit obligations, the accrued OPEB liabilities, and the annual net periodic pension and OPEB cost. The following table reflects the sensitivities associated with a hypothetical change in certain assumptions, primarily in the U.S. (in thousands):

	(Favorable) Unfavorable							
	1% Increase				1% Decrease			
	Increase (Decrease) in Benefit Obligation		Increase (Decrease) in Benefit Cost		Increase (Decrease) in Benefit Obligation		Increase (Decrease) in Benefit Cost	
Actuarial Assumptions								
Discount Rate:								
Pension	$	(60,102)	$	2,807	$	70,816	$	(3,595)
Other postretirement benefits	$	(2,373)	$	126	$	2,786	$	(155)
Expected return on plan assets:								
Pension		*	$	(5,283)		*	$	5,283

* Not applicable.

Of the $549.6 million total pension and postretirement assets at December 31, 2023, $80.5 million, or approximately 15%, are measured using the net asset value as a practical expedient. Gains or losses attributable to these assets are recognized in the consolidated balance sheets as either an increase or decrease in plan assets. See Note 15, "Pension Plans and Other Postretirement Benefits," to our consolidated financial statements included in Part II, Item 8 of this report.

Income Taxes

We use the liability method for determining our income taxes, under which current and deferred tax liabilities and assets are recorded in accordance with enacted tax laws and rates. Under this method, the amounts of deferred tax liabilities and assets at the end of each period are determined using the tax rate expected to be in effect when taxes are actually paid or recovered. Future tax benefits are recognized to the extent that realization of such benefits is more likely than not. In order to record deferred tax assets and liabilities, we are following guidance under ASU 2015-17, which requires deferred tax assets and liabilities to be classified as noncurrent on the balance sheet, along with any related valuation allowance. Tax effects are released from Accumulated Other Comprehensive Income using either the specific identification approach or the portfolio approach based on the nature of the underlying item.

Deferred income taxes are provided for the estimated income tax effect of temporary differences between the financial statement carrying amounts and the tax basis of existing assets and liabilities. Deferred tax assets are also provided for operating losses, capital losses and certain tax credit carryovers. A valuation allowance, reducing deferred tax assets, is established when it is more likely than not that some portion or all of the deferred tax assets will not be realized. The realization of such deferred tax assets is dependent upon the generation of sufficient future taxable income of the appropriate character. Although realization is not assured, we do not establish a valuation allowance when we believe it is more likely than not that a net deferred tax asset will be realized. We elected to not consider the estimated impact of potential future Corporate Alternative Minimum Tax liabilities for purposes of assessing valuation allowances on its deferred tax balances.

We only recognize a tax benefit after concluding that it is more likely than not that the benefit will be sustained upon audit by the respective taxing authority based solely on the technical merits of the associated tax position. Once the recognition threshold is met, we recognize a tax benefit measured as the largest amount of the tax benefit that, in our judgment, is greater than 50% likely to be realized. Interest and penalties related to income tax liabilities are included in Income tax expense on the consolidated statements of income.

We are subject to income taxes in the U.S. and numerous foreign jurisdictions. Due to the statute of limitations, we are no longer subject to U.S. federal income tax audits by the Internal Revenue Service ("IRS") for years prior to 2020. Due to the statute of limitations, we also are no longer subject to U.S. state income tax audits prior to 2017.

With respect to jurisdictions outside the U.S., several audits are in process. We have audits ongoing for the years 2014 through 2022 related to Belgium, Canada, Chile, China, Germany and South Africa, some of which are for entities that have since been divested.

While we believe we have adequately provided for all tax positions, amounts asserted by taxing authorities could be greater than our accrued position. Accordingly, additional provisions on federal and foreign tax-related matters could be recorded in the future as revised estimates are made or the underlying matters are settled or otherwise resolved.

Since the timing of resolutions and/or closure of tax audits are uncertain, it is difficult to predict with certainty the range of reasonably possible significant increases or decreases in the liability related to uncertain tax positions that may occur within the next twelve months. Our current view is that it is reasonably possible that we could record a decrease in the liability related to uncertain tax positions, relating to a number of issues, up to approximately $0.4 million as a result of closure of tax statutes. As a result of the sale of the Chemetall Surface Treatment business in 2016, we agreed to indemnify certain income and non-income tax liabilities, including uncertain tax positions, associated with the entities sold. The associated liability is recorded in Other noncurrent liabilities. See Note 16, “Other Noncurrent Liabilities,” and Note 21, “Income Taxes,” to our consolidated financial statements included in Part II, Item 8 of this report for further details.

We have designated the undistributed earnings of a portion of our foreign operations as indefinitely reinvested and as a result we do not provide for deferred income taxes on the unremitted earnings of these subsidiaries. Our foreign earnings are computed under U.S. federal tax earnings and profits (“E&P”) principles. In general, to the extent our financial reporting book basis over tax basis of a foreign subsidiary exceeds these E&P amounts, deferred taxes have not been provided, as they are essentially permanent in duration. The determination of the amount of such unrecognized deferred tax liability is not practicable. We provide for deferred income taxes on our undistributed earnings of foreign operations that are not deemed to be indefinitely invested. We will continue to evaluate our permanent investment assertion taking into consideration all relevant and current tax laws.

Financial Condition and Liquidity

Overview

The principal uses of cash in our business generally have been capital investments and resource development costs, funding working capital, and service of debt. We also make contributions to our defined benefit pension plans, pay dividends to our shareholders and have the ability to repurchase shares of our common stock. Historically, cash to fund the needs of our business has been principally provided by cash from operations, debt financing and equity issuances.

We are continually focused on working capital efficiency particularly in the areas of accounts receivable, payables and inventory. We anticipate that cash on hand, cash provided by operating activities, proceeds from divestitures and borrowings will be sufficient to pay our operating expenses, satisfy debt service obligations, fund capital expenditures and other investing activities, fund pension contributions and pay dividends for the foreseeable future.

Cash Flow

Our cash and cash equivalents were $889.9 million at December 31, 2023 as compared to $1.5 billion at December 31, 2022. Cash provided by operating activities was $1.3 billion, $1.9 billion and $344.3 million during the years ended December 31, 2023, 2022 and 2021, respectively.

The decrease in cash provided by operating activities in 2023 versus 2022 was primarily due lower earnings from the Energy Storage and Specialties segments, partially offset by lower working capital outflows and higher dividends received from unconsolidated investments, primarily from the Windfield joint venture. Working capital outflows in both 2023 and 2022 were driven by higher inventory balances from higher cost spodumene and accounts receivable balances from higher net sales each year. The increase in cash provided by operating activities in 2022 versus 2021 was primarily due to significantly higher earnings from the Energy Storage and Specialties segments and higher dividends received from unconsolidated investments, primarily from the Windfield joint venture. This increase was partially offset by an increase in working capital outflow driven by higher inventory and accounts receivable balances from higher lithium pricing and increased sales.

During 2023, cash on hand, cash provided by operations and net proceeds from net borrowings of commercial paper and long-term debt of $944.2 million funded $2.1 billion of capital expenditures for plant, machinery and equipment, net; approximately $380 million paid to MRL for the restructuring of the MARBL joint venture; $218.5 million to resolve the legal matter with the DOJ and SEC; investments in marketable securities, primarily public equity securities, of $204.5 million; and dividends to shareholders of $187.2 million. During 2022, cash on hand, cash provided by operations and the proceeds of $2.0 billion in long-term debt and credit agreements funded $1.3 billion of capital expenditures for plant, machinery and equipment, the repayment of long-term debt and credit agreements of $705.0 million, the net repayment of $391.7 million of commercial paper, the final payment of $332.5 million of a settlement of an arbitration ruling for a prior legal matter and dividends to shareholders of $184.4 million During 2021, cash on hand, cash provided by operations, net cash proceeds of $289.8 million from the sale of the FCS business, $388.5 million of commercial paper borrowings and the $1.5 billion net proceeds from our underwritten public offering of common stock funded debt principal payments of approximately $1.5 billion, early extinguishment of debt fees of $24.9 million, $332.5 million of a settlement of an arbitration ruling for a prior legal matter, $953.7 million of capital expenditures for plant, machinery and equipment, dividends to shareholders of $177.9 million, and pension and postretirement contributions of $30.3 million. In addition, during the years ended December 31, 2023, 2022 and 2021, our consolidated joint venture, JBC, declared dividends of $149.7 million, $274.5 million and $274.6 million, respectively, which resulted in dividends paid to noncontrolling interests of $105.6 million, $44.2 million ($53.1 million declared in 2022 was paid in the first quarter of 2023) and $96.1 million, respectively.

On October 18, 2023, the Company closed on the restructuring of the MARBL joint venture with MRL. This updated structure is intended to significantly simplify the commercial operation agreements previously entered into, allow us to retain full control of downstream conversion assets and to provide greater strategic opportunities for each company based on their global operations and the evolving lithium market.

Under the amended agreements, Albemarle acquired the remaining 40% ownership of the Kemerton lithium hydroxide processing facility in Australia that was jointly owned with Mineral Resources through the MARBL joint venture. Following this restructuring, Albemarle and MRL each own 50% of Wodgina, and MRL operates the Wodgina mine on behalf of the joint venture. During the fourth quarter of 2023, Albemarle paid MRL approximately $380 million in cash, which includes $180 million of consideration for the remaining ownership of Kemerton as well as a payment for the economic effective date of the transaction being retroactive to April 1, 2022.

On October 25, 2022, the Company completed the acquisition of all of the outstanding equity of Qinzhou, for approximately $200 million in cash. Qinzhou's operations include a recently constructed lithium processing plant strategically positioned near the Port of Qinzhou in Guangxi, which began commercial production in the first half of 2022. The plant has designed annual conversion capacity of up to 25,000 metric tonnes of LCE and is capable of producing battery-grade lithium carbonate and lithium hydroxide.

On May 13, 2022, the Company issued a series of notes (collectively, the “2022 Notes”) as follows:

- $650.0 million aggregate principal amount of senior notes, bearing interest at a rate of 4.65% payable semi-annually on June 1 and December 1 of each year, beginning on December 1, 2022. The effective interest rate on these senior notes is approximately 4.84%. These senior notes mature on June 1, 2027.
- $600.0 million aggregate principal amount of senior notes, bearing interest at a rate of 5.05% payable semi-annually on June 1 and December 1 of each year, beginning on December 1, 2022. The effective interest rate on these senior notes is approximately 5.18%. These senior notes mature on June 1, 2032.
- $450.0 million aggregate principal amount of senior notes, bearing interest at a rate of 5.65% payable semi-annually on June 1 and December 1 of each year, beginning on December 1, 2022. The effective interest rate on these senior notes is approximately 5.71%. These senior notes mature on June 1, 2052.

The net proceeds from the issuance of the 2022 Notes were used to repay the balance of commercial paper notes, the remaining balance of $425.0 million of the 4.15% Senior Notes due 2024 (the “2024 Notes”) and for general corporate purposes. The 2024 Notes were originally due to mature on December 15, 2024 and bore interest at a rate of 4.15%. During the year ended December 31, 2022, the Company recorded a loss on early extinguishment of debt of $19.2 million in Interest and financing expenses, representing the tender premiums, fees, unamortized discounts and unamortized deferred financing costs from the redemption of the 2024 Notes. In addition, the loss on early extinguishment of debt includes the accelerated amortization of the interest rate swap associated with the 2024 Notes from Accumulated other comprehensive income.

On June 1, 2021, we completed the sale of the FCS business to Grace for proceeds of approximately $570 million, consisting of $300 million in cash and the issuance to Albemarle of preferred equity of a Grace subsidiary having an aggregate stated value of $270 million. The preferred equity can be redeemed at Grace’s option under certain conditions and began accruing payment-in-kind dividends at an annual rate of 12% on June 1, 2023.

On February 8, 2021, we completed an underwritten public offering of 8,496,773 shares of our common stock at a price to the public of $153.00 per share. We also granted to the underwriters an option to purchase up to an additional 1,274,509 shares, which was exercised. The total gross proceeds from this offering were approximately $1.5 billion, before deducting expenses, underwriting discounts and commissions. In the first quarter of 2021, we made the following debt principal payments using the net proceeds from this underwritten public offering:

- €123.8 million of the 1.125% notes due in November 2025
- €393.0 million, the remaining balance, of the 1.875% Senior notes originally due in December 2021
- $128.4 million of the 3.45% senior notes due in November 2029
- $200.0 million, the remaining balance, of the floating rate notes originally due in November 2022
- €183.3 million, the outstanding balance, of the unsecured credit facility originally entered into on August 14, 2019, as amended and restated on December 15, 2020 (the “2019 Credit Facility”)
- $325.0 million, the outstanding balance, of the commercial paper notes

Capital expenditures were $2.1 billion, $1.3 billion and $953.7 million for the years ended December 31, 2023, 2022 and 2021, respectively, and were incurred mainly for plant, machinery and equipment. We expect our capital expenditures to be between $1.6 billion and $1.8 billion in 2024 primarily for Energy Storage growth and capacity increases, including in Australia, Chile, China and the U.S., as well as productivity and continuity of operations projects in all segments. Capital expenditures in 2024 are expected to decrease from 2023, reflecting an announced new level of spending to unlock cash flow over the near term and generate long-term financial flexibility. Train I of our Kemerton, Western Australia plant is operating and producing battery-grade product subject to customer qualification. Train II has achieved mechanical completion and transitioned to the commissioning stage. In addition, our lithium conversion plant in Meishan, China has reached mechanical completion and has moved into the commissioning phase.

The Company is permitted to repurchase up to a maximum of 15,000,000 shares under a share repurchase program authorized by our Board of Directors. There were no shares of our common stock repurchased during 2023, 2022 or 2021. At December 31, 2023, there were 7,396,263 remaining shares available for repurchase under the Company's authorized share repurchase program.

Net current assets decreased to approximately $1.7 billion at December 31, 2023 from $2.4 billion at December 31, 2022. The decrease is primarily due to lower cash balance for the uses noted above and the increase in the current portion of debt, primarily related to commercial paper borrowed. This is partially offset by an increase in accounts receivable related to value added tax and inventories. Additional changes in the components of net current assets are primarily due to the timing of the sale of goods and other ordinary transactions leading up to the balance sheet dates. The additional changes are not the result of any policy changes by the Company, and do not reflect any change in either the quality of our net current assets or our expectation of success in converting net working capital to cash in the ordinary course of business.

At December 31, 2023 and 2022, our cash and cash equivalents included $857.6 million and $1.3 billion, respectively, held by our foreign subsidiaries. The majority of these foreign cash balances are associated with earnings that we have asserted are indefinitely reinvested and which we plan to use to support our continued growth plans outside the U.S. through funding of capital expenditures, acquisitions, research, operating expenses or other similar cash needs of our foreign operations. From time to time, we repatriate cash associated with earnings from our foreign subsidiaries to the U.S. for normal operating needs through intercompany dividends, but only from subsidiaries whose earnings we have not asserted to be indefinitely reinvested or whose earnings qualify as "previously taxed income" as defined by the Internal Revenue Code. For the years ended December 31, 2023, 2022 and 2021, we repatriated approximately $2.9 million, $1.7 million and $0.9 million of cash, respectively, as part of these foreign earnings cash repatriation activities.

While we continue to closely monitor our cash generation, working capital management and capital spending in light of continuing uncertainties in the global economy, we believe that we will continue to have the financial flexibility and capability to opportunistically fund future growth initiatives. Additionally, we anticipate that future capital spending, including business acquisitions and other cash outlays, should be financed primarily with cash flow provided by operations, cash on hand and additional issuances of debt or equity securities, as needed.

Long-Term Debt

We currently have the following notes outstanding:

Issue Month/Year	Principal (in millions)	Interest Rate	Interest Payment Dates	Maturity Date
November 2019	€371.7	1.125%	November 25	November 25, 2025
May 2022[(a)]	$650.0	4.65%	June 1 and December 1	June 1, 2027
November 2019	€500.0	1.625%	November 25	November 25, 2028
November 2019[(a)]	$171.6	3.45%	May 15 and November 15	November 15, 2029
May 2022[(a)]	$600.0	5.05%	June 1 and December 1	June 1, 2032
November 2014[(a)]	$350.0	5.45%	June 1 and December 1	December 1, 2044
May 2022[(a)]	$450.0	5.65%	June 1 and December 1	June 1, 2052

(a) Denotes senior notes.

Our senior notes are senior unsecured obligations and rank equally with all our other senior unsecured indebtedness from time to time outstanding. The notes are effectively subordinated to all of our existing or future secured indebtedness and to the existing and future indebtedness of our subsidiaries. As is customary for such long-term debt instruments, each series of notes outstanding has terms that allow us to redeem the notes before maturity, in whole at any time or in part from time to time, at a redemption price equal to the greater of (i) 100% of the principal amount of these notes to be redeemed, or (ii) the sum of the present values of the remaining scheduled payments of principal and interest thereon (exclusive of interest accrued to the date of redemption) discounted to the redemption date on a semi-annual basis using the comparable government rate (as defined in the indentures governing these notes) plus between 25 and 40 basis points, depending on the series of notes, plus, in each case, accrued interest thereon to the date of redemption. Holders may require us to purchase such notes at 101% upon a change of control triggering event, as defined in the indentures. These notes are subject to typical events of default, including bankruptcy and insolvency events, nonpayment and the acceleration of certain subsidiary indebtedness of $40 million or more caused by a nonpayment default.

Our Euro notes issued in 2019 are unsecured and unsubordinated obligations and rank equally in right of payment to all our other unsecured senior obligations. The Euro notes are effectively subordinated to all of our existing or future secured indebtedness and to the existing and future indebtedness of our subsidiaries. As is customary for such long-term debt instruments, each series of notes outstanding has terms that allow us to redeem the notes before their maturity, in whole at any time or in part from time to time, at a redemption price equal to the greater of (i) 100% of the principal amount of the notes to be redeemed and (ii) the sum of the present values of the remaining scheduled payments of principal thereof and interest thereon (exclusive of interest accrued to, but excluding, the date of redemption) discounted to the redemption date on an annual basis using the bond rate (as defined in the indentures governing these notes) plus between 25 and 35 basis points, depending on the series of notes, plus, in each case, accrued and unpaid interest on the principal amount being redeemed to, but excluding, the date of redemption. Holders may require us to purchase such notes at 101% upon a change of control triggering event, as defined in the indentures. These notes are subject to typical events of default, including bankruptcy and insolvency events, nonpayment and the acceleration of certain subsidiary indebtedness exceeding $100 million caused by a nonpayment default.

Given the current economic conditions, specifically around the market pricing of lithium, and the related impact on the Company's future earnings, on February 9, 2024 we amended our revolving, unsecured amended and restated credit agreement dated October 28, 2022 (the "2022 Credit Agreement"), which provides for borrowings of up to $1.5 billion and matures on October 28, 2027. Borrowings under the 2022 Credit Agreement bear interest at variable rates based on a benchmark rate depending on the currency in which the loans are denominated, plus an applicable margin which ranges from 0.910% to 1.375%, depending on the Company's credit rating from Standard & Poor's Ratings Services LLC ("S&P"), Moody's Investors Services, Inc. ("Moody's") and Fitch Ratings, Inc. ("Fitch"). With respect to loans denominated in U.S. dollars, interest is calculated using the term Secured Overnight Financing Rate ("SOFR") plus a term SOFR adjustment of 0.10%, plus the applicable margin. The applicable margin on the facility was 1.125% as of December 31, 2023. There were no borrowings outstanding under the 2022 Credit Agreement as of December 31, 2023.

Borrowings under the 2022 Credit Agreement are conditioned upon satisfaction of certain customary conditions precedent, including the absence of defaults. The February 2024 amendment was entered into to modify the financial covenants under the 2022 Credit Agreement to avoid a potential covenant violation over the following 18 months given the current market pricing of lithium. Following the February 2024 amendment, the 2022 Credit Agreement subjects the Company to two financial covenants, as well as customary affirmative and negative covenants. The first financial covenant requires that the ratio of (a) the Company's consolidated net funded debt plus a proportionate amount of Windfield's net funded debt to (b) consolidated Windfield-Adjusted EBITDA (as such terms are defined in the 2022 Credit Agreement) be less than or equal to (i) 3.50:1 prior to the second quarter of 2024, (ii) 5.00:1 for the second quarter of 2024, (iii) 5.50:1 for the third quarter of 2024, (iv) 4.00:1 for the fourth quarter of 2024, (v) 3.75:1 for the first and second quarters of 2025 and (vi) 3.50:1 after the second quarter of 2025. The maximum permitted leverage ratios described above are subject to adjustment in accordance with the terms of the 2022 Credit Agreement upon the consummation of an acquisition after June 30, 2025 if the consideration includes cash proceeds from issuance of funded debt in excess of $500 million.

Beginning in the fourth quarter of 2024, the second financial covenant requires that the ratio of the Company's consolidated EBITDA to consolidated interest charges (as such terms are defined in the 2022 Credit Agreement) be no less than 2.00:1 for fiscal quarters through June 30, 2025, and no less than 3.00:1 for all fiscal quarters thereafter. The 2022 Credit Agreement also contains customary default provisions, including defaults for non-payment, breach of representations and warranties, insolvency, non-performance of covenants and cross-defaults to other material indebtedness. The occurrence of an event of default under the 2022 Credit Agreement could result in all loans and other obligations becoming immediately due and payable and the commitments under the 2022 Credit Agreement being terminated. The amendments to the financial covenants assume moderate improvement to the current market pricing of lithium. If lithium market prices do not improve, or worsen, the Company may not be able to maintain compliance with its amended financial covenants and it will require the Company to seek additional amendments to the 2022 Credit Agreement and/or issue debt or equity securities, as needed, to fund its activities and maintain financial flexibility. If the Company is not able to obtain such necessary additional amendments, this would lead to an event of default and its lenders could require the Company to repay its outstanding debt. In that situation, the Company may not be able to raise sufficient debt or equity capital, or divest assets, to refinance or repay the lenders.

On August 14, 2019, the Company entered into a $1.2 billion unsecured credit facility with several banks and other financial institutions, which was amended and restated on December 15, 2020 and again on December 10, 2021 (the "2019 Credit Facility"). On October 24, 2022, the 2019 Credit Facility was terminated, with the outstanding balance of $250 million repaid using cash on hand.

On May 29, 2013, we entered into agreements to initiate a commercial paper program on a private placement basis under which we may issue unsecured commercial paper notes (the "Commercial Paper Notes") from time-to-time. On May 17, 2023, we entered into definitive documentation to increase the size of our existing commercial paper program. The maximum aggregate face amount of Commercial Paper Notes outstanding at any time is $1.5 billion (up from $750 million prior to the increase).. The proceeds from the issuance of the Commercial Paper Notes are expected to be used for general corporate purposes, including the repayment of other debt of the Company. The 2022 Credit Agreement is available to repay the Commercial Paper Notes, if necessary. Aggregate borrowings outstanding under the 2022 Credit Agreement and the Commercial Paper Notes will not exceed the $1.5 billion current maximum amount available under the 2022 Credit Agreement. The Commercial Paper Notes will be sold at a discount from par, or alternatively, will be sold at par and bear interest at rates that will vary based upon market conditions at the time of issuance. The maturities of the Commercial Paper Notes will vary but may not exceed 397 days from the date of issue. The definitive documents relating to the commercial paper program contain customary representations, warranties, default and indemnification provisions. At December 31, 2023, we had $620.0 million of Commercial Paper Notes outstanding bearing a weighted-average interest rate of approximately 6.05% and a weighted-average maturity of 11 days. The Commercial Paper Notes are classified as Current portion of long-term debt in our condensed consolidated balance sheets at December 31, 2023.

In the second quarter of 2023, the Company received a loan of $300.0 million to be repaid in five equal annual installments beginning on December 31, 2026. This interest-free loan was discounted using an imputed interest rate of 5.5% and the Company will amortize that discount through Interest and financing expenses over the term of the loan.

When constructing new facilities or making major enhancements to existing facilities, we may have the opportunity to enter into incentive agreements with local government agencies in order to reduce certain state and local tax expenditures. Under these agreements, we transfer the related assets to various local government entities and receive bonds. We immediately lease the facilities from the local government entities and have an option to repurchase the facilities for a nominal amount upon tendering the bonds to the local government entities at various predetermined dates. The bonds and the associated obligations for the leases of the facilities offset, and the underlying assets are recorded in property, plant and equipment. We currently have the ability to transfer up to $540 million in assets under these arrangements. At December 31, 2023, there are $14.3 million of bonds outstanding under these arrangements.

The non-current portion of our long-term debt amounted to $3.5 billion at December 31, 2023, compared to $3.2 billion at December 31, 2022. In addition, at December 31, 2023, we had the ability to borrow $880.0 million under our commercial paper program and the 2022 Credit Agreement, and $104.1 million under other existing lines of credit, subject to various financial covenants under the 2022 Credit Agreement. We have the ability and intent to refinance our borrowings under our other existing credit lines with borrowings under the 2022 Credit Agreement, as applicable. Therefore, the amounts outstanding under those credit lines, if any, are classified as long-term debt. We believe that as of December 31, 2023 we were, and currently are, in compliance with all of our debt covenants. For additional information about our long-term debt obligations, see Note 14, "Long-Term Debt," to our consolidated financial statements included in Part II, Item 8 of this report.

Off-Balance Sheet Arrangements

In the normal course of business with customers, vendors and others, we have entered into off-balance sheet arrangements, including bank guarantees and letters of credit, which totaled approximately $217.2 million at December 31, 2023. None of these off-balance sheet arrangements has, or is likely to have, a material effect on our current or future financial condition, results of operations, liquidity or capital resources.

Liquidity Outlook

We generally use cash on hand and cash provided by operating activities, divestitures and borrowings to pay our operating expenses, satisfy debt service obligations, fund any capital expenditures, make acquisitions, make pension contributions and pay dividends. We also could issue additional debt or equity securities to fund these activities in an effort to maintain our financial flexibility. Our main focus in the short-term, during the continued uncertainty surrounding the global economy, including lithium market pricing and recent inflationary trends, is to continue to maintain financial flexibility by continuing our cost savings initiative, while still protecting our employees and customers, committing to shareholder returns and maintaining an investment grade rating. Over the next three years, in terms of uses of cash, we will continue to invest in growth of the businesses and return value to shareholders. Additionally, we will continue to evaluate the merits of any opportunities that may arise for acquisitions of businesses or assets, which may require additional liquidity. Financing the purchase price of any such acquisitions could involve borrowing under existing or new credit facilities and/or the issuance of debt or equity securities, in addition to cash on hand. We expect 2024 capital expenditures to be down from 2023 levels, as part of an intentional re-phasing of larger projects to focus on those that are significantly progressed, near completion and in start up. We are also pursuing actions to optimize our cost structure by reducing costs primarily related to sales, general and administrative expenses, including a reduction in headcount and lower spending on contracted services, as announced in January 2024. As part of the announced reduction in headcount, we expect to record a charge of approximately $15 million to $20 million for severance and outplacement costs in the first quarter of 2024. We expect these severance payments to primarily be made during 2024.

Our growth investments include strategic investments in China with plans to build a battery grade lithium conversion plant in Meishan initially targeting 50,000 metric tonnes of LCE per year. The Meishan lithium conversion plant achieved mechanical completion and has moved to the commissioning phase. We also announced the decision to build two additional processing trains at the Kemerton lithium hydroxide plant in Western Australia. The additional trains would increase the facility’s production by 50,000 metric tonnes per year.

In October 2022, we announced we had been awarded a nearly $150 million grant from the U.S. Department of Energy to expand domestic manufacturing of batteries for EVs and the electrical grid and for materials and components currently imported from other countries. The grant funding is intended to support a portion of the anticipated cost to construct a new, commercial-scale U.S.-based lithium concentrator facility at our Kings Mountain, North Carolina, location. We expect the concentrator facility to create hundreds of construction and full-time jobs, and to supply up to 350,000 metric tonnes per year of spodumene concentrate to our previously announced mega-flex lithium conversion facility. To further support the restart of the Kings Mountain mine, in August 2023, we announced a $90 million critical materials award from the U.S. Department of Defense.

In addition, we previously announced plans to construct a new $1.3 billion lithium mega-flex processing facility in South Carolina capable of annually producing approximately 50,000 metric tonnes of battery-grade lithium hydroxide, with the potential to expand up to 100,000 metric tonnes. In December 2022, we also acquired a location in Charlotte, North Carolina, where we intend to invest at least $180 million to establish the Albemarle Technology Park, a world-class facility designed for novel materials research, advanced process development, and acceleration of next-generation lithium products to market. In January 2024 we announced that we will defer spending on both of these projects to preserve cash flow over the near term.

In January 2024, the Company sold equity securities of a public company for proceeds of approximately $81.5 million. As a result of the sale, the Company expects to realize a loss of approximately $33.7 million in the three months ended March 31, 2024.

Overall, with generally strong cash-generative businesses and no significant long-term debt maturities before November 2025, we believe we have, and will be able to maintain a solid liquidity position. In order to maintain financial flexibility, we may issue additional debt or equity securities to fund future capital spending and other cash outlays. Our annual maturities of long-term debt as of December 31, 2023 are as follows (in millions): 2024—$625.8; 2025—$416.5; 2026—$60.0; 2027—$710.0; 2028—$612.2; thereafter—$1,848.3. In addition, we expect to make interest payments on those long-term debt obligations as follows (in millions): 2024—$124.7; 2025—$124.3; 2026—$120.0; 2027—$102.5; 2028—$89.1; thereafter—$1,009.7. For variable-rate debt obligations, projected interest payments are calculated using the December 31, 2023 weighted average interest rate of approximately 5.76%.

In addition, we expect our capital expenditures to be between $1.6 billion and $1.8 billion in 2024, down from $2.1 billion in 2023, primarily for Energy Storage growth and capacity increases, including in Australia, Chile, China and the U.S., as well as productivity and continuity of operations projects in all segments. As of December 31, 2023, we have also committed to approximately $324.2 million of payments to third-party vendors in the normal course of business to secure raw materials for our production processes, with approximately $137.4 million to be paid in 2024. In order to secure materials, sometimes for long durations, these contracts mandate a minimum amount of product to be purchased at predetermined rates over a set timeframe.

See Note 18, “Leases,” to our consolidated financial statements included in Part II, Item 8 of this report for our annual expected payments under our operating lease obligations at December 31, 2023.

In 2024, we expect to pay $64.4 million of the $191.7 million balance remaining from the transition tax on foreign earnings as a result of the Tax Cuts and Jobs Act (“TCJA”) signed into law in December 2017. The one-time transition tax imposed by the TCJA is based on our total post-1986 earnings and profits that we previously deferred from U.S. income taxes and is payable over an eight-year period, with the final payment made in 2026.

Contributions to our domestic and foreign qualified and nonqualified pension plans, including our supplemental executive retirement plan, are expected to approximate $14 million in 2024. We may choose to make additional pension contributions in excess of this amount. We made contributions of approximately $15.5 million to our domestic and foreign pension plans (both qualified and nonqualified) during the year ended December 31, 2023.

The liability related to uncertain tax positions, including interest and penalties, recorded in Other noncurrent liabilities totaled $220.6 million and $83.7 million at December 31, 2023 and 2022, respectively. Related assets for corresponding offsetting benefits recorded in Other assets totaled $73.0 million and $32.4 million at December 31, 2023 and 2022, respectively. We cannot estimate the amounts of any cash payments during the next twelve months associated with these liabilities and are unable to estimate the timing of any such cash payments in the future at this time.

Our cash flows from operations may be negatively affected by adverse consequences to our customers and the markets in which we compete as a result of moderating global economic conditions, continuing inflationary trends and reduced capital availability. We have experienced, and may continue to experience, volatility and increases in the price of certain raw materials and in transportation and energy costs as a result of global market and supply chain disruptions and the broader inflationary environment. As a result, we are planning for various economic scenarios and actively monitoring our balance sheet to maintain the financial flexibility needed.

Although we maintain business relationships with a diverse group of financial institutions as sources of financing, an adverse change in their credit standing could lead them to not honor their contractual credit commitments to us, decline funding under our existing but uncommitted lines of credit with them, not renew their extensions of credit or not provide new financing to us. While the global corporate bond and bank loan markets remain strong, periods of elevated uncertainty related to the stability of the banking system, future pandemics or global economic and/or geopolitical concerns may limit efficient access to such markets for extended periods of time. If such concerns heighten, we may incur increased borrowing costs and reduced credit capacity as our various credit facilities mature. If the U.S. Federal Reserve or similar national reserve banks in other countries decide to continue tightening the monetary supply, we may incur increased borrowing costs (as interest rates increase on our variable rate credit facilities, as our various credit facilities mature or as we refinance any maturing fixed rate debt obligations), although these cost increases would be partially offset by increased income rates on portions of our cash deposits.

As first reported in 2018, following receipt of information regarding potential improper payments being made by third-party sales representatives of our Refining Solutions business, within what is now the Ketjen segment, we investigated and voluntarily self-reported potential violations of the U.S. Foreign Corrupt Practices Act to the U.S. Department of Justice (“DOJ”) and the SEC, and also reported this conduct to the Dutch Public Prosecutor. We cooperated with these agencies in their investigations of this historical conduct and implemented appropriate remedial measures intended to strengthen our compliance program and related internal controls.

In September 2023, the Company finalized agreements to resolve these matters with the DOJ and SEC. The DPP has confirmed it will not pursue action in this matter. In connection with this resolution, which relates to conduct prior to 2018, we entered into a non-prosecution agreement with the DOJ and an administrative resolution with the SEC, pursuant to which we paid a total of $218.5 million in aggregate fines, disgorgement, and prejudgment interest to the DOJ and SEC. The resolution does not include a compliance monitorship, although the Company has agreed to certain ongoing compliance reporting obligations. The agreed upon amounts were paid to the DOJ and SEC in October 2023, with this matter considered finalized and no future financial obligations expected.

We had cash and cash equivalents totaling $889.9 million as of December 31, 2023, of which $857.6 million is held by our foreign subsidiaries. This cash represents an important source of our liquidity and is invested in bank accounts or money market investments with no limitations on access. The cash held by our foreign subsidiaries is intended for use outside of the U.S. We anticipate that any needs for liquidity within the U.S. in excess of our cash held in the U.S. can be readily satisfied with borrowings under our existing U.S. credit facilities or our commercial paper program.

Guarantor Financial Information

Albemarle Wodgina Pty Ltd Issued Notes

Albemarle Wodgina Pty Ltd (the "Issuer"), a wholly-owned subsidiary of Albemarle Corporation, issued $300.0 million aggregate principal amount of 3.45% Senior Notes due 2029 (the "3.45% Senior Notes") in November 2019. The 3.45% Senior Notes are fully and unconditionally guaranteed (the "Guarantee") on a senior unsecured basis by Albemarle Corporation (the "Parent Guarantor"). No direct or indirect subsidiaries of the Parent Guarantor guarantee the 3.45% Senior Notes (such subsidiaries are referred to as the "Non-Guarantors").

In 2019, we completed the acquisition of a 60% interest in Wodgina in Western Australia and formed an unincorporated joint venture with MRL, named MARBL Lithium Joint Venture, for the exploration, development, mining, processing and production of lithium and other minerals (other than iron ore and tantalum) from the Wodgina spodumene mine and for the operation of the Kemerton assets in Western Australia. We participate in Wodgina through our ownership interest in the Issuer. On October 18, 2023 we amended the joint venture agreements, resulting in a decrease of our ownership interest in the MARBL joint venture and Wodgina to 50%.

The Parent Guarantor conducts its U.S. Specialties and Ketjen operations directly, and conducts its other operations (other than operations conducted through the Issuer) through the Non-Guarantors.

The 3.45% Senior Notes are the Issuer's senior unsecured obligations and rank equally in right of payment to the senior indebtedness of the Issuer, effectively subordinated to all of the secured indebtedness of the Issuer, to the extent of the value of the assets securing that indebtedness, and structurally subordinated to all indebtedness and other liabilities of its subsidiaries. The Guarantee is the senior unsecured obligation of the Parent Guarantor and ranks equally in right of payment to the senior indebtedness of the Parent Guarantor, effectively subordinated to the secured debt of the Parent Guarantor to the extent of the value of the assets securing the indebtedness and structurally subordinated to all indebtedness and other liabilities of its subsidiaries.

For cash management purposes, the Parent Guarantor transfers cash among itself, the Issuer and the Non-Guarantors through intercompany financing arrangements, contributions or declaration of dividends between the respective parent and its subsidiaries. The transfer of cash under these activities facilitates the ability of the recipient to make specified third-party payments for principal and interest on the Issuer and/or the Parent Guarantor's outstanding debt, common stock dividends and common stock repurchases. There are no significant restrictions on the ability of the Issuer or the Parent Guarantor to obtain funds from subsidiaries by dividend or loan.

The following tables present summarized financial information for the Parent Guarantor and the Issuer on a combined basis after elimination of (i) intercompany transactions and balances among the Issuer and the Parent Guarantor and (ii) equity in earnings from and investments in any subsidiary that is a Non-Guarantor. Each entity in the combined financial information follows the same accounting policies as described herein.

Summarized Statement of Operations

$ in thousands	**Year ended December 31, 2023**
Net sales[(a)]	$ 2,392,057
Gross profit	802,653
Loss before income taxes and equity in net income of unconsolidated investments[(b)]	254,066
Net loss attributable to the Guarantor and the Issuer	(216,033)

(a) Includes net sales to Non-Guarantors of $1.5 billion for the year ended December 31, 2023.

(b) Includes intergroup expenses to Non-Guarantors of $70.2 million for the year ended December 31, 2023.

Summarized Balance Sheet

$ in thousands		At December 31, 2023
Current assets[(a)]	$	723,518
Net property, plant and equipment		2,246,404
Other non-current assets[(b)]		2,619,575
Current liabilities[(c)]	$	2,374,074
Long-term debt		2,252,540
Other non-current liabilities[(d)]		7,409,175

(a) Includes receivables from Non-Guarantors of $293.8 million at December 31, 2023.
(b) Includes non-curent receivables from Non-Guarantors of $2.0 billion at December 31, 2023.
(c) Includes current payables to Non-Guarantors of $1.0 billion at December 31, 2023.
(d) Includes non-current payables to Non-Guarantors of $6.9 billion at December 31, 2023.

The 3.45% Senior Notes are structurally subordinated to the indebtedness and other liabilities of the Non-Guarantors. The Non-Guarantors are separate and distinct legal entities and have no obligation, contingent or otherwise, to pay any amounts due pursuant to the 3.45% Senior Notes or the Indenture under which the 3.45% Senior Notes were issued, or to make any funds available therefor, whether by dividends, loans, distributions or other payments. Any right that the Parent Guarantor has to receive any assets of any of the Non-Guarantors upon the liquidation or reorganization of any Non-Guarantor, and the consequent rights of holders of the 3.45% Senior Notes to realize proceeds from the sale of any of a Non-Guarantor's assets, would be effectively subordinated to the claims of such Non-Guarantor's creditors, including trade creditors and holders of preferred equity interests, if any, of such Non-Guarantor. Accordingly, in the event of a bankruptcy, liquidation or reorganization of any of the Non-Guarantors, the Non-Guarantors will pay the holders of their debts, holders of preferred equity interests, if any, and their trade creditors before they will be able to distribute any of their assets to the Parent Guarantor.

The 3.45% Senior Notes are obligations of the Issuer. The Issuer's cash flow and ability to make payments on the 3.45% Senior Notes could be dependent upon the earnings it derives from the production from MARBL for Wodgina. Absent income received from sales of its share of production from MARBL, the Issuer's ability to service the 3.45% Senior Notes could be dependent upon the earnings of the Parent Guarantor's subsidiaries and other joint ventures and the payment of those earnings to the Issuer in the form of equity, loans or advances and through repayment of loans or advances from the Issuer.

The Issuer's obligations in respect of MARBL are guaranteed by the Parent Guarantor. Further, under MARBL pursuant to a deed of cross security between the Issuer, the joint venture partner and the manager of the project (the "Manager"), each of the Issuer, and the joint venture partner have granted security to each other and the Manager for the obligations each of the Issuer and the joint venture partner have to each other and to the Manager. The claims of the joint venture partner, the Manager and other secured creditors of the Issuer will have priority as to the assets of the Issuer over the claims of holders of the 3.45% Senior Notes.

Albemarle Corporation Issued Notes

In March 2021, Albemarle New Holding GmbH (the "Subsidiary Guarantor"), a wholly-owned subsidiary of Albemarle Corporation, added a full and unconditional guarantee (the "Upstream Guarantee") to all securities of Albemarle Corporation (the "Parent Issuer") issued and outstanding as of such date and, subject to the terms of the applicable amendment or supplement, securities issuable by the Parent Issuer pursuant to the Indenture, dated as of January 20, 2005, as amended and supplemented from time to time (the "Indenture"). No other direct or indirect subsidiaries of the Parent Issuer guarantee these securities (such subsidiaries are referred to as the "Upstream Non-Guarantors"). See Long-term debt section above for a description of the securities issued by the Parent Issuer.

The current securities outstanding under the Indenture are the Parent Issuer's unsecured and unsubordinated obligations and rank equally in right of payment with all other unsecured and unsubordinated indebtedness of the Parent Issuer. All securities currently outstanding under the Indenture are effectively subordinated to the Parent Issuer's existing and future secured indebtedness to the extent of the value of the assets securing that indebtedness. With respect to any series of securities issued under the Indenture that is subject to the Upstream Guarantee (which series of securities does not include the 2022 Notes), the Upstream Guarantee is, and will be, an unsecured and unsubordinated obligation of the Subsidiary Guarantor, ranking pari passu with all other existing and future unsubordinated and unsecured indebtedness of the Subsidiary Guarantor.

All securities currently outstanding under the Indenture (other than the 2022 Notes) are effectively subordinated to all existing and future indebtedness and other liabilities of the Parent's Subsidiaries other than the Subsidiary Guarantor. The 2022 Notes are effectively subordinated to all existing and future indebtedness and other liabilities of the Parent's Subsidiaries, including the Subsidiary Guarantor.

For cash management purposes, the Parent Issuer transfers cash among itself, the Subsidiary Guarantor and the Upstream Non-Guarantors through intercompany financing arrangements, contributions or declaration of dividends between the respective parent and its subsidiaries. The transfer of cash under these activities facilitates the ability of the recipient to make specified third-party payments for principal and interest on the Parent Issuer and/or the Subsidiary Guarantor's outstanding debt, common stock dividends and common stock repurchases. There are no significant restrictions on the ability of the Parent Issuer or the Subsidiary Guarantor to obtain funds from subsidiaries by dividend or loan.

The following tables present summarized financial information for the Subsidiary Guarantor and the Parent Issuer on a combined basis after elimination of (i) intercompany transactions and balances among the Parent Issuer and the Subsidiary Guarantor and (ii) equity in earnings from and investments in any subsidiary that is an Upstream Non-Guarantor.

Summarized Statement of Operations

$ in thousands		Year ended December 31, 2023
Net sales[(a)]	$	1,297,308
Gross profit		68,743
Loss before income taxes and equity in net income of unconsolidated investments[(b)]		(444,249)
Net loss attributable to the Subsidiary Guarantor and the Parent Issuer		(697,911)

(a) Includes net sales to Non-Guarantors of $482.0 million for the year ended December 31, 2023.
(b) Includes intergroup income from Non-Guarantors of $146.0 million for the year ended December 31, 2023.

Summarized Balance Sheet

$ in thousands		At December 31, 2023
Current assets[(a)]	$	872,571
Net property, plant and equipment		1,090,112
Other non-current assets[(b)]		1,731,960
Current liabilities[(c)]	$	2,024,190
Long-term debt		2,994,732
Other non-current liabilities[(d)]		6,828,262

(a) Includes current receivables from Non-Guarantors of $472.5 million at December 31, 2023.
(b) Includes noncurrent receivables from Non-Guarantors of $1.1 billion at December 31, 2023.
(c) Includes current payables to Non-Guarantors of $1.0 billion at December 31, 2023.
(d) Includes non-current payables to Non-Guarantors of $6.4 billion at December 31, 2023.

These securities are structurally subordinated to the indebtedness and other liabilities of the Upstream Non-Guarantors. The Upstream Non-Guarantors are separate and distinct legal entities and have no obligation, contingent or otherwise, to pay any amounts due pursuant to these securities or the Indenture under which these securities were issued, or to make any funds available therefor, whether by dividends, loans, distributions or other payments. Any right that the Subsidiary Guarantor has to receive any assets of any of the Upstream Non-Guarantors upon the liquidation or reorganization of any Upstream Non-Guarantors, and the consequent rights of holders of these securities to realize proceeds from the sale of any of an Upstream Non-Guarantor's assets, would be effectively subordinated to the claims of such Upstream Non-Guarantor's creditors, including trade creditors and holders of preferred equity interests, if any, of such Upstream Non-Guarantor. Accordingly, in the event of a bankruptcy, liquidation or reorganization of any of the Upstream Non-Guarantors, the Upstream Non-Guarantors will pay the holders of their debts, holders of preferred equity interests, if any, and their trade creditors before they will be able to distribute any of their assets to the Subsidiary Guarantor.

Safety and Environmental Matters

We are subject to federal, state, local and foreign requirements regulating the handling, manufacture and use of materials (some of which may be classified as hazardous or toxic by one or more regulatory agencies), the discharge of materials into the environment and the protection of the environment. To our knowledge, we are currently complying and expect to continue to comply in all material respects with applicable environmental laws, regulations, statutes and ordinances. Compliance with existing federal, state, local and foreign environmental protection laws is not currently expected to have a material effect on capital expenditures, earnings or our competitive position, but the costs associated with increased legal or regulatory requirements could have an adverse effect on our operating results.

Among other environmental requirements, we are subject to the federal Superfund law, and similar state laws, under which we may be designated as a PRP, and may be liable for a share of the costs associated with cleaning up various hazardous waste sites. Management believes that in cases in which we may have liability as a PRP, our liability for our share of cleanup is de minimis. Further, almost all such sites represent environmental issues that are quite mature and have been investigated, studied and in many cases settled. In de minimis situations, our policy generally is to negotiate a consent decree and to pay any apportioned settlement, enabling us to be effectively relieved of any further liability as a PRP, except for remote contingencies. In other than de minimis PRP matters, our records indicate that unresolved PRP exposures should be immaterial. We accrue and expense our proportionate share of PRP costs. Because management has been actively involved in evaluating environmental matters, we are able to conclude that the outstanding environmental liabilities for unresolved PRP sites should not have a material adverse effect upon our results of operations or financial condition.

Our environmental and safety operating costs charged to expense were $73.0 million, $46.3 million and $43.2 million during the years ended December 31, 2023, 2022 and 2021, respectively, excluding depreciation of previous capital expenditures, and are expected to be in the same range in the next few years. Costs for remediation have been accrued and payments related to sites are charged against accrued liabilities, which at December 31, 2023 totaled approximately $34.1 million, a decrease of $4.1 million from $38.2 million at December 31, 2022. See Note 17, “Commitments and Contingencies” to our consolidated financial statements included in Part II, Item 8 of this report for a reconciliation of our environmental liabilities for the years ended December 31, 2023, 2022 and 2021.

We believe that any sum we may be required to pay in connection with environmental remediation and asset retirement obligation matters in excess of the amounts recorded should occur over a period of time and should not have a material adverse effect upon our results of operations, financial condition or cash flows on a consolidated annual basis, although any such sum could have a material adverse impact on our results of operations, financial condition or cash flows in a particular quarterly reporting period.

Capital expenditures for pollution-abatement and safety projects, including such costs that are included in other projects, were approximately $116.7 million, $75.6 million and $55.4 million during the years ended December 31, 2023, 2022 and 2021, respectively. In the future, capital expenditures for these types of projects may increase due to more stringent environmental regulatory requirements and our efforts in reaching sustainability goals. Management’s estimates of the effects of compliance with governmental pollution-abatement and safety regulations are subject to (a) the possibility of changes in the applicable statutes and regulations or in judicial or administrative construction of such statutes and regulations and (b) uncertainty as to whether anticipated solutions to pollution problems will be successful, or whether additional expenditures may prove necessary.

Recently Issued Accounting Pronouncements

See Note 1, “Summary of Significant Accounting Policies” to our consolidated financial statements included in Part II, Item 8 of this report for a discussion of our Recently Issued Accounting Pronouncements.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk.

The primary currencies to which we have foreign currency exchange rate exposure are the Chinese Renminbi, Euro, Australian Dollar, Chilean Peso and Japanese Yen. In response to greater fluctuations in foreign currency exchange rates in recent periods, we have increased the degree of exposure risk management activities to minimize the potential impact on earnings.

We manage our foreign currency exposures by balancing certain assets and liabilities denominated in foreign currencies and through the use, from time to time, of foreign currency forward contracts. The principal objective of such contracts is to minimize the financial impact of changes in foreign currency exchange rates. The counterparties to these contractual agreements are major financial institutions with which we generally have other financial relationships. We are exposed to credit loss in the event of nonperformance by these counterparties. However, we do not anticipate nonperformance by the counterparties. We do not utilize financial instruments for trading or other speculative purposes.

The primary method we use to reduce foreign currency exposure is to identify natural hedges, in which the operating activities denominated in respective currencies across various subsidiaries balance in respect to timing and the underlying exposures. In the event a natural hedge is not available, we may employ a forward contract to reduce exposure, generally expiring within one year. While these contracts are subject to fluctuations in value, such fluctuations are intended to offset the changes in the value of the underlying exposures being hedged. In the fourth quarter of 2019, we entered into a foreign currency forward contract to hedge the cash flow exposure of non-functional currency purchases during the construction of the Kemerton plant in Australia. This contract has been designated as an effective hedging instrument, and beginning the date of designation, gains or losses on the revaluation of this contract to our reporting currency have been and will be recorded in Accumulated other comprehensive loss. All other gains and losses on foreign currency forward contracts not designated as an effective hedging instrument are recognized in Other income (expenses), net, and generally do not have a significant impact on results of operations.

At December 31, 2023, our financial instruments subject to foreign currency exchange risk consisted of foreign currency forward contracts with an aggregate notional value of $8.1 billion and with a fair value representing a net asset position of $12.1 million. The aggregate notional value of foreign currency forward contracts increased in 2022 due to increased balance sheet exposure from higher sales and income in foreign-denominated currencies. Fluctuations in the value of these contracts are intended to offset the changes in the value of the underlying exposures being hedged. We conducted a sensitivity analysis on the fair value of our foreign currency hedge portfolio assuming an instantaneous 10% change in select foreign currency exchange rates from their levels as of December 31, 2023, with all other variables held constant. A 10% appreciation of the U.S. Dollar against foreign currencies that we hedge would result in a decrease of approximately $0.3 million in the fair value of our foreign currency forward contracts. A 10% depreciation of the U.S. Dollar against these foreign currencies would result in a decrease of approximately $86.1 million in the fair value of our foreign currency forward contracts. The sensitivity of the fair value of our foreign currency hedge portfolio represents changes in fair values estimated based on market conditions as of December 31, 2023, without reflecting the effects of underlying anticipated transactions. When those anticipated transactions are realized, actual effects of changing foreign currency exchange rates could have a material impact on our earnings and cash flows in future periods.

On December 18, 2014, the carrying value of our 1.875% Euro-denominated senior notes was designated as an effective hedge of our net investment in foreign subsidiaries where the Euro serves as the functional currency, and beginning on the date of designation, gains or losses on the revaluation of these senior notes to our reporting currency have been recorded in Accumulated other comprehensive loss. In the first quarter of 2021, we repaid the outstanding balance of these senior notes, and as a result, this net investment hedge was discontinued. The balance of foreign exchange revaluation gains and losses associated with this discontinued net investment hedge will remain within Accumulated other comprehensive loss until the hedged net investment is sold or liquidated.

We are exposed to changes in interest rates that could impact our results of operations and financial condition. We manage global interest rate and foreign exchange exposure as part of our regular operational and financing strategies. We had variable interest rate borrowings of $650.2 million and $3.0 million outstanding at December 31, 2023 and 2022, respectively. These borrowings represented 15% and less than 1% of total outstanding debt and bore average interest rates of 5.76% and 0.07% at December 31, 2023 and 2022, respectively. A hypothetical 100 basis point increase in the average interest rate applicable to these borrowings would change our annualized interest expense by approximately $6.5 million as of December 31, 2023. We may enter into interest rate swaps, collars or similar instruments with the objective of reducing interest rate volatility relating to our borrowing costs.

Our raw materials are subject to price volatility caused by weather, supply and demand conditions, political and economic variables and other unpredictable factors. Historically, we have not used futures, options or swap contracts to manage the volatility related to the above exposures. However, the refinery catalysts business has used financing arrangements to provide long-term protection against changes in natural gas and metals prices. We seek to limit our exposure by entering into long-term contracts when available, and we seek price increase limitations through contracts. These contracts do not have a significant impact on our results of operations.

Item 8. Financial Statements and Supplementary Data.

MANAGEMENT'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING

Our management is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Exchange Act Rule 13a-15(f) and 15d-15(f). Our internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with accounting principles generally accepted in the United States. Our internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of assets; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with accounting principles generally accepted in the United States, and that receipts and expenditures of the Company are being made only in accordance with management's and our directors' authorizations; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of our assets that could have a material effect on the financial statements.

Under the supervision and with the participation of our management, including our principal executive officer and principal financial officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting as of December 31, 2023. In making this assessment, management used the criteria for effective internal control over financial reporting described in the *Internal Control—Integrated Framework 2013* set forth by the Committee of Sponsoring Organizations of the Treadway Commission (COSO). Based on the assessment, management concluded that, as of December 31, 2023, our internal control over financial reporting was effective to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles in the United States. The concept of reasonable assurance is based on the recognition that there are inherent limitations in all systems of internal control. Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

The effectiveness of our internal control over financial reporting as of December 31, 2023 has been audited by PricewaterhouseCoopers LLP, an independent registered public accounting firm, as stated in their report, which is included herein.

/S/ J. KENT MASTERS

J. Kent Masters
Chairman, President and Chief Executive Officer
(principal executive officer)
February 14, 2024

Report of Independent Registered Public Accounting Firm

To the Board of Directors and Shareholders of Albemarle Corporation

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Albemarle Corporation and its subsidiaries (the "Company") as of December 31, 2023 and 2022, and the related consolidated statements of income, of comprehensive income, of changes in equity and of cash flows for each of the three years in the period ended December 31, 2023, including the related notes (collectively referred to as the "consolidated financial statements"). We also have audited the Company's internal control over financial reporting as of December 31, 2023, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2023 and 2022, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2023 in conformity with accounting principles generally accepted in the United States of America. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2023, based on criteria established in *Internal Control - Integrated Framework* (2013) issued by the COSO.

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express opinions on the Company's consolidated financial statements and on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that (i) relates to accounts or disclosures that are material to the consolidated financial statements and (ii) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Goodwill Impairment Assessment – Refining Solutions Reporting Unit

As described in Notes 1 and 12 to the consolidated financial statements, the Company’s goodwill balance was $1,629.7 million as of December 31, 2023, and the goodwill associated with the Refining Solutions reporting unit was $172.6 million. Management tests the Company’s recorded goodwill for impairment in the fourth quarter of each year or upon the occurrence of events or changes in circumstances that would more likely than not reduce the fair value of the Company’s reporting units below their carrying amounts. Management performed the annual goodwill impairment test as of October 31, 2023 by comparing the estimated fair value of the reporting units to the related carrying value. Management estimates the fair value using a discounted cash flow model. For the Refining Solutions reporting unit, the revenue growth rates, adjusted EBITDA (earnings before interest and financing expenses, income tax expense, depreciation and amortization) margins, and the discount rate were deemed to be significant assumptions.

The principal considerations for our determination that performing procedures relating to the goodwill impairment assessment of the Refining Solutions reporting unit is a critical audit matter are (i) the significant judgment by management when developing the fair value estimate of the Refining Solutions reporting unit; (ii) a high degree of auditor judgment, subjectivity, and effort in performing procedures and evaluating management’s significant assumptions related to revenue growth rates, adjusted EBITDA margins, and the discount rate; and (iii) the audit effort involved the use of professionals with specialized skill and knowledge.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of controls relating to management’s goodwill impairment assessment, including controls over the valuation of the Refining Solutions reporting unit. These procedures also included, among others (i) testing management’s process for developing the fair value estimate of the Refining Solutions reporting unit; (ii) evaluating the appropriateness of the discounted cash flow model used by management; (iii) testing the completeness and accuracy of underlying data used in the discounted cash flow model; and (iv) evaluating the reasonableness of the significant assumptions used by management related to revenue growth rates, adjusted EBITDA margins, and the discount rate. Evaluating management’s assumptions related to revenue growth rates and adjusted EBITDA margins involved evaluating whether the assumptions used by management were reasonable considering (i) the current and past performance of the Refining Solutions reporting unit; (ii) the consistency with external market and industry data; and (iii) whether the assumptions were consistent with evidence obtained in other areas of the audit. Professionals with specialized skill and knowledge were used to assist in evaluating (i) the appropriateness of the discounted cash flow model and (ii) the reasonableness of the discount rate assumption.

/s/ PricewaterhouseCoopers LLP
Charlotte, North Carolina
February 14, 2024

We have served as the Company’s auditor since 1994.

(In Thousands, Except Per Share Amounts)

Year Ended December 31	**2023**	**2022**	**2021**
Net sales	$ 9,617,203	$ 7,320,104	$ 3,327,957
Cost of goods sold[(a)]	8,431,294	4,245,517	2,329,986
Gross profit	1,185,909	3,074,587	997,971
Selling, general and administrative expenses	919,493	524,145	441,482
Research and development expenses	85,725	71,981	54,026
(Gain) loss on change in interest in properties/sale of business, net	(71,190)	8,400	(295,971)
Operating profit	251,881	2,470,061	798,434
Interest and financing expenses	(116,072)	(122,973)	(61,476)
Other income (expenses), net	110,929	86,356	(603,340)
Income before income taxes and equity in net income of unconsolidated investments	246,738	2,433,444	133,618
Income tax expense	430,277	390,588	29,446
Income before equity in net income of unconsolidated investments	(183,539)	2,042,856	104,172
Equity in net income of unconsolidated investments (net of tax)	1,854,082	772,275	95,770
Net income	1,670,543	2,815,131	199,942
Net income attributable to noncontrolling interests	(97,067)	(125,315)	(76,270)
Net income attributable to Albemarle Corporation	$ 1,573,476	$ 2,689,816	$ 123,672
Basic earnings per share	$ 13.41	$ 22.97	$ 1.07
Diluted earnings per share	$ 13.36	$ 22.84	$ 1.06
Weighted-average common shares outstanding—basic	117,317	117,120	115,841
Weighted-average common shares outstanding—diluted	117,766	117,793	116,536

(a) Included purchases from related unconsolidated affiliates of $2.3 billion, $656.7 million and $156.3 million for the years ended December 31, 2023, 2022 and 2021, respectively.

See accompanying notes to the consolidated financial statements.

CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

(In Thousands) Year Ended December 31	2023	2022	2021
Net income	$ 1,670,543	$ 2,815,131	$ 199,942
Other comprehensive income (loss), net of tax:			
Foreign currency translation and other	26,403	(171,295)	(74,385)
Net investment hedge	—	—	5,110
Cash flow hedge	5,851	(4,399)	174
Interest rate swap	—	7,399	2,623
Total other comprehensive income (loss), net of tax	32,254	(168,295)	(66,478)
Comprehensive income	1,702,797	2,646,836	133,464
Comprehensive income attributable to noncontrolling interests	(97,185)	(125,232)	(76,110)
Comprehensive income attributable to Albemarle Corporation	$ 1,605,612	$ 2,521,604	$ 57,354

See accompanying notes to the consolidated financial statements.

CONSOLIDATED BALANCE SHEETS

(In Thousands) **December 31**	**2023**	**2022**
Assets		
Current assets:		
Cash and cash equivalents	$ 889,900	$ 1,499,142
Trade accounts receivable, less allowance for doubtful accounts (2023—$2,808; 2022—$2,534)	1,213,160	1,190,970
Other accounts receivable	509,097	185,819
Inventories	2,161,287	2,076,031
Other current assets	443,475	234,955
Total current assets	5,216,919	5,186,917
Property, plant and equipment, at cost	12,233,757	9,354,330
Less accumulated depreciation and amortization	2,738,553	2,391,333
Net property, plant and equipment	9,495,204	6,962,997
Investments	1,369,855	1,150,553
Other assets	297,087	250,558
Goodwill	1,629,729	1,617,627
Other intangibles, net of amortization	261,858	287,870
Total assets	$ 18,270,652	$ 15,456,522
Liabilities and Equity		
Current liabilities:		
Accounts payable to third parties	$ 1,537,859	$ 1,533,624
Accounts payable to related parties	550,186	518,377
Accrued expenses	544,835	505,894
Current portion of long-term debt	625,761	2,128
Dividends payable	46,666	46,116
Income taxes payable	255,155	134,876
Total current liabilities	3,560,462	2,741,015
Long-term debt	3,541,002	3,214,972
Postretirement benefits	26,247	32,751
Pension benefits	150,312	159,571
Other noncurrent liabilities	769,100	636,596
Deferred income taxes	558,430	480,770
Commitments and contingencies (Note 17)		
Equity:		
Albemarle Corporation shareholders' equity:		
Common stock, $.01 par value (authorized 150,000 shares), issued and outstanding — 117,356 in 2023 and 117,168 in 2022	1,174	1,172
Additional paid-in capital	2,952,517	2,940,840
Accumulated other comprehensive loss	(528,526)	(560,662)
Retained earnings	6,987,015	5,601,277
Total Albemarle Corporation shareholders' equity	9,412,180	7,982,627
Noncontrolling interests	252,919	208,220
Total equity	9,665,099	8,190,847
Total liabilities and equity	$ 18,270,652	$ 15,456,522

See accompanying notes to the consolidated financial statements.

CONSOLIDATED STATEMENTS OF CHANGES IN EQUITY

(In Thousands, Except Share Data)

	Common Stock							
	Shares	**Amounts**	**Additional Paid-in Capital**	**Accumulated Other Comprehensive (Loss) Income**	**Retained Earnings**	**Total Albemarle Shareholders' Equity**	**Noncontrolling Interests**	**Total Equity**
Balance at January 1, 2021	106,842,369	$ 1,069	$ 1,438,038	$ (326,132)	$ 3,155,252	$ 4,268,227	$ 200,367	$ 4,468,594
Net income					123,672	123,672	76,270	199,942
Other comprehensive loss				(66,318)		(66,318)	(160)	(66,478)
Cash dividends declared, $1.56 per common share					(182,385)	(182,385)	(96,136)	(278,521)
Stock-based compensation			18,818			18,818		18,818
Fees related to public issuance of common stock			(888)			(888)		(888)
Exercise of stock options	302,151	3	18,389			18,392		18,392
Issuance of common stock, net	9,919,755	99	1,453,789			1,453,888		1,453,888
Shares withheld for withholding taxes associated with common stock issuances	(48,942)	(1)	(8,139)			(8,140)		(8,140)
Balance at December 31, 2021	117,015,333	$ 1,170	$ 2,920,007	$ (392,450)	$ 3,096,539	$ 5,625,266	$ 180,341	$ 5,805,607
Net income					2,689,816	2,689,816	125,315	2,815,131
Other comprehensive loss				(168,212)		(168,212)	(83)	(168,295)
Cash dividends declared, $1.58 per common share					(185,078)	(185,078)	(97,353)	(282,431)
Stock-based compensation			31,390			31,390		31,390
Exercise of stock options	32,581	1	2,395			2,396		2,396
Issuance of common stock, net	186,768	2	385			387		387
Shares withheld for withholding taxes associated with common stock issuances	(66,316)	(1)	(13,337)			(13,338)		(13,338)
Balance at December 31, 2022	117,168,366	$ 1,172	$ 2,940,840	$ (560,662)	$ 5,601,277	$ 7,982,627	$ 208,220	$ 8,190,847
Net income					1,573,476	1,573,476	97,067	1,670,543
Other comprehensive income				32,136		32,136	118	32,254
Cash dividends declared, $1.60 per common share					(187,738)	(187,738)	(52,486)	(240,224)
Stock-based compensation			38,957			38,957		38,957
Exercise of stock options	3,124	—	190			190		190
Issuance of common stock, net	298,781	3	(3)			—		—
Shares withheld for withholding taxes associated with common stock issuances	(114,001)	(1)	(27,467)			(27,468)		(27,468)
Balance at December 31, 2023	117,356,270	$ 1,174	$ 2,952,517	$ (528,526)	$ 6,987,015	$ 9,412,180	$ 252,919	$ 9,665,099

See accompanying notes to the consolidated financial statements.

(In Thousands) **Year Ended December 31**	**2023**	**2022**	**2021**
Cash and cash equivalents at beginning of year	$ 1,499,142	$ 439,272	$ 746,724
Cash flows from operating activities:			
Net income	1,670,543	2,815,131	199,942
Adjustments to reconcile net income to cash flows from operating activities:			
Depreciation and amortization	429,944	300,841	254,000
(Gain) loss on change in interest in properties/sale of business, net	(71,190)	8,400	(295,971)
Inventory net realizable value adjustment	604,099	—	—
Stock-based compensation and other	36,545	30,474	20,120
Equity in net income of unconsolidated investments (net of tax)	(1,854,082)	(772,275)	(95,770)
Dividends received from unconsolidated investments and nonmarketable securities	2,000,862	801,239	78,391
Pension and postretirement benefit	(1,658)	(52,254)	(74,010)
Pension and postretirement contributions	(17,866)	(16,112)	(30,253)
Unrealized loss (gain) on investments in marketable securities	39,864	3,279	(3,818)
Loss on early extinguishment of debt	—	19,219	28,955
Deferred income taxes	100,877	93,339	(38,500)
Changes in current assets and liabilities, net of effects of acquisitions and divestitures:			
(Increase) in accounts receivable	(350,655)	(786,121)	(49,295)
(Increase) in inventories	(962,924)	(1,609,642)	(127,401)
(Increase) decrease in other current assets	(171,870)	(104,655)	17,411
(Decrease) increase in accounts payable to third parties	(315,220)	816,194	126,563
Increase in accounts payable to related parties	31,809	470,878	17,376
Increase (decrease) in accrued expenses and income taxes payable	253,518	(201,356)	127,068
Non-cash transfer of 40% value of construction in progress of Kemerton plant to MRL	17,297	122,682	135,928
Other, net	(114,572)	(31,412)	53,521
Net cash provided by operating activities	1,325,321	1,907,849	344,257
Cash flows from investing activities:			
Acquisitions, net of cash acquired	(426,228)	(162,239)	—
Capital expenditures	(2,149,281)	(1,261,646)	(953,667)
Cash proceeds from divestitures, net	—	—	289,791
(Purchases) sales of marketable securities, net	(204,451)	1,942	3,774
Investments in equity investments and nonmarkertable securities	(1,200)	(706)	(6,488)
Net cash used in investing activities	(2,781,160)	(1,422,649)	(666,590)
Cash flows from financing activities:			
Proceeds from issuance of common stock	—	—	1,453,888
Proceeds from borrowings of long-term debt	356,047	1,964,216	—
Repayments of long-term debt and credit agreements	(28,862)	(705,000)	(1,173,823)
Other borrowings (repayments), net	617,014	(391,662)	60,991
Fees related to early extinguishment of debt	—	(9,767)	(24,877)
Dividends paid to shareholders	(187,188)	(184,429)	(177,853)
Dividends paid to noncontrolling interests	(105,631)	(44,208)	(96,136)
Proceeds from exercise of stock options	190	2,783	18,392
Withholding taxes paid on stock-based compensation award distributions	(27,468)	(13,338)	(8,140)
Other	(191)	(6,708)	(2,230)
Net cash provided by financing activities	623,911	611,887	50,212
Net effect of foreign exchange on cash and cash equivalents	222,686	(37,217)	(35,331)
(Decrease) increase in cash and cash equivalents	(609,242)	1,059,870	(307,452)
Cash and cash equivalents at end of year	$ 889,900	$ 1,499,142	$ 439,272

See accompanying notes to the consolidated financial statements.

NOTE 1—Summary of Significant Accounting Policies:

Basis of Consolidation

The consolidated financial statements include the accounts and operations of Albemarle Corporation and our wholly owned, majority owned and controlled subsidiaries. Unless the context otherwise indicates, the terms “Albemarle,” “we,” “us,” “our” or “the Company” mean Albemarle Corporation and its consolidated subsidiaries. For entities that we control and are the primary beneficiary, but own less than 100%, we record the minority ownership as noncontrolling interest, except as noted below. We apply the equity method of accounting for investments in which we have an ownership interest from 20% to 50% or where we exercise significant influence over the related investee’s operations. In addition, the consolidated financial statements contained herein include our proportionate share of the results of operations of the MARBL Lithium Joint Venture (“MARBL”), which manages the exploration, development, mining, processing and production of lithium and other minerals from the Wodgina hard rock lithium mine project (“Wodgina”). As described in Note 10, “Investments,” the Company closed on the restructuring of the MARBL joint venture with Mineral Resources Limited (“MRL”) on October 18, 2023 to reduce our ownership interest in the MARBL joint venture to 50% from 60%. The consolidated financial statements reflect our ownership percentage of the MARBL joint venture during the periods presented. The joint venture is unincorporated with each investor holding an undivided interest in each asset and proportionately liable for each liability; therefore our proportionate share of assets, liabilities, revenue and expenses are included in the appropriate classifications in the consolidated financial statements. All significant intercompany accounts and transactions are eliminated in consolidation.

Estimates, Assumptions and Reclassifications

The preparation of financial statements in conformity with generally accepted accounting principles (“GAAP”) in the United States (“U.S.”) requires management to make estimates and assumptions that affect the reported amounts of revenues, expenses, assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Actual results could differ from those estimates.

Revenue Recognition

Revenue is measured as the amount of consideration we expect to receive in exchange for transferring goods or providing services, and is recognized when performance obligations are satisfied under the terms of contracts with our customers. A performance obligation is deemed to be satisfied when control of the product or service is transferred to our customer. The transaction price of a contract, or the amount we expect to receive upon satisfaction of all performance obligations, is determined by reference to the contract’s terms and includes adjustments, if applicable, for any variable consideration, such as customer rebates, noncash consideration or consideration payable to the customer, although these adjustments are generally not material. Where a contract contains more than one distinct performance obligation, the transaction price is allocated to each performance obligation based on the standalone selling price of each performance obligation, although these situations are rare and are generally not built into our contracts. Any unsatisfied performance obligations are not material. Standalone selling prices are based on prices we charge to our customers, which in some cases are based on established market prices. Sales and other similar taxes collected from customers on behalf of third parties are excluded from revenue. Our payment terms are generally between 30 to 90 days, however, they vary by market factors, such as customer size, creditworthiness, geography and competitive environment.

All of our revenue is derived from contracts with customers, and almost all of our contracts with customers contain one performance obligation for the transfer of goods where such performance obligation is satisfied at a point in time. Control of a product is deemed to be transferred to the customer upon shipment or delivery. Significant portions of our sales are sold free on board shipping point or on an equivalent basis, while delivery terms of other transactions are based upon specific contractual arrangements. Our standard terms of delivery are generally included in our contracts of sale, order confirmation documents and invoices, while the timing between shipment and delivery generally ranges between 1 and 45 days. Costs for shipping and handling activities, whether performed before or after the customer obtains control of the goods, are accounted for as fulfillment costs. Such costs are immaterial.

The Company currently utilizes the following practical expedients, as permitted by Accounting Standards Codification (“ASC”) 606, *Revenue from Contracts with Customers*:

- All sales and other pass-through taxes are excluded from contract value;
- In utilizing the modified retrospective transition method, no adjustment was necessary for contracts that did not cross over the reporting year;

- We will not consider the possibility of a contract having a significant financing component (which would effectively attribute a portion of the sales price to interest income) unless, if at contract inception, the expected payment terms (from time of delivery or other relevant criterion) are more than one year;
- If our right to customer payment is directly related to the value of our completed performance, we recognize revenue consistent with the invoicing right; and
- We expense as incurred all costs of obtaining a contract incremental to any costs/compensation attributable to individual product sales/shipments for contracts where the amortization period for such costs would otherwise be one year or less.

Certain products we produce are made to our customer's specifications where such products have limited alternative use or would need significant rework costs in order to be sold to another customer. In management's judgment, control of these arrangements is transferred to the customer at a point in time (upon shipment or delivery) and not over the time they are produced. Therefore revenue is recognized upon shipment or delivery of these products.

Costs incurred to obtain contracts with customers are not significant and are expensed immediately as the amortization period would be one year or less. When the Company incurs pre-production or other fulfillment costs in connection with an existing or specific anticipated contract and such costs are recoverable through margin or explicitly reimbursable, such costs are capitalized and amortized to Cost of goods sold on a systematic basis that is consistent with the pattern of transfer to the customer of the goods or services to which the asset relates, which is less than one year. We record bad debt expense in specific situations when we determine the customer is unable to meet its financial obligation.

Included in Trade accounts receivable at December 31, 2023 and 2022 is approximately $1.2 billion and $1.0 billion, respectively, arising from contracts with customers. The remaining balance of Trade accounts receivable at December 31, 2023 and 2022 primarily includes value-added taxes collected from customers on behalf of various taxing authorities.

Cash and Cash Equivalents

Cash and cash equivalents include cash and money market investments with insignificant interest rate risks and no limitations on access.

Inventories

Inventories are stated at lower of cost and net realizable value with cost determined primarily on the first-in, first-out basis. Cost is determined on the weighted-average basis for a small portion of our inventories at foreign plants and our stores, supplies and other inventory. A portion of our domestic produced finished goods and raw materials are determined on the last-in, first-out basis.

The Company eliminates the balance of intra-entity profits on purchases of inventory from its equity method investments that remains unsold at the balance sheet in Inventories, specifically finished goods and equally reduces Equity in net income of unconsolidated investments (net of tax) on the consolidated statements of income. The intra-entity profit is recognized in Equity in net income of unconsolidated investments (net of tax) in the period that converted inventory is sold to a third-party customer. In the same period, the intra-entity profit is also recognized as higher Cost of goods sold on the consolidated statements of income.

Property, Plant and Equipment

Property, plant and equipment include costs of assets constructed, purchased or leased under a finance lease, related delivery and installation costs and interest incurred on significant capital projects during their construction periods. Expenditures for renewals and betterments also are capitalized, but expenditures for normal repairs and maintenance are expensed as incurred. Costs associated with yearly planned major maintenance are generally deferred and amortized over 12 months or until the same major maintenance activities must be repeated, whichever is shorter. The cost and accumulated depreciation applicable to assets retired or sold are removed from the respective accounts, and gains or losses thereon are included in income.

We assign the useful lives of our property, plant and equipment based upon our internal engineering estimates, which are reviewed periodically. The estimated useful lives of our property, plant and equipment range from two to sixty years and depreciation is recorded on the straight-line method, with the exception of our mineral rights and reserves, which are depleted on a units-of-production method.

We evaluate the recovery of our property, plant and equipment by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized.

Leases

We determine if an arrangement is a lease at inception. Right-of-use ("ROU") assets represent our right to use an underlying asset for the lease term and lease liabilities represent our obligation to make lease payments arising from the lease. Operating lease ROU assets and liabilities are recognized at commencement date based on the present value of lease payments over the lease term. As an implicit rate for most of our leases is not determinable, we use our incremental borrowing rate based on the information available at commencement date in determining the present value of lease payments. The lease payments for the initial measurement of lease ROU assets and lease liabilities include fixed and variable payments based on an index or a rate. Variable lease payments that are not index or rate based are recorded as expenses when incurred. Our variable lease payments typically include real estate taxes, insurance costs and common-area maintenance. The operating lease ROU asset also includes any lease payments made, net of lease incentives. The lease term is the non-cancelable period of the lease, including any options to extend, purchase or terminate the lease when it is reasonably certain that we will exercise that option. We amortize the operating lease ROU assets on a straight-line basis over the period of the lease and the finance lease ROU assets on a straight-line basis over the shorter of their estimated useful lives or the lease terms. Leases with an initial term of 12 months or less are not recorded on the balance sheet, and we recognize lease expense for these leases on a straight-line basis over the lease term.

Additionally, we have made accounting policy elections such as exclusion of short-term leases (leases with a term of 12 months or less and which do not include a purchase option that we are reasonably certain to exercise) from the balance sheet presentation, use of portfolio approach in determination of discount rate and accounting for non-lease components in a contract as part of a single lease component for all asset classes, except specific mining operation equipment.

Resource Development Expenses

We incur costs in resource exploration, evaluation and development during the different phases of our resource development projects. Exploration costs incurred before the declaration of proven and probable resources are generally expensed as incurred. After proven and probable resources are declared, exploration, evaluation and development costs necessary to bring the property to commercial capacity or increase the capacity or useful life are capitalized. Any costs to maintain the production capacity in a property under production are expensed as incurred.

Capitalized resource costs are depleted using the units-of-production method. Our resource development assets are evaluated for impairment when events or changes in circumstances indicate that the carrying amount may not be recoverable.

Investments

Investments are accounted for using the equity method of accounting if the investment gives us the ability to exercise significant influence, but not control, over the investee. Significant influence is generally deemed to exist if we have an ownership interest in the voting stock of the investee between 20% and 50%, although other factors, such as representation on the investee's board of directors and the impact of commercial arrangements, are considered in determining whether the equity method of accounting is appropriate. Under the equity method of accounting, we record our investments in equity-method investees in the consolidated balance sheets as Investments and our share of investees' earnings or losses together with other-than-temporary impairments in value as Equity in net income of unconsolidated investments in the consolidated statements of income. We evaluate our equity method investments for impairment whenever events or changes in circumstances indicate that the carrying amounts of such investments may be impaired. If a decline in the value of an equity method investment is determined to be other than temporary, a loss is recorded in earnings in the current period.

Certain investments in equity securities and mutual fund investments are accounted for as trading equities and are marked-to-market on a periodic basis through the consolidated statements of income. Investments in joint ventures and nonmarketable securities of immaterial entities are estimated based upon the overall performance of the entity where financial results are not available on a timely basis.

Environmental Compliance and Remediation

Environmental compliance costs include the cost of purchasing and/or constructing assets to prevent, limit and/or control pollution or to monitor the environmental status at various locations. These costs are capitalized and depreciated based on estimated useful lives. Environmental compliance costs also include maintenance and operating costs with respect to pollution prevention and control facilities and other administrative costs. Such operating costs are expensed as incurred. Environmental remediation costs of facilities used in current operations are generally immaterial and are expensed as incurred. We accrue for environmental remediation costs and post-remediation costs that relate to existing conditions caused by past operations at facilities or off-plant disposal sites in the accounting period in which responsibility is established and when the related liability is considered probable and estimable. In developing these cost estimates, we evaluate currently available facts regarding each site, with consideration given to existing technology, presently enacted laws and regulations, prior experience in remediation of contaminated sites, the financial capability of other potentially responsible parties and other factors, subject to uncertainties inherent in the estimation process. If the amount and timing of the cash payments for a site are fixed or reliably determinable, the liability is discounted, if the calculated discount is material. Additionally, these estimates are reviewed periodically, with adjustments to the accruals recorded as necessary.

Research and Development Expenses

Our research and development expenses related to present and future products are expensed as incurred. These expenses consist primarily of personnel-related costs and other overheads, as well as outside service and consulting costs incurred for specific programs. Our U.S. facilities in Texas and Louisiana and our global facilities in the Netherlands, Germany, Belgium and Korea form the capability base for our contract research and custom manufacturing businesses. These business areas provide research and scale-up services primarily to innovative life science companies.

Goodwill and Other Intangible Assets

We account for goodwill and other intangibles acquired in a business combination in conformity with current accounting guidance that requires that goodwill and indefinite-lived intangible assets not be amortized.

We test goodwill for impairment by comparing the estimated fair value of our reporting units to the related carrying value. Our reporting units are either our operating business segments or one level below our operating business segments for which discrete financial information is available and for which operating results are regularly reviewed by the business management. In applying the goodwill impairment test, the Company initially performs a qualitative test (“Step 0”), where it first assesses qualitative factors to determine whether it is more likely than not that the fair value of the reporting units is less than its carrying value. Qualitative factors may include, but are not limited to, economic conditions, industry and market considerations, cost factors, overall financial performance of the reporting units and other entity and reporting unit specific events. If after assessing these qualitative factors, the Company determines it is “more-likely-than-not” that the fair value of the reporting unit is less than the carrying value, the Company performs a quantitative test (“Step 1”). During Step 1, the Company estimates the fair value using a discounted cash flow model. Future cash flows for all reporting units include assumptions about revenue growth rates, adjusted EBITDA margins, discount rate as well as other economic or industry-related factors. The Company defines adjusted EBITDA as earnings before interest and financing expense, income tax expenses, depreciation and amortization, as adjusted on a consistent basis for certain non-operating, non-recurring or unusual items in a balanced manner and on a segment basis. For the Refining Solutions reporting unit, the revenue growth rates, adjusted EBITDA margins and the discount rate were deemed to be significant assumptions. Significant management judgment is involved in estimating these variables and they include inherent uncertainties since they are forecasting future events. The Company uses a Weighted Average Cost of Capital (“WACC”) approach to determine our discount rate for goodwill recoverability testing. The WACC calculation incorporates industry-weighted average returns on debt and equity from a market perspective. The factors in this calculation are largely external to the Company and, therefore, are beyond its control. The Company performs a sensitivity analysis by using a range of inputs to confirm the reasonableness of these estimates being used in the goodwill impairment analysis. The Company tests its recorded goodwill for impairment in the fourth quarter of each year or upon the occurrence of events or changes in circumstances that would more likely than not reduce the fair value of its reporting units below their carrying amounts.

The Company performed its annual goodwill impairment test as of October 31, 2023. The performance catalyst solutions (“PCS”) reporting unit, within the Ketjen segment, has experienced declining earnings from a changing market. During this annual impairment test, it was determined that it is expected to experience a continued decline in its foreseeable forecast, resulting in a fair value based on the present value future cash flows that was lower than its current carrying value. As a result, the Company recorded a $6.8 million impairment loss, representing the full value of goodwill associated with the PCS reporting unit. No evidence of impairment was noted for the other reporting units from the analysis. However, if the adjusted EBITDA or discount rate estimates for the Refining Solutions reporting unit negatively changed by 10%, the Refining Solutions fair value would be below its carrying value.

The Company assesses its indefinite-lived intangible assets, which include trade names and trademarks, for impairment annually and between annual tests if events or changes in circumstances indicate that it is more likely than not that the asset is impaired. The indefinite-lived intangible asset impairment standard allows the Company to first assess qualitative factors to determine if a quantitative impairment test is necessary. Further testing is only required if we determine, based on the qualitative assessment, that it is more likely than not that the indefinite-lived intangible asset's fair value is less than its carrying amount. If we determine based on the qualitative assessment that it is more likely than not that the asset is impaired, an impairment test is performed by comparing the fair value of the indefinite-lived intangible asset to its carrying amount. During the year ended December 31, 2023, no evidence of impairment was noted from the analysis for the Company's indefinite-lived intangible assets.

Definite-lived intangible assets, such as purchased technology, patents and customer lists, are amortized over their estimated useful lives generally for periods ranging from five to twenty-five years. Except for customer lists and relationships associated with the majority of our Energy Storage business, which are amortized using the pattern of economic benefit method, definite-lived intangible assets are amortized using the straight-line method. We evaluate the recovery of our definite-lived intangible assets by comparing the net carrying value of the asset group to the undiscounted net cash flows expected to be generated from the use and eventual disposition of that asset group when events or changes in circumstances indicate that its carrying amount may not be recoverable. If the carrying amount of the asset group is not recoverable, the fair value of the asset group is measured and if the carrying amount exceeds the fair value, an impairment loss is recognized. See Note 12, "Goodwill and Other Intangibles."

Pension Plans and Other Postretirement Benefits

Under authoritative accounting standards, assumptions are made regarding the valuation of benefit obligations and the performance of plan assets. As required, we recognize a balance sheet asset or liability for each of our pension and other postretirement benefit ("OPEB") plans equal to the plan's funded status as of the measurement date. The primary assumptions are as follows:

- Discount Rate—The discount rate is used in calculating the present value of benefits, which is based on projections of benefit payments to be made in the future.
- Expected Return on Plan Assets—We project the future return on plan assets based on prior performance and future expectations for the types of investments held by the plans, as well as the expected long-term allocation of plan assets for these investments. These projected returns reduce the net benefit costs recorded currently.
- Rate of Compensation Increase—For salary-related plans, we project employees' annual pay increases, which are used to project employees' pension benefits at retirement.
- Mortality Assumptions—Assumptions about life expectancy of plan participants are used in the measurement of related plan obligations.

Actuarial gains and losses are recognized annually in our consolidated statements of income in the fourth quarter and whenever a plan is determined to qualify for a remeasurement during a fiscal year. The remaining components of pension and OPEB plan expense, primarily service cost, interest cost and expected return on assets, are recorded on a monthly basis. The market-related value of assets equals the actual market value as of the date of measurement.

During 2023, we made changes to assumptions related to discount rates and expected rates of return on plan assets. We consider available information that we deem relevant when selecting each of these assumptions.

In selecting the discount rates for the U.S. plans, we consider expected benefit payments on a plan-by-plan basis. As a result, the Company uses different discount rates for each plan depending on the demographics of participants and the expected timing of benefit payments. For 2023, the discount rates were calculated using the results from a bond matching technique developed by Milliman, which matched the future estimated annual benefit payments of each respective plan against a portfolio of bonds of high quality to determine the discount rate. We believe our selected discount rates are determined using preferred methodology under authoritative accounting guidance and accurately reflect market conditions as of the December 31, 2023 measurement date.

In selecting the discount rates for the foreign plans, we look at long-term yields on AA-rated corporate bonds when available. Our actuaries have developed yield curves based on the yields on the constituent bonds in the various indices as well as on other market indicators such as swap rates, particularly at the longer durations. For the Eurozone, we apply the Aon Hewitt yield curve to projected cash flows from the relevant plans to derive the discount rate. For the United Kingdom ("U.K."), the discount rate is determined by applying the Aon Hewitt yield curve for typical schemes of similar duration to projected cash flows of Albemarle's U.K. plan. In other countries where there is not a sufficiently deep market of high-quality corporate bonds, we set the discount rate by referencing the yield on government bonds of an appropriate duration.

In estimating the expected return on plan assets, we consider past performance and future expectations for the types of investments held by the plan as well as the expected long-term allocation of plan assets to these investments. In projecting the rate of compensation increase, we consider past experience in light of movements in inflation rates.

For the purpose of measuring our U.S. pension and OPEB obligations at December 31, 2023 and 2022, we used the Pri-2012 Mortality Tables along with the MP-2021 Mortality Improvement Scale, respectively, published by the SOA.

Stock-based Compensation Expense

The fair value of restricted stock awards, restricted stock unit awards and performance unit awards with a service condition are determined based on the number of shares or units granted and the quoted price of our common stock on the date of grant, and the fair value of stock options is determined using the Black-Scholes valuation model. The fair value of performance unit awards with a service condition and a market condition are estimated on the date of grant using a Monte Carlo simulation model. The fair value of these awards is determined after giving effect to estimated forfeitures. Such value is recognized as expense over the service period, which is generally the vesting period of the equity grant. To the extent restricted stock awards, restricted stock unit awards, performance unit awards and stock options are forfeited prior to vesting in excess of the estimated forfeiture rate, the corresponding previously recognized expense is reversed as an offset to operating expenses.

Income Taxes

We use the liability method for determining our income taxes, under which current and deferred tax liabilities and assets are recorded in accordance with enacted tax laws and rates. Under this method, the amounts of deferred tax liabilities and assets at the end of each period are determined using the tax rate expected to be in effect when taxes are actually paid or recovered. Future tax benefits are recognized to the extent that realization of such benefits is more likely than not. The Company’s deferred tax assets and liabilities are classified as noncurrent on the balance sheet, along with any related valuation allowance. Tax effects are released from Accumulated Other Comprehensive Income using either the specific identification approach or the portfolio approach based on the nature of the underlying item.

Deferred income taxes are provided for the estimated income tax effect of temporary differences between the financial statement carrying amounts and the tax basis of existing assets and liabilities. Deferred tax assets are also provided for operating losses, capital losses and certain tax credit carryovers. A valuation allowance, reducing deferred tax assets, is established when it is more likely than not that some portion or all of the deferred tax assets will not be realized. The realization of such deferred tax assets is dependent upon the generation of sufficient future taxable income of the appropriate character. Although realization is not assured, we do not establish a valuation allowance when we believe it is more likely than not that a net deferred tax asset will be realized. The Company elected to not consider the estimated impact of potential future Corporate Alternative Minimum Tax liabilities for purposes of assessing valuation allowances on its deferred tax balances.

We only recognize a tax benefit after concluding that it is more likely than not that the benefit will be sustained upon audit by the respective taxing authority based solely on the technical merits of the associated tax position. Once the recognition threshold is met, we recognize a tax benefit measured as the largest amount of the tax benefit that, in our judgment, is greater than 50% likely to be realized. Under current accounting guidance for uncertain tax positions, interest and penalties related to income tax liabilities are included in Income tax expense on the consolidated statements of income.

We have designated the undistributed earnings of a portion of our foreign operations as indefinitely reinvested and as a result we do not provide for deferred income taxes on the unremitted earnings of these subsidiaries. Our foreign earnings are computed under U.S. federal tax earnings and profits, or E&P, principles. In general, to the extent our financial reporting book basis over tax basis of a foreign subsidiary exceeds these E&P amounts, deferred taxes have not been provided as they are essentially permanent in duration. The determination of the amount of such unrecognized deferred tax liability is not practicable. We provide for deferred income taxes on our undistributed earnings of foreign operations that are not deemed to be indefinitely invested. We will continue to evaluate our permanent investment assertion taking into consideration all relevant and current tax laws.

Accumulated Other Comprehensive Loss

Accumulated other comprehensive loss comprises principally foreign currency translation adjustments, gains or losses on foreign currency cash flow hedges designated as effective hedging instruments, amounts related to the revaluation of our euro-denominated senior notes which were designated as a hedge of our net investment in foreign operations in 2014, a realized loss on a forward starting interest rate swap entered into in 2014 which was designated as a cash flow hedge, and deferred income taxes related to the aforementioned items.

Foreign Currency Translation

The assets and liabilities of all foreign subsidiaries were prepared in their respective functional currencies and translated into U.S. Dollars based on the current exchange rate in effect at the balance sheet dates, while income and expenses were translated at average exchange rates for the periods presented. Translation adjustments are reflected as a separate component of equity.

Foreign exchange transaction and revaluation gains (losses) were $39.9 million, ($21.8) million and $0.1 million for the years ended December 31, 2023, 2022 and 2021, respectively, and are included in Other income (expenses), net, in our consolidated statements of income, with the unrealized portion included in Other, net, in our consolidated statements of cash flows.

Derivative Financial Instruments

We manage our foreign currency exposures by balancing certain assets and liabilities denominated in foreign currencies and through the use of foreign currency forward contracts from time to time, which generally expire within one year. The principal objective of such contracts is to minimize the financial impact of changes in foreign currency exchange rates. While these contracts are subject to fluctuations in value, such fluctuations are generally expected to be offset by changes in the value of the underlying foreign currency exposures being hedged. Gains or losses under foreign currency forward contracts that have been designated as an effective hedging instrument under ASC 815, *Derivatives and Hedging* will be recorded in Accumulated other comprehensive loss beginning on the date of designation. All other gains and losses on foreign currency forward contracts not designated as an effective hedging instrument are recognized currently in Other income (expenses), net, and generally do not have a significant impact on results of operations.

We may also enter into interest rate swaps, collars or similar instruments from time to time, with the objective of reducing interest rate volatility relating to our borrowing costs.

The counterparties to these contractual agreements are major financial institutions with which we generally have other financial relationships. We are exposed to credit loss in the event of nonperformance by these counterparties. However, we do not anticipate nonperformance by the counterparties. We do not utilize financial instruments for trading or other speculative purposes. In the fourth quarter of 2019, we entered into a foreign currency forward contract to hedge the cash flow exposure of non-functional currency purchases during the construction of the Kemerton plant in Australia and designated it as an effective hedging instrument under ASC 815, *Derivatives and Hedging*. All other foreign currency forward contracts outstanding at December 31, 2023 and 2022 have not been designated as hedging instruments under ASC 815, *Derivatives and Hedging*.

Recently Issued Accounting Pronouncements

In March 2020, the Financial Accounting Standards Board ("FASB") issued accounting guidance that provides optional expedients and exceptions for applying U.S. GAAP to contracts, hedging relationships and other transactions affected by reference rate reform if certain criteria are met. The guidance applies only to contracts, hedging relationships and other transactions that reference LIBOR or another reference rate expected to be discontinued because of reference rate reform. In January 2021, the FASB issued additional accounting guidance which clarifies that certain optional expedients and exceptions apply to derivatives that are affected by the discounting transition. The guidance under both FASB issuances was originally effective March 12, 2020 through December 31, 2022. However, in December 2022, the FASB issued an update to defer the sunset date of this guidance to December 31, 2024. The Company currently does not expect this guidance to have a significant impact on its consolidated financial statements.

In October 2021, the FASB issued guidance on how to recognize and measure acquired contract assets and liabilities from revenue contracts in a business combination, which requires the acquirer to recognize and measure contract assets and contract liabilities acquired in a business combination in accordance with ASC 606, *Revenue from Contracts with Customers* as if it had originated the contracts. This guidance is effective for financial statements issued for annual periods beginning after December 15, 2022, including interim periods within those annual periods. This guidance does not currently, nor is it expected to, have a significant impact on its consolidated financial statements.

In March 2022, the FASB issued accounting guidance that expands the Company's abilities to hedge the benchmark interest rate risk of portfolios of financial assets or beneficial interests in a fair value hedge. This guidance expands the use of the portfolio layer method to allow multiple hedges of a single closed portfolio of assets using spot starting, forward starting, and amortizing-notional swaps. This also permits both prepayable and non-prepayable financial assets to be included in the closed portfolio of assets hedged in a portfolio layer hedge. In addition, this guidance requires that basis adjustments not be allocated to individual assets for active portfolio layer method hedges, but rather be maintained on the closed portfolio of assets as a whole. This guidance is effective for financial statements issued for annual periods beginning after December 15, 2022, including interim periods within those annual periods. This guidance does not currently, nor is it expected to, have a significant impact on its consolidated financial statements.

In March 2023, the FASB issued guidance requiring the Company to amortize leasehold improvements associated with common control leases over the asset's useful life to the common control group regardless of the lease term. This guidance is effective for financial statements issued for annual periods beginning after December 15, 2023, including interim periods within those annual periods. The Company currently does not expect this guidance to have a significant impact on its consolidated financial statements.

In August 2023, the FASB issued guidance which will require a joint venture to recognize and initially measure its assets, including goodwill, and liabilities using a new basis of accounting upon formation. Initial measurement of a joint venture's total net assets will be equal to the fair value of one hundred percent of the joint venture's equity. In addition, a joint venture will be permitted to apply the measurement period guidance of ASC 805-10 if the initial accounting for the joint venture formation is incomplete by the end of the reporting period in which the formation occurs. This guidance is effective prospectively for all joint venture formations with a formation date on or after January 1, 2025. The Company currently does not expect this guidance to have a significant impact on its consolidated financial statements.

In November 2023, the FASB issued guidance to update qualitative and quantitative reportable segment disclosure requirements, including enhanced disclosures about significant segment expenses and increased interim disclosure requirements, among others. This guidance is effective for fiscal years beginning after December 15, 2023, and interim periods within fiscal years beginning after December 15, 2024. Early adoption is permitted, and the amendments should be applied retrospectively. The Company currently does not expect this guidance to have a significant impact on its consolidated financial statement disclosures.

In December 2023, the FASB issued guidance to require qualitative and quantitative updates to the rate reconciliation and income taxes paid disclosures, among others, in order to enhance the transparency of income tax disclosures, including consistent categories and greater disaggregation of information in the rate reconciliation and disaggregation by jurisdiction of income taxes paid. This guidance is effective for fiscal years beginning after December 15, 2024, with early adoption permitted. The amendments should be applied prospectively; however, retrospective application is also permitted. The Company is currently evaluating the impact this guidance will have on its financial statement disclosures.

NOTE 2—Acquisitions:

Guangxi Tianyuan New Energy Materials Acquisition

On October 25, 2022, the Company completed the acquisition of all of the outstanding equity of Guangxi Tianyuan New Energy Materials Co., Ltd. ("Qinzhou"), for approximately $200 million in cash, which included the deferral of approximately $29 million. The full amount of the deferral, net of working capital adjustments, was paid in installments ending in July 2023. Qinzhou's operations include a lithium processing plant strategically positioned near the Port of Qinzhou in Guangxi, which began commercial production in the first half of 2022. The plant has designed annual conversion capacity of up to 25,000 metric tonnes of lithium carbonate equivalent ("LCE") and is capable of producing battery-grade lithium carbonate and lithium hydroxide.

The aggregate purchase price noted above was allocated to the major categories of assets and liabilities acquired based upon their estimated fair values at the acquisition closing date, which were based, in part, upon third-party appraisals for certain assets. The fair value of the assets and liabilities was primarily related to Property, plant and equipment of $106.6 million, Other intangibles of $16.3 million, net current liabilities of $5.5 million, and long-term liabilities of $7.1 million. The excess of the purchase price over the fair value of the net assets acquired was $76.8 million and was recorded as Goodwill.

The allocation of the purchase price was finalized in the third quarter of 2023. The fair value of the assets acquired and liabilities assumed was based on management's estimates and assumptions, as well as other information compiled by management, including valuations that utilize customary valuation procedures and techniques. The discount rate is a significant assumption used in the valuation model. If the actual results differ from the estimates and judgments used in these fair values, the amounts recorded in the consolidated financial statements could be subject to possible impairment.

Goodwill arising from the acquisition was recorded within the Energy Storage segment and consists largely of anticipated synergies and economies of scale from the combined companies and overall strategic importance of the acquired businesses to Albemarle. The goodwill attributable to the acquisition will not be amortizable or deductible for tax purposes.

Acquisition, integration and potential divestiture related costs

Acquisition, integration and potential divestiture related costs for the years ended December 31, 2023, 2022 and 2021 of $26.8 million, $16.3 million and $12.7 million were included primarily in Selling, general and administrative expenses, respectively, on our consolidated statements of income. These include costs for the Qinzhou acquisitions noted above, as well as various other completed or potential acquisitions and divestitures.

NOTE 3—Divestitures:

On June 1, 2021, the Company completed the sale of its fine chemistry services ("FCS") business to W. R. Grace & Co. ("Grace") for proceeds of approximately $570 million, consisting of $300 million in cash and the issuance to Albemarle of preferred equity of a Grace subsidiary having an aggregate stated value of $270 million. The preferred equity can be redeemed at Grace's option under certain conditions and began accruing payment-in-kind ("PIK") dividends at an annual rate of 12% on June 1, 2023. This preferred equity can be redeemed by Albemarle when the accumulated balance reaches 200% of its original value. The balance of this preferred equity is reported in Investments in the consolidated balance sheets.

As part of the transaction, Grace acquired our manufacturing facilities located in South Haven, Michigan and Tyrone, Pennsylvania. The sale of the FCS business reflects the Company's commitment to investing in its core, growth-oriented business segments. During the year ended December 31, 2021 we recorded a gain of $428.4 million ($330.9 million after taxes) related to the sale of this business.

The results of operations of the business classified as held for sale are included in the consolidated statements of income through June 1, 2021. This business did not qualify for discontinued operations treatment because the Company's management does not consider the sale as representing a strategic shift that had or will have a major effect on the Company's operations and financial results.

NOTE 4—Supplemental Cash Flow Information:

Supplemental information related to the consolidated statements of cash flows is as follows (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Cash paid during the year for:			
Income taxes (net of refunds of $31,386, $11,564 and $32,677 in 2023, 2022 and 2021, respectively)	$ 319,391	$ 248,143	$ 130,840
Interest (net of capitalization)	$ 101,978	$ 92,095	$ 27,734
Supplemental non-cash disclosures related to investing and financing activities:			
Capital expenditures included in Accounts payable	$ 494,029	$ 296,294	$ 165,677
Promissory note issued for capital expenditures[a]	$ —	$ 10,876	$ —
Non-cash proceeds from divestitures[b]	$ —	$ —	$ 244,530

(a) During the first quarter of 2022, the Company issued a promissory note with a present value of $10.9 million for land purchased in Kings Mountain, North Carolina. The promissory note is payable in equal annual installments from the years 2027 to 2048.
(b) Fair value of preferred equity of a Grace subsidiary received as part of proceeds for the sale of our FCS business. See Note 3, "Divestitures," for further details.

As part of the purchase price paid for the acquisition of a 60% interest in Wodgina in 2019, the Company transferred $17.3 million, $122.7 million and $135.9 million of its construction in progress of the designated Kemerton assets during the years ended December 31, 2023, 2022 and 2021, respectively, representing MRL's 40% interest in the assets at the time of transfer. Since the acquisition, the Company has transferred the full $480 million of construction in progress to MRL, as defined in the original purchase agreement. In addition, during the years ended December 31, 2022 and 2021, the Company recorded expenses of $8.4 million and $132.4 million, respectively, related to cost overruns of the designated Kemerton assets. The cash outflow for these assets was recorded in Capital expenditures within Cash flows from investing activities on the condensed consolidated statements of cash flows. The non-cash transfer of these assets is recorded in Non-cash transfer of 40% value of construction in progress of the Kemerton plant to MRL within Cash flows from operating activities on the consolidated statements of cash flows.

Other, net within Cash flows from operating activities on the consolidated statements of cash flows for the years ended December 31, 2023, 2022 and 2021 included $64.4 million, $41.8 million and $28.7 million, respectively, representing the reclassification of the current portion of the one-time transition tax resulting from the enactment of the Tax Cuts and Jobs Act ("TCJA") in 2017, from Other noncurrent liabilities to Income taxes payable within current liabilities. For additional information, see Note 21, "Income Taxes." In addition, included in Other, net for the years ended December 31, 2023, 2022 and 2021 is $39.9 million, ($21.8) million and $0.1 million, respectively, related to gains (losses) on fluctuations in foreign currency exchange rates.

NOTE 5—Earnings Per Share:

Basic and diluted earnings per share are calculated as follows (in thousands, except per share amounts):

	Year Ended December 31,		
	2023	2022	2021
Basic earnings per share			
Numerator:			
Net income attributable to Albemarle Corporation	$ 1,573,476	$ 2,689,816	$ 123,672
Denominator:			
Weighted-average common shares for basic earnings per share	117,317	117,120	115,841
Basic earnings per share	$ 13.41	$ 22.97	$ 1.07
Diluted earnings per share			
Numerator:			
Net income attributable to Albemarle Corporation	$ 1,573,476	$ 2,689,816	$ 123,672
Denominator:			
Weighted-average common shares for basic earnings per share	117,317	117,120	115,841
Incremental shares under stock compensation plans	449	673	695
Weighted-average common shares for diluted earnings per share	117,766	117,793	116,536
Diluted earnings per share	$ 13.36	$ 22.84	$ 1.06

At December 31, 2023, there were 165,159 common stock equivalents not included in the computation of diluted earnings per share because their effect would have been anti-dilutive.

Included in the calculation of basic earnings per share are unvested restricted stock awards that contain nonforfeitable rights to dividends. At December 31, 2023, there were 4,500 unvested shares of restricted stock awards outstanding.

We have the authority to issue 15 million shares of preferred stock in one or more classes or series. As of December 31, 2023, no shares of preferred stock have been issued.

On February 8, 2021, we completed an underwritten public offering of 8,496,773 shares of our common stock, par value $0.01 per share, at a price to the public of $153.00 per share. The Company also granted to the Underwriters an option to purchase up to an additional 1,274,509 shares for a period of 30 days, which was exercised. The total gross proceeds from this offering were approximately $1.5 billion, before deducting expenses, underwriting discounts and commissions.

In November 2016, our Board of Directors authorized an increase in the number of shares the Company is permitted to repurchase under our share repurchase program, pursuant to which the Company is now permitted to repurchase up to a maximum of 15 million shares, including those previously authorized but not yet repurchased.

There were no shares of the Company's common stock repurchased during the year ended December 31, 2023, 2022 or 2021. As of December 31, 2023, there were 7,396,263 remaining shares available for repurchase under the Company's authorized share repurchase program.

NOTE 6—Other Accounts Receivable:

Other accounts receivable consist of the following at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
Value added tax/consumption tax	$ 474,280	$ 141,856
Other	34,817	43,963
Total	$ 509,097	$ 185,819

NOTE 7—Inventories:

The following table provides a breakdown of inventories at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
Finished goods	$ 1,624,893	$ 1,679,473
Raw materials and work in process[(a)]	401,050	296,998
Stores, supplies and other	135,344	99,560
Total[(b)]	$ 2,161,287	$ 2,076,031

(a) Included $213.4 million and $133.2 million at December 31, 2023 and 2022, respectively, of work in process in our Energy Storage segment.

(b) During the year ended December 31, 2023, the Company recorded a $604.1 million charge in Cost of goods sold to reduce the value of certain spodumene and finished goods to their net realizable value following the decline in lithium market pricing at the end of the year.

Approximately 3% of our inventories are valued using the last-in, first-out ("LIFO") method at both December 31, 2023 and 2022. The portion of our domestic inventories stated on the LIFO basis amounted to $60.4 million and $52.9 million at December 31, 2023 and 2022, respectively, which are below replacement cost by approximately $60.1 million and $57.9 million, respectively.

The Company eliminates the balance of intra-entity profits on purchases of inventory from its equity method investments that remains unsold at the balance sheet in Inventories, specifically finished goods and equally reduces Equity in net income of unconsolidated investments (net of tax) on the consolidated statements of income. The balance of intra-entity profits on inventory purchased from equity method investments in Inventories totaled $559.6 million and $332.3 million at December 31, 2023 and 2022, respectively. The intra-entity profit is recognized in Equity in net income of unconsolidated investments (net of tax) in the period that converted inventory is sold to a third-party customer. In the same period, the intra-entity profit is also recognized as higher Cost of goods sold on the consolidated statements of income.

NOTE 8—Other Current Assets:

Other current assets consist of the following at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
Income tax receivables	$ 112,953	$ 71,795
Prepaid taxes	207,894	97,682
Other prepaid expenses	116,033	58,754
Other	6,595	6,724
Total	$ 443,475	$ 234,955

NOTE 9—Property, Plant and Equipment:

Property, plant and equipment, at cost, consist of the following at December 31, 2023 and 2022 (in thousands):

	Useful Lives (Years)	December 31,	
		2023	2022
Land	—	$ 297,435	$ 172,464
Land improvements	10 – 30	316,544	201,284
Buildings and improvements	10 – 50	699,045	492,509
Machinery and equipment[(a)]	2 – 45	6,173,463	4,446,315
Mineral rights and reserves	7 – 60	1,689,013	1,795,668
Construction in progress	—	3,058,257	2,246,090
Total		$ 12,233,757	$ 9,354,330

(a) Consists primarily of (1) short-lived production equipment components, office and building equipment and other equipment with estimated lives ranging 2 – 7 years, (2) production process equipment (intermediate components) with estimated lives ranging 8 – 19 years, (3) production process equipment (major unit components) with estimated lives ranging 20 – 29 years, and (4) production process equipment (infrastructure and other) with estimated lives ranging 30 – 45 years.

The cost of property, plant and equipment is depreciated generally by the straight-line method. Depletion of mineral rights is based on the units-of-production method. Depreciation expense, including depletion, amounted to $398.5 million, $273.0 million and $225.6 million during the years ended December 31, 2023, 2022 and 2021, respectively. Interest capitalized on significant capital projects in 2023, 2022 and 2021 was $72.7 million, $31.1 million and $50.0 million, respectively.

In October 2022, the Company announced it has been awarded a nearly $150 million grant from the U.S. Department of Energy to expand domestic manufacturing of batteries for EVs and the electric grid and for materials and components currently imported from other countries. The grant funding is intended to support a portion of the anticipated cost to construct a new, commercial-scale U.S.-based lithium concentrator facility at our Kings Mountain, North Carolina location. The grant will be received over the life of the construction period for the new facility (projected as 2024 to 2026) as reimbursement for capital expenditures. To further support the restart of the Kings Mountain mine, in August 2023, we announced a $90 million critical materials award from the U.S. Department of Defense. As funds are received for both of these grants, the Company will reduce the cost of the assets by the amount of the grant, and income will be recognized by the lower depreciation expense over the useful life of the assets.

NOTE 10—Investments:

Investments include our share of unconsolidated joint ventures, nonmarketable securities and marketable equity securities. The following table details the Company’s investment balances at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
Joint ventures	$ 855,131	$ 832,119
Available for sale debt securities	289,307	260,139
Nonmarketable securities	18,389	18,760
Marketable equity securities	207,028	39,535
Total	$ 1,369,855	$ 1,150,553

Unconsolidated Joint Ventures

The Company’s ownership positions in significant unconsolidated investments are shown below:

		December 31,		
		2023	2022	2021
*	Windfield Holdings Pty. Ltd. (“Windfield”) - a joint venture with Sichuan Tianqi Lithium Industries, Inc., that mines lithium ore and produces lithium concentrate	49 %	49 %	49 %
*	Nippon Aluminum Alkyls - a joint venture with Mitsui Chemicals, Inc. that produces aluminum alkyls	50 %	50 %	50 %
*	Nippon Ketjen Company Limited - a joint venture with Sumitomo Metal Mining Company Limited that produces refinery catalysts	50 %	50 %	50 %
*	Eurecat S.A. - a joint venture with Axens Group for refinery catalysts regeneration services	50 %	50 %	50 %
*	Fábrica Carioca de Catalisadores S.A. - a joint venture with Petrobras Quimica S.A. - PETROQUISA that produces catalysts and includes catalysts research and product development activities	50 %	50 %	50 %

The following table details the Company’s equity in net income of unconsolidated investments (net of tax) for the years ended December 31, 2023, 2022 and 2021 (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Windfield	$ 1,833,589	$ 750,378	$ 75,206
Other joint ventures	20,493	21,897	20,564
Total	$ 1,854,082	$ 772,275	$ 95,770

Our investment in the significant unconsolidated joint ventures above amounted to $841.5 million and $813.9 million as of December 31, 2023 and 2022, respectively. Undistributed earnings attributable to our significant unconsolidated investments represented approximately $97.3 million and $242.7 million of our consolidated retained earnings at December 31, 2023 and 2022, respectively. All of the unconsolidated joint ventures in which we have investments are private companies and accordingly do not have a quoted market price available.

The following summary lists the assets, liabilities and results of operations for the Company’s significant unconsolidated joint ventures presented herein (in thousands):

	December 31,	
	2023	2022
Summary of Balance Sheet Information:		
Current assets	$ 1,424,059	$ 1,927,791
Noncurrent assets	2,321,261	1,659,692
Total assets	$ 3,745,320	$ 3,587,483
Current liabilities	$ 773,931	$ 770,211
Noncurrent liabilities	1,267,271	1,175,773
Total liabilities	$ 2,041,202	$ 1,945,984

	Year Ended December 31,		
	2023	2022	2021
Summary of Statements of Income Information:			
Net sales	$ 7,019,117	$ 4,290,223	$ 827,848
Gross profit	$ 6,373,472	$ 3,765,304	$ 443,129
Income before income taxes	$ 5,988,737	$ 3,301,875	$ 269,788
Net income	$ 4,224,961	$ 2,314,094	$ 187,084

We have evaluated each of the unconsolidated investments pursuant to current accounting guidance and none qualify for consolidation. Dividends received from our significant unconsolidated investments were $2.0 billion, $800.9 million and $78.4 million in 2023, 2022 and 2021, respectively.

The Company holds a 49% equity interest in Windfield, which we acquired in the Rockwood acquisition. With regards to the Company's ownership in Windfield, the parties share risks and benefits disproportionate to their voting interests. As a result, the Company considers Windfield to be a variable interest entity ("VIE"). However, the Company does not consolidate Windfield as it is not the primary beneficiary. The carrying amount of our 49% equity interest in Windfield, which is our most significant VIE, was $712.0 million and $694.5 million at December 31, 2023 and 2022, respectively. The Company's unconsolidated VIEs are reported in Investments in the consolidated balance sheets. The Company does not guarantee debt for, or have other financial support obligations to, these entities, and its maximum exposure to loss in connection with its continuing involvement with these entities is limited to the carrying value of the investments.

Proportionately Consolidated Joint Ventures

On October 18, 2023, the Company closed on the restructuring of the MARBL joint venture with MRL. This updated structure is intended to significantly simplify the commercial operation agreements previously entered into, allow us to retain full control of downstream conversion assets and to provide greater strategic opportunities for each company based on their global operations and the evolving lithium market.

Under the amended agreements, Albemarle acquired the remaining 40% ownership of the Kemerton lithium hydroxide processing facility in Australia that was jointly owned with MRL through the MARBL joint venture. Following this restructuring, Albemarle and MRL each own 50% of Wodgina, and MRL operates the Wodgina mine on behalf of the joint venture. During the fourth quarter of 2023, Albemarle paid MRL approximately $380 million in cash, which includes $180 million of consideration for the remaining ownership of Kemerton as well as a payment for the economic effective date of the transaction being retroactive to April 1, 2022.

As a result of this transaction, the Company recorded a gain of $71.2 million on the consolidated statement of income during the fourth quarter of 2023. The fair value of the 40% ownership of the Kemerton lithium hydroxide processing facility was based on management's estimates and assumptions, as well as other information compiled by management, including valuations that utilize customary valuation procedures and techniques. If the actual results differ from the estimates and judgments used in these fair values, the amounts recorded in the consolidated financial statements could be subject to possible impairment.

This joint venture is unincorporated with each investor holding an undivided interest in each asset and proportionately liable for each liability; therefore our proportionate share of assets, liabilities, revenue and expenses are included in the appropriate classifications in the consolidated financial statements.

Public Equity Securities

Included in the Company's marketable equity securities balance are holdings in equity securities of public companies. The fair value is measured using publicly available share prices of the investments, with any changes reported in Other income (loss), net in our consolidated statements of income. During the year ended December 31, 2023, the Company purchased approximately $203.4 million of shares in publicly-traded companies. In addition, during the years ended December 31, 2023 and 2022, the Company recorded unrealized mark-to-market (losses) gains of ($41.4) million and $4.3 million, respectively, in Other income (loss), net for all public equity securities held at the end of the balance sheet date.

In January 2024, the Company sold equity securities of a public company for proceeds of approximately $81.5 million. As a result of the sale, the Company expects to realize a loss of $33.7 million in the three months ended March 31, 2024.

Other

The Company holds a 50% equity interest in Jordan Bromine Company Limited ("JBC"), reported in the Bromine segment. The Company consolidates this venture as it is considered the primary beneficiary due to its operational and financial control.

On June 1, 2021, the Company completed the sale of its FCS business to Grace for proceeds of approximately $570 million, consisting of $300 million in cash and the issuance to Albemarle of preferred equity of a Grace subsidiary having an aggregate stated value of $270 million. The preferred equity can be redeemed at Grace's option under certain conditions and will accrue PIK dividends at an annual rate of 12% beginning June 1, 2023, two years after issuance. The fair value of this preferred equity was $289.3 million and $260.1 million at December 31, 2023 and 2022, respectively.

We maintain a Benefit Protection Trust (the "Trust") that was created to provide a source of funds to assist in meeting the obligations of our Executive Deferred Compensation Plan ("EDCP"), subject to the claims of our creditors in the event of our insolvency. Assets of the Trust, in conjunction with our EDCP, are accounted for as trading securities in accordance with authoritative accounting guidance. The assets of the Trust consist primarily of mutual fund investments and are marked-to-market on a monthly basis through the consolidated statements of income. At December 31, 2023 and 2022, these marketable securities amounted to $33.6 million and $27.3 million, respectively.

NOTE 11—Other Assets:

Other assets consist of the following at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
Deferred income taxes[a]	$ 22,433	$ 46,434
Assets related to unrecognized tax benefits[a]	73,009	32,421
Operating leases[b]	137,405	128,173
Other	64,240	43,530
Total	$ 297,087	$ 250,558

(a) See Note 1, "Summary of Significant Accounting Policies" and Note 21, "Income Taxes."
(b) See Note 18, "Leases."

NOTE 12—Goodwill and Other Intangibles:

The following table summarizes the changes in goodwill by reportable segment for the years ended December 31, 2023 and 2022 (in thousands):

	Energy Storage	Specialties	Ketjen	Total
Balance at December 31, 2021	$ 1,394,182	$ 20,319	$ 183,126	$ 1,597,627
Acquisitions[a]	76,105	—	—	76,105
Foreign currency translation adjustments and other	(46,012)	—	(10,093)	(56,105)
Balance at December 31, 2022	1,424,275	20,319	173,033	1,617,627
Change in ownership interest[b]	(6,058)	—	—	(6,058)
Segment realignment[c]	(12,316)	12,316	—	—
Impairment loss[d]	—	—	(6,765)	(6,765)
Foreign currency translation adjustments and other	18,583	4	6,338	24,925
Balance at December 31, 2023[e]	$ 1,424,484	$ 32,639	$ 172,606	$ 1,629,729

(a) Represents purchase price adjustments for the Qinzhou acquisition. See Note 2, "Acquisitions," for additional information.
(b) Represents the reduction of goodwill associated with the proportionately consolidated MARBL joint venture. On October 18, 2023, we completed the restructuring the MARBL joint venture, which reduced the Company's ownership percentage from 60% to 50%. See Note 10, "Investments," for further details.
(c) Effective January 1, 2023, the Company realigned its Lithium and Bromine reportable segments into the Energy Storage and Specialties reportable segments. See Note 25, "Segment and Geographic Area Information," for additional details. As a result, the Company transferred goodwill from its legacy Lithium segment to the new Specialties reportable segment during the year ended December 31, 2023.
(d) During the year ended December 31, 2023, the Company recorded an impairment loss for the remaining balance of its goodwill associated with its PCS business within the Ketjen segment. See Note 1, "Summary of Significant Accounting Policies," for further details.
(e) Balance at December 31, 2023 includes an accumulated impairment loss of $6.8 million in Ketjen. As a result, the balance of Ketjen as of December 31, 2023 fully consists of goodwill related to the Refining Solutions reporting unit.

Other intangibles consist of the following at December 31, 2023 and 2022 (in thousands):

	Customer Lists and Relationships	Trade Names and Trademarks[b]	Patents and Technology	Other	Total
Gross Asset Value					
Balance at December 31, 2021	$ 428,379	$ 17,883	$ 57,313	$ 36,705	$ 540,280
Acquisitions[a]	6,000	—	8,300	2,030	16,330
Retirements	—	(4,253)	(16,206)	(5,844)	(26,303)
Foreign currency translation adjustments and other	(21,709)	(469)	(3,008)	2,295	(22,891)
Balance at December 31, 2022	412,670	13,161	46,399	35,186	507,416
Foreign currency translation adjustments and other	5,133	244	(112)	(537)	4,728
Balance at December 31, 2023	$ 417,803	$ 13,405	$ 46,287	$ 34,649	$ 512,144
Accumulated Amortization					
Balance at December 31, 2021	$ (163,283)	$ (7,983)	$ (39,796)	$ (20,271)	$ (231,333)
Amortization	(22,144)	—	(1,649)	(914)	(24,707)
Retirements	—	4,253	16,206	5,844	26,303
Foreign currency translation adjustments and other	7,800	143	1,449	799	10,191
Balance at December 31, 2022	(177,627)	(3,587)	(23,790)	(14,542)	(219,546)
Amortization	(24,510)	—	(2,563)	(953)	(28,026)
Foreign currency translation adjustments and other	(2,344)	(86)	(405)	121	(2,714)
Balance at December 31, 2023	$ (204,481)	$ (3,673)	$ (26,758)	$ (15,374)	$ (250,286)
Net Book Value at December 31, 2022	$ 235,043	$ 9,574	$ 22,609	$ 20,644	$ 287,870
Net Book Value at December 31, 2023	$ 213,322	$ 9,732	$ 19,529	$ 19,275	$ 261,858

(a) Represents purchase price adjustments for the Qinzhou acquisition. See Note 2, "Acquisitions," for additional information.
(b) Net Book Value includes only indefinite-lived intangible assets.

Useful lives range from 13 – 25 years for customer lists and relationships; 8 – 20 years for patents and technology; and primarily 5 – 25 years for other.

Amortization of other intangibles amounted to $28.0 million, $24.7 million and $25.3 million for the years ended December 31, 2023, 2022 and 2021, respectively. Included in amortization for the years ended December 31, 2023, 2022 and 2021 is $16.7 million, $17.2 million and $19.3 million, respectively, of amortization using the pattern of economic benefit method.

Total estimated amortization expense of other intangibles for the next five fiscal years is as follows (in thousands):

	Estimated Amortization Expense
2024	$ 29,583
2025	$ 29,046
2026	$ 28,525
2027	$ 28,024
2028	$ 27,534

NOTE 13—Accrued Expenses:

Accrued expenses consist of the following at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
Employee benefits, payroll and related taxes	$ 168,361	$ 145,885
Dividend payable to noncontrolling interest	—	53,168
Other[(a)]	376,474	306,841
Total	$ 544,835	$ 505,894

(a) Other accrued expenses represent balances such as operating lease liabilities, environmental reserves, asset retirement obligations, pension obligations, interest, utilities, other taxes, among other liabilities, expected to be paid within the next 12 months. No individual component exceeds 5% of total current liabilities.

In January 2024, the Company announced it is taking measures to unlock near term cash flow and generate long-term financial flexibility by re-phasing organic growth investments and optimizing its cost structure. As part of those actions, the Company announced headcount reductions and expects to record a charge of approximately $15 million to $20 million for severance and outplacement costs in the first quarter of 2024. The Company expects these severance payments to primarily be made during 2024.

NOTE 14—Long-Term Debt:

Long-term debt consisted of the following at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
1.125% notes due 2025	$ 416,501	$ 401,265
1.625% notes due 2028	552,200	532,000
3.45% Senior notes due 2029	171,612	171,612
4.65% Senior notes due 2027	650,000	650,000
5.05% Senior notes due 2032	600,000	600,000
5.45% Senior notes due 2044	350,000	350,000
5.65% Senior notes due 2052	450,000	450,000
Commercial paper notes	620,000	—
Interest-free loan	300,000	—
Variable-rate foreign bank loans	30,197	2,997
Finance lease obligations	110,245	76,537
Other	22,000	11,378
Unamortized discount and debt issuance costs	(105,992)	(28,689)
Total long-term debt	4,166,763	3,217,100
Less amounts due within one year	625,761	2,128
Long-term debt, less current portion	$ 3,541,002	$ 3,214,972

Aggregate annual maturities of long-term debt as of December 31, 2023 are as follows (in millions): 2024—$625.8; 2025—$416.5; 2026—$60.0; 2027—$710.0; 2028—$612.2; thereafter—$1,848.3.

2022 Notes

On May 13, 2022, the Company issued a series of notes (collectively, the "2022 Notes") as follows:

- $650.0 million aggregate principal amount of senior notes, bearing interest at a rate of 4.65% payable semi-annually on June 1 and December 1 of each year, beginning on December 1, 2022. The effective interest rate on these senior notes is approximately 4.84%. These senior notes mature on June 1, 2027.
- $600.0 million aggregate principal amount of senior notes, bearing interest at a rate of 5.05% payable semi-annually on June 1 and December 1 of each year, beginning on December 1, 2022. The effective interest rate on these senior notes is approximately 5.18%. These senior notes mature on June 1, 2032.

- $450.0 million aggregate principal amount of senior notes, bearing interest at a rate of 5.65% payable semi-annually on June 1 and December 1 of each year, beginning on December 1, 2022. The effective interest rate on these senior notes is approximately 5.71%. These senior notes mature on June 1, 2052.

The net proceeds from the issuance of the 2022 Notes were used to repay the balance of the commercial paper notes, the remaining balance of $425.0 million of the 4.15% Senior Notes due 2024 (the "2024 Notes") and for general corporate purposes. The 2024 Notes were originally due to mature on December 15, 2024 and bore interest at a rate of 4.15%. During the year ended December 31, 2022, the Company recorded a loss on early extinguishment of debt of $19.2 million in Interest and financing expenses, representing the tender premiums, fees, unamortized discounts and unamortized deferred financing costs from the redemption of the 2024 Notes. In addition, the loss on early extinguishment of debt includes the accelerated amortization of the interest rate swap associated with the 2024 Notes from Accumulated other comprehensive income.

2019 Notes

On November 25, 2019, the Company issued a series of notes (collectively, the "2019 Notes") as follows:

- $200.0 million aggregate principal amount of notes, bearing interest at a floating rate, which were fully repaid in the first quarter of 2021, as noted below.
- €500.0 million aggregate principal amount of notes, bearing interest at a rate of 1.125% payable annually on November 25 of each year, beginning in 2020. The effective interest rate on these notes is approximately 1.30%. These notes mature on November 25, 2025. These notes were partially repaid in the first quarter of 2021, as noted below.
- €500.0 million aggregate principal amount of notes, bearing interest at a rate of 1.625% payable annually on November 25 of each year, beginning in 2020. The effective interest rate on these notes is approximately 1.74%. These notes mature on November 25, 2028.
- $300.0 million aggregate principal amount of senior notes, bearing interest at a rate of 3.45% payable semi-annually on May 15 and November 15 of each year, beginning in 2020. The effective interest rate on these senior notes is approximately 3.58%. These senior notes mature on November 15, 2029. These notes were partially repaid in the first quarter of 2021, as noted below.

2014 Senior Notes

We currently have outstanding $350.0 million aggregate principal amount of senior notes issued on November 24, 2014, bearing interest at a rate of 5.45% payable semi-annually on June 1 and December 1 of each year, beginning June 1, 2015. The effective interest rate on these senior notes is approximately 5.50%. These senior notes mature on December 1, 2044.

In the first quarter of 2021, the Company made certain debt principal payments using proceeds from the February 2021 underwritten public offering of common stock. As a result, included in Interest and financing expenses for the year ended December 31, 2021 is a loss on early extinguishment of debt of $29.0 million representing the tender premiums, fees, unamortized discounts and unamortized deferred financing costs from the redemption of this debt.

On January 22, 2014, we entered into a pay fixed, receive variable rate forward starting interest rate swap, with a notional amount of $325.0 million, with J.P. Morgan Chase Bank, N.A., to be effective October 15, 2014. Our risk management objective and strategy for undertaking this hedge was to eliminate the variability in the interest rate and partial credit spread on the 20 future semi-annual coupon payments that were to be paid in connection with the 2024 Notes. On October 15, 2014, the swap was settled, resulting in a payment to the counterparty of $33.4 million. This amount was recorded in Accumulated other comprehensive loss and was to be amortized to interest expense over the life of the 2024 Notes. As noted above, the 2024 Notes were repaid in the second quarter of 2022, and as a result, the unamortized balance of this interest rate swap was reclassified to interest expense during the same period as part of the early extinguishment of debt.

Prior to repayment in the first quarter of 2021, the carrying value of the 1.875% Euro-denominated senior notes was designated as an effective hedge of our net investment in certain foreign subsidiaries where the Euro serves as the functional currency, and gains or losses on the revaluation of these senior notes to our reporting currency were recorded in accumulated other comprehensive loss. Upon repayment of these notes, this net investment hedge was discontinued. The balance of foreign exchange revaluation gains and losses associated with this discontinued net investment hedge will remain within accumulated other comprehensive loss until the hedged net investment is sold or liquidated. Prior to the net investment hedge being discontinued a gain of $5.1 million (net of income taxes), during the year ended December 31, 2021, was recorded in Accumulated other comprehensive loss.

Credit Agreements

Given the current economic conditions, specifically around the market pricing of lithium, and the related impact on the Company's future earnings, on February 9, 2024 we amended our revolving, unsecured amended and restated credit agreement dated October 28, 2022 (the "2022 Credit Agreement"), which provides for borrowings of up to $1.5 billion and matures on October 28, 2027. Borrowings under the 2022 Credit Agreement bear interest at variable rates based on a benchmark rate depending on the currency in which the loans are denominated, plus an applicable margin which ranges from 0.910% to 1.375%, depending on the Company's credit rating from Standard & Poor's Ratings Services LLC ("S&P"), Moody's Investors Services, Inc. ("Moody's") and Fitch Ratings, Inc. ("Fitch"). With respect to loans denominated in U.S. dollars, interest is calculated using the term Secured Overnight Financing Rate ("SOFR") plus a term SOFR adjustment of 0.10%, plus the applicable margin. The applicable margin on the facility was 1.125% as of December 31, 2023. There were no borrowings outstanding under the 2022 Credit Agreement as of December 31, 2023.

Borrowings under the 2022 Credit Agreement are conditioned upon satisfaction of certain customary conditions precedent, including the absence of defaults. The February 2024 amendment was entered into to modify the financial covenants under the 2022 Credit Agreement to avoid a potential covenant violation over the following 18 months given the current market pricing of lithium. Following the February 2024 amendment, the 2022 Credit Agreement subjects the Company to two financial covenants, as well as customary affirmative and negative covenants. The first financial covenant requires that the ratio of (a) the Company's consolidated net funded debt plus a proportionate amount of Windfield's net funded debt to (b) consolidated Windfield-Adjusted EBITDA (as such terms are defined in the 2022 Credit Agreement) be less than or equal to (i) 3.50:1 prior to the second quarter of 2024, (ii) 5.00:1 for the second quarter of 2024, (iii) 5.50:1 for the third quarter of 2024, (iv) 4.00:1 for the fourth quarter of 2024, (v) 3.75:1 for the first and second quarters of 2025 and (vi) 3.50:1 after the second quarter of 2025. The maximum permitted leverage ratios described above are subject to adjustment in accordance with the terms of the 2022 Credit Agreement upon the consummation of an acquisition after June 30, 2025 if the consideration includes cash proceeds from issuance of funded debt in excess of $500 million.

Beginning in the fourth quarter of 2024, the second financial covenant requires that the ratio of the Company's consolidated EBITDA to consolidated interest charges (as such terms are defined in the 2022 Credit Agreement) be no less than 2.00:1 for fiscal quarters through June 30, 2025, and no less than 3.00:1 for all fiscal quarters thereafter. The 2022 Credit Agreement also contains customary default provisions, including defaults for non-payment, breach of representations and warranties, insolvency, non-performance of covenants and cross-defaults to other material indebtedness. The occurrence of an event of default under the 2022 Credit Agreement could result in all loans and other obligations becoming immediately due and payable and the commitments under the 2022 Credit Agreement being terminated. The amendments to the financial covenants assume moderate improvement to the current market pricing of lithium. If lithium market prices do not improve, or worsen, the Company may not be able to maintain compliance with its amended financial covenants and it will require the Company to seek additional amendments to the 2022 Credit Agreement and/or issue debt or equity securities, as needed, to fund its activities and maintain financial flexibility. If the Company is not able to obtain such necessary additional amendments, this would lead to an event of default and its lenders could require the Company to repay its outstanding debt. In that situation, the Company may not be able to raise sufficient debt or equity capital, or divest assets, to refinance or repay the lenders.

On August 14, 2019, the Company entered into a $1.2 billion unsecured credit facility with several banks and other financial institutions, which was amended and restated on December 15, 2020 and again on December 10, 2021 (the "2019 Credit Facility"). On October 24, 2022, the 2019 Credit Facility was terminated, with the outstanding balance of $250 million repaid using cash on hand.

Commercial Paper Notes

On May 29, 2013, we entered into agreements to initiate a commercial paper program on a private placement basis under which we may issue unsecured commercial paper notes (the "Commercial Paper Notes") from time-to-time. On May 17, 2023, we entered into definitive documentation to increase the size of our existing commercial paper program. The maximum aggregate face amount of Commercial Paper Notes outstanding at any time is $1.5 billion (up from $750 million prior to the increase). The proceeds from the issuance of the Commercial Paper Notes are expected to be used for general corporate purposes, including the repayment of other debt of the Company. The 2022 Credit Agreement is available to repay the Commercial Paper Notes, if necessary. Aggregate borrowings outstanding under the 2022 Credit Agreement and the Commercial Paper Notes will not exceed the $1.5 billion current maximum amount available under the 2022 Credit Agreement. The Commercial Paper Notes will be sold at a discount from par, or alternatively, will be sold at par and bear interest at rates that will vary based upon market conditions at the time of issuance. The maturities of the Commercial Paper Notes will vary but may not exceed 397 days. At December 31, 2023, we had $620.0 million of Commercial Paper Notes outstanding bearing a weighted-average interest rate of approximately 6.05% and a weighted-average maturity of 11 days. The Commercial Paper Notes are classified as Current portion of long-term debt in our condensed consolidated balance sheets at December 31, 2023.

Other

In the second quarter of 2023, the Company received a loan of $300.0 million to be repaid in five equal annual installments beginning on December 31, 2026. This interest-free loan was discounted using an imputed interest rate of 5.53% and the Company will amortize that discount through Interest and financing expenses over the term of the loan.

We have additional uncommitted credit lines with various U.S. and foreign financial institutions that provide for borrowings of up to approximately $279.8 million at December 31, 2023. Outstanding borrowings under these agreements were $30.2 million and $3.0 million at December 31, 2023 and 2022, respectively. The average interest rate on borrowings under these agreements during 2023, 2022 and 2021 was approximately 0.4%.

At December 31, 2023 and 2022, we had the ability and intent to refinance our borrowings under our other existing credit lines with borrowings under the 2022 Credit Agreement. Therefore, the amounts outstanding under those credit lines, if any, are classified as long-term debt at December 31, 2023 and 2022. At December 31, 2023, we had the ability to borrow $880.0 million under our commercial paper program and the Credit Agreements.

We believe that as of December 31, 2023, we were, and currently are, in compliance with all of our debt covenants.

NOTE 15—Pension Plans and Other Postretirement Benefits:

We maintain various noncontributory defined benefit pension plans covering certain employees, primarily in the U.S., the U.K., Germany and Japan. We also have a contributory defined benefit plan covering certain Belgian employees. The benefits for these plans are based primarily on compensation and/or years of service. Our U.S. and U.K. defined benefit plans for non-represented employees are closed to new participants, with no additional benefits accruing under these plans as participants' accrued benefits have been frozen. The funding policy for each plan complies with the requirements of relevant governmental laws and regulations. The pension information for all periods presented includes amounts related to salaried and hourly plans.

The following provides a reconciliation of benefit obligations, plan assets and funded status, as well as a summary of significant assumptions, for our defined benefit pension plans (in thousands):

	Year Ended December 31, 2023		Year Ended December 31, 2022	
	U.S. Pension Plans	Foreign Pension Plans	U.S. Pension Plans	Foreign Pension Plans
Change in benefit obligations:				
Benefit obligation at January 1	$ 514,971	$ 180,561	$ 680,696	$ 255,234
Service cost	499	5,686	904	3,700
Interest cost	26,924	7,153	18,827	3,363
Actuarial gain	11,957	10,078	(144,288)	(49,380)
Benefits paid	(41,449)	(9,051)	(41,168)	(11,049)
Employee contributions	—	60	—	64
Foreign exchange loss (gain)	—	7,137	—	(18,562)
Settlements/curtailments	—	(5,606)	—	(1,028)
Other	—	(100)	—	(1,781)
Benefit obligation at December 31	$ 512,902	$ 195,918	$ 514,971	$ 180,561
Change in plan assets:				
Fair value of plan assets at January 1	$ 469,828	$ 58,229	$ 605,991	$ 94,256
Actual return on plan assets	54,785	4,395	(95,925)	(29,694)
Employer contributions	967	14,496	930	12,451
Benefits paid	(41,449)	(9,051)	(41,168)	(11,049)
Employee contributions	—	60	—	64
Foreign exchange gain (loss)	—	3,091	—	(9,004)
Settlements/curtailments	—	(5,606)	—	(1,028)
Other	—	(100)	—	2,233
Fair value of plan assets at December 31	$ 484,131	$ 65,514	$ 469,828	$ 58,229
Funded status at December 31	$ (28,771)	$ (130,404)	$ (45,143)	$ (122,332)

	December 31, 2023		December 31, 2022	
	U.S. Pension Plans	Foreign Pension Plans	U.S. Pension Plans	Foreign Pension Plans
Amounts recognized in consolidated balance sheets:				
Current liabilities (accrued expenses)	$ (912)	$ (7,951)	$ (947)	$ (6,957)
Noncurrent liabilities (pension benefits)	(27,859)	(122,453)	(44,196)	(115,375)
Net pension liability	$ (28,771)	$ (130,404)	$ (45,143)	$ (122,332)
Amounts recognized in accumulated other comprehensive (loss) income:				
Prior service benefit	$ —	$ (531)	$ —	$ (615)
Net amount recognized	$ —	$ (531)	$ —	$ (615)
Weighted-average assumptions used to determine benefit obligations at December 31:				
Discount rate	5.21 %	3.73 %	5.46 %	4.04 %
Rate of compensation increase	— %	3.67 %	— %	3.67 %

The accumulated benefit obligation for all defined benefit pension plans was $700.4 million and $688.0 million at December 31, 2023 and 2022, respectively.

Postretirement medical benefits and life insurance is provided for certain groups of U.S. retired employees. Medical and life insurance benefit costs have been funded principally on a pay-as-you-go basis. Although the availability of medical coverage after retirement varies for different groups of employees, the majority of employees who retire before becoming eligible for Medicare can continue group coverage by paying a portion of the cost of a monthly premium designed to cover the claims incurred by retired employees subject to a cap on payments allowed. The availability of group coverage for Medicare-eligible retirees also varies by employee group with coverage designed either to supplement or coordinate with Medicare. Retirees generally pay a portion of the cost of the coverage. Plan assets for retiree life insurance are held under an insurance contract and are reserved for retiree life insurance benefits. In 2005, the postretirement medical benefit available to U.S. employees was changed to provide that employees who are under age 50 as of December 31, 2005 would no longer be eligible for a company-paid retiree medical premium subsidy. Employees who are of age 50 and above as of December 31, 2005 and who retire after January 1, 2006 will have their retiree medical premium subsidy capped. Effective January 1, 2008, our medical insurance for certain groups of U.S. retired employees is now insured through a medical carrier.

The following provides a reconciliation of benefit obligations, plan assets and funded status, as well as a summary of significant assumptions, for our postretirement benefit plans (in thousands):

	Year Ended December 31,	
	2023	2022
	Other Postretirement Benefits	Other Postretirement Benefits
Change in benefit obligations:		
Benefit obligation at January 1	$ 35,990	$ 47,493
Service cost	47	85
Interest cost	1,873	1,307
Actuarial gain	(6,618)	(10,164)
Benefits paid	(2,403)	(2,731)
Benefit obligation at December 31	$ 28,889	$ 35,990
Change in plan assets:		
Fair value of plan assets at January 1	$ —	$ —
Employer contributions	2,403	2,731
Benefits paid	(2,403)	(2,731)
Fair value of plan assets at December 31	$ —	$ —
Funded status at December 31	$ (28,889)	$ (35,990)

	December 31,	
	2023	2022
	Other Postretirement Benefits	Other Postretirement Benefits
Amounts recognized in consolidated balance sheets:		
Current liabilities (accrued expenses)	$ (2,642)	$ (3,239)
Noncurrent liabilities (postretirement benefits)	(26,247)	(32,751)
Net postretirement liability	$ (28,889)	$ (35,990)
Weighted-average assumptions used to determine benefit obligations at December 31:		
Discount rate	5.21 %	5.45 %
Rate of compensation increase	— %	— %

The components of pension benefits cost (credit) are as follows (in thousands):

	Year Ended December 31, 2023		Year Ended December 31, 2022		Year Ended December 31, 2021	
	U.S. Pension Plans	Foreign Pension Plans	U.S. Pension Plans	Foreign Pension Plans	U.S. Pension Plans	Foreign Pension Plans
Service cost	$ 499	$ 5,686	$ 904	$ 3,700	$ 869	$ 3,697
Interest cost	26,924	7,153	18,827	3,363	18,005	2,427
Expected return on assets	(30,875)	(2,872)	(40,288)	(3,252)	(39,972)	(3,593)
Actuarial (gain) loss	(11,951)	8,593	(8,008)	(18,818)	(34,857)	(19,494)
Amortization of prior service benefit	—	81	—	89	—	115
Total net pension benefits (credit) cost	$ (15,403)	$ 18,641	$ (28,565)	$ (14,918)	$ (55,955)	$ (16,848)
Weighted-average assumption percentages:						
Discount rate	5.46 %	4.04 %	2.86 %	1.44 %	2.50 %	0.86 %
Expected return on plan assets	6.88 %	4.86 %	6.89 %	3.85 %	6.88 %	3.98 %
Rate of compensation increase	— %	3.67 %	— %	3.12 %	— %	3.26 %

Effective January 1, 2024, the weighted-average expected rate of return on plan assets for the U.S. and foreign defined benefit pension plans is 6.88% and 5.95%, respectively.

The components of postretirement benefits cost (credit) are as follows (in thousands):

	Year Ended December 31,		
	2023	2022	2021
	Other Postretirement Benefits	Other Postretirement Benefits	Other Postretirement Benefits
Service cost	$ 47	$ 85	$ 123
Interest cost	1,873	1,307	1,238
Actuarial gain	(6,816)	(10,163)	(2,568)
Total net postretirement benefits credit	$ (4,896)	$ (8,771)	$ (1,207)
Weighted-average assumption percentages:			
Discount rate	5.45 %	2.85 %	2.49 %
Rate of compensation increase	— %	— %	3.50 %

All components of net benefit cost (credit), other than service cost, are included in Other income (expenses), net on the consolidated statements of income.

The mark-to-market actuarial gain in 2023 was primarily attributable to a higher return on pension plan assets during the year than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was 11.21% versus an expected return of 6.66%. This was partially offset by a decrease in the weighted-average discount rate to 5.21% from 5.46% for our U.S. pension plans and to 3.73% from 4.04% for our foreign pension plans to reflect market conditions as of the December 31, 2023 measurement date.

The mark-to-market actuarial gain in 2022 was primarily attributable to a significant increase in the weighted average discount rate to 5.46% from 2.86% for our U.S. pension plans and to 4.04% from 1.44% for our foreign pension plans to reflect market conditions as of the December 31, 2022 measurement date. This was partially offset by a lower return on pension plan assets in 2022 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was (17.94)% versus an expected return of 6.48%.

The mark-to-market actuarial gain in 2021 was primarily attributable to a higher return on pension plan assets in 2021 than was expected, as a result of overall market and investment portfolio performance. The weighted-average actual return on our U.S. and foreign pension plan assets was 8.42% versus an expected return of 6.50%. In addition, there was an increase in the weighted-average discount rate to 2.86% from 2.50% for our U.S. pension plans and to 1.44% from 0.86% for our foreign pension plans to reflect market conditions as of the December 31, 2021 measurement date.

Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (exit price). The inputs used to measure fair value are classified into the following hierarchy:

Level 1	Unadjusted quoted prices in active markets for identical assets or liabilities
Level 2	Unadjusted quoted prices in active markets for similar assets or liabilities, or unadjusted quoted prices for identical or similar assets or liabilities in markets that are not active, or inputs other than quoted prices that are observable for the asset or liability
Level 3	Unobservable inputs for the asset or liability

We endeavor to utilize the best available information in measuring fair value. Financial assets and liabilities are classified in their entirety based on the lowest level of input that is significant to the fair value measurement. Investments for which market quotations are readily available are valued at the closing price on the last business day of the year. Listed securities for which no sale was reported on such date are valued at the mean between the last reported bid and asked price. Securities traded in the over-the-counter market are valued at the closing price on the last business day of the year or at bid price. The net asset value of shares or units is based on the quoted market value of the underlying assets. The market value of corporate bonds is based on institutional trading lots and is most often reflective of bid price. Government securities are valued at the mean between bid and ask prices. Holdings in private equity securities are typically valued using the net asset valuations provided by the underlying private investment companies.

The following tables set forth the assets of our pension and postretirement plans that were accounted for at fair value on a recurring basis as of December 31, 2023 and 2022 (in thousands):

	December 31, 2023	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Pension Assets:				
Domestic Equity[(a)]	$ 58,906	$ 58,906	$ —	$ —
International Equity[(b)]	106,491	99,432	7,059	—
Fixed Income[(c)]	294,140	257,299	36,841	—
Absolute Return Measured at Net Asset Value[(d)]	80,542	—	—	—
Cash	9,566	9,566	—	—
Total Pension Assets	$ 549,645	$ 425,203	$ 43,900	$ —

	December 31, 2022	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Pension Assets:				
Domestic Equity[(a)]	$ 98,080	$ 97,984	$ 96	$ —
International Equity[(b)]	88,002	79,815	8,187	—
Fixed Income[(c)]	269,352	235,184	34,168	—
Absolute Return Measured at Net Asset Value[(d)]	68,725	—	—	—
Cash	3,898	3,898	—	—
Total Pension Assets	$ 528,057	$ 416,881	$ 42,451	$ —

(a) Consists primarily of U.S. stock funds that track or are actively managed and measured against the S&P 500 index.
(b) Consists primarily of international equity funds that invest in common stocks and other securities whose value is based on an international equity index or an underlying equity security or basket of equity securities.
(c) Consists primarily of debt obligations issued by governments, corporations, municipalities and other borrowers. Also includes insurance policies.
(d) Consists primarily of funds with holdings in private investment companies. See additional information about the Absolute Return investments below. Holdings in private investment companies are measured at fair value using the net asset value per share as a practical expedient and have not been categorized in the fair value hierarchy. Their fair values are included in this table to permit reconciliation to the reconciliation of plan assets table above.

The Company's pension plan assets in the U.S. and U.K. represent approximately 96% of the total pension plan assets. The investment objective of these pension plan assets is to achieve solid returns while preserving capital to meet current plan cash flow requirements. Assets should participate in rising markets, with defensive action in declining markets expected to an even greater degree. Depending on market conditions, the broad asset class targets may range up or down by approximately 10%. These asset classes include but are not limited to hedge fund of funds, bonds and other fixed income vehicles, high yield fixed income securities, equities and distressed debt. At December 31, 2023 and 2022, equity securities held by our pension and OPEB plans did not include direct ownership of Albemarle common stock.

The weighted-average target allocations as of the measurement date are as follows:

	Target Allocation
Equity securities	38 %
Fixed income	53 %
Absolute return	9 %

Our Absolute Return investments consist primarily of our investments in hedge fund of funds. These are holdings in private investment companies with fair values that are based on significant unobservable inputs including assumptions where there is little, if any, market activity for the investment. Investment managers or fund managers associated with these investments provide valuations of the investments on a monthly basis utilizing the net asset valuation approach for determining fair values. These valuations are reviewed by the Company for reasonableness based on applicable sector, benchmark and company performance to validate the appropriateness of the net asset values as a fair value measurement. Where available, audited financial statements are obtained and reviewed for the investments as support for the manager's investment valuation. In general, the investment objective of these funds is high risk-adjusted returns with an emphasis on preservation of capital. The investment strategies of each of the funds vary; however, the objective of our Absolute Return investments is complementary to the overall investment objective of our U.S. pension plan assets.

We made contributions to our defined benefit pension and OPEB plans of $17.9 million, $16.1 million and $30.3 million during the years ended December 31, 2023, 2022 and 2021, respectively. We expect contributions to our domestic nonqualified and foreign qualified and nonqualified pension plans to approximate $14.2 million in 2024. Also, we expect to pay approximately $2.4 million in premiums to our U.S. postretirement benefit plan in 2024. However, we may choose to make additional voluntary pension contributions in excess of these amounts.

The current forecast of benefit payments, which reflects expected future service, amounts to (in thousands):

	U.S. Pension Plans	Foreign Pension Plans	Other Postretirement Benefits
2024	$ 43,432	$ 13,476	$ 2,446
2025	$ 43,600	$ 11,493	$ 2,425
2026	$ 43,399	$ 11,753	$ 2,400
2027	$ 42,985	$ 12,322	$ 2,368
2028	$ 42,350	$ 12,716	$ 2,330
2029-2033	$ 197,112	$ 66,160	$ 10,884

We have a supplemental executive retirement plan ("SERP"), which provides unfunded supplemental retirement benefits to certain management or highly compensated employees. The SERP provides for incremental pension benefits to offset the limitations imposed on qualified plan benefits by federal income tax regulations. Costs (credits) relating to our SERP were $0.6 million, ($1.2) million and ($0.2) million for the years ended December 31, 2023, 2022 and 2021, respectively. The projected benefit obligation for the SERP recognized in the consolidated balance sheets at December 31, 2023 and 2022 was $6.2 million and $6.5 million, respectively. The benefit expenses and obligations of this SERP are included in the tables above. Benefits of $0.9 million are expected to be paid to SERP retirees in 2024. On October 1, 2012, our Board of Directors approved amendments to the SERP, such that effective December 31, 2014, no additional benefits shall accrue under this plan and participants' accrued benefits shall be frozen as of that date to reflect the same changes as were made under the U.S. qualified defined benefit plan.

At December 31, 2023, the assumed rate of increase in the pre-65 and post-65 per capita cost of covered health care benefits for U.S. retirees was zero as the employer-paid premium caps (pre-65 and post-65) were met starting January 1, 2013.

Defined Contribution Plans

On March 31, 2004, a new defined contribution pension plan benefit was adopted under the qualified defined contribution plan for U.S. non-represented employees hired after March 31, 2004. On October 1, 2012, our Board of Directors approved certain plan amendments, such that effective January 1, 2013, the defined contribution pension plan benefit is expanded to include non-represented employees hired prior to March 31, 2004, and revised the contribution for all participants to be based on 5% of eligible employee compensation. The employer portion of contributions to our U.S. defined contribution pension plan amounted to $17.8 million, $12.1 million, and $16.7 million in 2023, 2022 and 2021, respectively. Contributions in 2021 included amounts deferred from 2020 as a result of the Company's plan to maintain financial flexibility during the COVID-19 pandemic.

Certain of our employees participate in our defined contribution 401(k) employee savings plan, which is generally available to all U.S. full-time salaried and non-union hourly employees and to employees who are covered by a collective bargaining agreement that provides for such participation. This U.S. defined contribution plan is funded with contributions made by the participants and us. Our contributions to the 401(k) plan amounted to $18.4 million, $12.7 million and $17.4 million in 2023, 2022 and 2021, respectively. Contributions in 2021 included amounts deferred from 2020 as a result of the Company's plan to maintain financial flexibility during the COVID-19 pandemic.

Multiemployer Plan

Prior to 2022, certain current and former employees participated in a multiemployer plan in Germany, the Pensionskasse Dynamit Nobel Versicherungsverein auf Gegenseitigkeit, Troisdorf ("DN Pensionskasse") that provided monthly payments in the case of disability, death or retirement. On January 1, 2022, the Company terminated its membership with the DN Pensionskasse and as a result did not make any contributions during the year.

In prior years, the majority of the Company's contributions to the DN Pensionskasse were tied to employees' contributions, which are generally calculated as a percentage of base compensation, up to a certain statutory ceiling. Our normal contributions to this plan were $1.5 million in the year ended December 31, 2021.

Effective July 1, 2016, the DN Pensionskasse was subject to a financial improvement plan, which expired on December 31, 2022, with the final contribution in the second quarter of 2023. This financial improvement plan called for increased capital reserves to avoid future underfunding risk. During the years ended December 31, 2023, 2022 and 2021, the Company made contributions for its employees covered under this plan of $0.4 million, $2.8 million and $1.3 million, respectively, recorded in Selling, general and administrative expenses, as a result of this financial improvement plan.

NOTE 16—Other Noncurrent Liabilities:

Other noncurrent liabilities consist of the following at December 31, 2023 and 2022 (in thousands):

	December 31,	
	2023	2022
Transition tax on foreign earnings[a]	$ 127,339	$ 191,708
Operating leases[b]	113,681	99,269
Liabilities related to uncertain tax positions[c]	220,555	83,670
Executive deferred compensation plan obligation	33,564	27,270
Environmental liabilities[d]	23,224	31,272
Asset retirement obligations[d]	88,703	79,522
Tax indemnification liability[e]	14,481	66,137
Deferred revenue	78,027	—
Other[f]	69,526	57,748
Total	$ 769,100	$ 636,596

(a) Noncurrent portion of one-time transition tax on foreign earnings. See Note 21, "Income Taxes," for additional information.
(b) See Note 18, "Leases."
(c) See Note 21, "Income Taxes."
(d) See Note 17, "Commitments and Contingencies."
(e) Indemnification of certain income and non-income tax liabilities, primarily associated with the Chemetall Surface Treatment entities sold in 2017.
(f) No individual component exceeds 5% of total liabilities.

NOTE 17—Commitments and Contingencies:

In the ordinary course of business, we have commitments in connection with various activities. We believe that amounts recorded are adequate for known items which might become due in the current year. The most significant commitments are as follows:

Environmental

We had the following activity in our recorded environmental liabilities for the years ended December 31, 2023, 2022 and 2021 (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Balance, beginning of year	$ 38,245	$ 46,617	$ 45,771
Expenditures	(3,393)	(10,378)	(2,752)
Accretion of discount	1,094	1,031	960
Additions, liability releases and changes in estimates, net	(2,541)	673	4,063
Foreign currency translation adjustments and other	744	302	(1,425)
Balance, end of year	34,149	38,245	46,617
Less amounts reported in Accrued expenses	10,925	6,973	9,077
Amounts reported in Other noncurrent liabilities	$ 23,224	$ 31,272	$ 37,540

Environmental remediation liabilities included discounted liabilities of $27.4 million and $30.1 million at December 31, 2023 and 2022, respectively, discounted at rates with a weighted-average of 3.7% and 3.4%, respectively, with the undiscounted amount totaling $55.4 million and $57.5 million at December 31, 2023 and 2022, respectively. For certain locations where the Company is operating groundwater monitoring and/or remediation systems, prior owners or insurers have assumed all or most of the responsibility.

The amounts recorded represent our future remediation and other anticipated environmental liabilities. These liabilities typically arise during the normal course of our operational and environmental management activities or at the time of acquisition of the site, and are based on internal analysis as well as input from outside consultants. As evaluations proceed at each relevant site, changes in risk assessment practices, remediation techniques and regulatory requirements can occur, therefore such liability estimates may be adjusted accordingly. The timing and duration of remediation activities at these sites will be determined when evaluations are completed. Although it is difficult to quantify the potential financial impact of these remediation liabilities, management estimates (based on the latest available information) that there is a reasonable possibility that future environmental remediation costs associated with our past operations could represent an additional $47 million before income taxes, in excess of amounts already recorded.

We believe that any sum we may be required to pay in connection with environmental remediation matters in excess of the amounts recorded would likely occur over a period of time and would likely not have a material adverse effect upon our results of operations, financial condition or cash flows on a consolidated annual basis although any such sum could have a material adverse impact on our results of operations, financial condition or cash flows in a particular quarterly reporting period.

Asset Retirement Obligations

The following is a reconciliation of our beginning and ending asset retirement obligation balances for 2023 and 2022 (in thousands):

	Year Ended December 31,	
	2023	2022
Balance, beginning of year	$ 80,101	$ 79,213
Additions and changes in estimates	11,288	2,919
Accretion of discount	2,421	1,996
Liabilities settled	(3,044)	(4,266)
Foreign currency translation adjustments and other	(1,607)	239
Balance, end of year	$ 89,159	$ 80,101
Less amounts reported in Accrued expenses	456	579
Amounts reported in Other noncurrent liabilities	$ 88,703	$ 79,522

Asset retirement obligations primarily relate to post-closure reclamation of brine wells and sites involved in the surface mining and manufacturing of lithium. We are not aware of any conditional asset retirement obligations that would require recognition in our consolidated financial statements.

Litigation

We are involved from time to time in legal proceedings of types regarded as common in our business, including administrative or judicial proceedings seeking remediation under environmental laws, such as the federal Comprehensive Environmental Response, Compensation and Liability Act, commonly known as CERCLA or Superfund, products liability, breach of contract liability and premises liability litigation. Where appropriate, we may establish financial reserves for such proceedings. We also maintain insurance to mitigate certain of such risks. Costs for legal services are generally expensed as incurred.

On February 6, 2017, Huntsman International LLC (“Huntsman”), a subsidiary of Huntsman Corporation, filed a lawsuit in New York state court against Rockwood Holdings, Inc. (“Rockwood”), Rockwood Specialties, Inc., certain former executives of Rockwood and its subsidiaries, Seifollah Ghasemi, Thomas Riordan, Andrew Ross, and Michael Valente, and Albemarle. The lawsuit arises out of Huntsman’s acquisition of certain Rockwood subsidiaries in connection with a stock purchase agreement (the “SPA”), dated September 17, 2013. Before that transaction closed on October 1, 2014, Albemarle began discussions with Rockwood to purchase all outstanding equity of Rockwood and did so in a transaction that closed on January 12, 2015. Huntsman’s complaint asserted that certain technology that Rockwood had developed for a production facility in Augusta, Georgia, and which was among the assets that Huntsman acquired pursuant to the SPA, did not work, and that Rockwood and the defendant executives had intentionally misled Huntsman about that technology in connection with the Huntsman-Rockwood transaction. The complaint asserted claims for, among other things, fraud, negligent misrepresentation, and breach of the SPA, and sought certain costs for completing construction of the production facility.

On March 10, 2017, Albemarle moved in New York state court to compel arbitration, which was granted on January 8, 2018 (although Huntsman unsuccessfully appealed that decision). Huntsman’s arbitration demand asserted claims substantially similar to those asserted in its state court complaint, and sought various forms of legal remedies, including cost overruns, compensatory damages, expectation damages, punitive damages, and restitution. After a trial, the arbitration panel issued an award on October 28, 2021, awarding approximately $600 million (including interest) to be paid by Albemarle to Huntsman, in addition to the possibility of attorney’s fees, costs and expenses. Following the arbitration panel decision, Albemarle reached a settlement with Huntsman to pay $665 million in two equal installments, with the first payment made in December 2021. The second and final payment of $332.5 million was made in May 2022. As a result, the consolidated statements of income for the year ended December 31, 2021, includes expense of $657.4 million ($508.5 million net of income tax), inclusive of estimated possible legal fees incurred by Huntsman and other related obligations, to reflect the increase in liabilities for this legal matter.

As first reported in 2018, following receipt of information regarding potential improper payments being made by third-party sales representatives of our Refining Solutions business, within what is now the Ketjen segment, we investigated and voluntarily self-reported potential violations of the U.S. Foreign Corrupt Practices Act to the U.S. Department of Justice (“DOJ”) and the SEC, and also reported this conduct to the Dutch Public Prosecutor (“DPP”). We cooperated with these agencies in their investigations of this historical conduct and implemented appropriate remedial measures intended to strengthen our compliance program and related internal controls.

In September 2023, the Company finalized agreements to resolve these matters with the DOJ and SEC. The DPP has confirmed it will not pursue action in this matter. In connection with this resolution, which relates to conduct prior to 2018, we entered into a non-prosecution agreement with the DOJ and an administrative resolution with the SEC, pursuant to which we paid a total of $218.5 million in aggregate fines, disgorgement, and prejudgment interest to the DOJ and SEC. The resolution does not include a compliance monitorship, although the Company has agreed to certain ongoing compliance reporting obligations.

During the year ended December 31, 2023, the Company recorded a charge of $218.5 million in Selling, General and Administrative Expenses in its consolidated statement of operations and accrued a corresponding liability on its consolidated balance sheet for these agreements. The agreed upon amounts were paid to the DOJ and SEC in October 2023, with this matter considered finalized and no future financial obligations expected.

Indemnities

We are indemnified by third parties in connection with certain matters related to acquired and divested businesses. Although we believe that the financial condition of those parties who may have indemnification obligations to the Company is generally sound, in the event the Company seeks indemnity under any of these agreements or through other means, there can be no assurance that any party who may have obligations to indemnify us will adhere to their obligations and we may have to resort to legal action to enforce our rights under the indemnities.

The Company may be subject to indemnity claims relating to properties or businesses it divested, including properties or businesses of acquired businesses that were divested prior to the completion of the acquisition. In the opinion of management, and based upon information currently available, the ultimate resolution of any indemnification obligations owed to the Company or by the Company is not expected to have a material effect on the Company's financial condition, results of operations or cash flows. The Company had approximately $14.5 million and $66.1 million at December 31, 2023 and 2022, respectively, recorded in Other noncurrent liabilities primarily related to the indemnification of certain income and non-income tax liabilities associated with the Chemetall Surface Treatment entities sold in 2017.

Other

The Company has standby letters of credit and guarantees with various financial institutions. The following table summarizes our letters of credit and guarantee agreements (in thousands):

	2024	2025	2026	2027	2028	Thereafter
Letters of credit and other guarantees	$ 193,648	$ 13,375	$ 2,454	$ 868	$ 717	$ 6,088

The outstanding letters of credit are primarily related to insurance claim payment guarantees. The majority of the Company's other guarantees have terms of one year and mainly consist of performance and environmental guarantees, as well as guarantees to customs and port authorities. The guarantees arose during the ordinary course of business.

We do not have recorded reserves for the letters of credit and guarantees as of December 31, 2023. We are unable to estimate the maximum amount of the potential future liability under guarantees and letters of credit. However, we accrue for any potential loss for which we believe a future payment is probable and a range of loss can be reasonably estimated. We believe our liability under such obligations is immaterial.

We currently, and are from time to time, subject to transactional audits in various taxing jurisdictions and to customs audits globally. We do not expect the financial impact of any of these audits to have a material adverse effect on the Company's results of operations, financial condition or cash flows.

NOTE 18—Leases:

We lease certain office space, buildings, transportation and equipment in various countries. The initial lease terms generally range from 1 to 30 years for real estate leases, and from 2 to 15 years for non-real estate leases. Leases with an initial term of 12 months or less are not recorded on the balance sheet, and we recognize lease expense for these leases on a straight-line basis over the lease term.

Many leases include options to terminate or renew, with renewal terms that can extend the lease term from 1 to 50 years or more. The exercise of lease renewal options is at our sole discretion. Certain leases also include options to purchase the leased property. The depreciable life of assets and leasehold improvements are limited by the expected lease term, unless there is a transfer of title or purchase option reasonably certain of exercise. Our lease agreements do not contain any material residual value guarantees or material restrictive covenants.

The following table provides details of our lease contracts for the years ended December 31, 2023, 2022 and 2021 (in thousands):

	Year Ended December 31,		
	2023	**2022**	**2021**
Operating lease cost	$ 48,238	$ 43,809	$ 42,338
Finance lease cost:			
Amortization of right of use assets	5,302	3,377	614
Interest on lease liabilities	5,070	3,504	3,010
Total finance lease cost	10,372	6,881	3,624
Short-term lease cost	20,309	13,985	11,084
Variable lease cost	25,075	8,064	8,002
Total lease cost	$ 103,994	$ 72,739	$ 65,048

Supplemental cash flow information related to our lease contracts for the years ended December 31, 2023, 2022 and 2021 is as follows (in thousands):

	Year Ended December 31,		
	2023	**2022**	**2020**
Cash paid for amounts included in the measurement of lease liabilities:			
Operating cash flows from operating leases	$ 49,261	$ 36,629	$ 33,030
Operating cash flows from finance leases	4,671	3,389	1,776
Financing cash flows from finance leases	2,165	1,432	687
Right-of-use assets obtained in exchange for lease obligations:			
Operating leases	48,655	15,913	56,814
Finance leases	46,773	3,976	17,096

Supplemental balance sheet information related to our lease contracts, including the location on balance sheet, at December 31, 2023 and 2022 is as follows (in thousands, except as noted):

	December 31,	
	2023	2022
Operating leases:		
Other assets	$ 137,405	$ 128,173
Accrued expenses	30,583	35,515
Other noncurrent liabilities	113,681	99,269
Total operating lease liabilities	144,264	134,784
Finance leases:		
Net property, plant and equipment	112,438	81,356
Current portion of long-term debt[(a)]	9,702	4,995
Long-term debt	104,484	74,409
Total finance lease liabilities	114,186	79,404
Weighted average remaining lease term (in years):		
Operating leases	12.2	13.3
Finance leases	20.7	22.8
Weighted average discount rate (%):		
Operating leases	4.74 %	3.60 %
Finance leases	4.71 %	4.41 %

(a) Balance includes accrued interest of finance lease.

Maturities of lease liabilities as of December 31, 2023 were as follows (in thousands):

	Operating Leases	Finance Leases
2024	$ 33,646	$ 12,386
2025	28,980	9,229
2026	20,667	8,566
2027	15,664	8,566
2028	11,102	8,566
Thereafter	107,058	128,547
Total lease payments	217,117	175,860
Less imputed interest	72,853	61,674
Total	$ 144,264	$ 114,186

NOTE 19—Stock-based Compensation Expense:

Incentive Plans

We have various share-based compensation plans that authorize the granting of (i) qualified and non-qualified stock options to purchase shares of our common stock, (ii) restricted stock and restricted stock units, (iii) performance unit awards and (iv) stock appreciation rights ("SARs") to employees and non-employee directors, at our option. Stock options granted to employees generally vest over three years and have a term of ten years. Restricted stock and restricted stock unit awards vest in periods ranging from one to five years from the date of grant. Performance unit awards are earned at a level ranging from 0% to 200% contingent upon the achievement of specific performance criteria over periods ranging from one to three years. Distribution of earned units occurs generally 50% upon completion of the applicable measurement period with the remaining 50% distributed one year thereafter.

In May 2017, the Company adopted the Albemarle Corporation 2017 Incentive Plan (the "Incentive Plan"), which replaced the Albemarle Corporation 2008 Incentive Plan. The maximum number of shares available for issuance to participants under the Incentive Plan is 4,500,000 shares. The adoption of the Incentive Plan did not affect awards already granted under the Albemarle Corporation 2008 Incentive Plan. In February 2023, the Company adopted the Albemarle Corporation 2023 Stock Compensation and Deferral Election Plan for Non-Employee Directors (the "Non-Employee Directors Plan"). The Non-Employee Directors Plan replaced the 2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors, which expired by its terms in May 2023. Under the Non-Employee Directors Plan, a maximum aggregate number of 500,000 shares of our common stock is authorized for issuance to the Company's non-employee directors; any shares remaining available for issuance under the prior plans were canceled. The aggregate fair market value of shares that may be issued to a director during any compensation year (as defined in the Non-Employee Directors Plan, generally July 1 to June 30) shall not exceed $750,000. At December 31, 2023, there were 3,072,368 shares available for grant under the Incentive Plan and 493,250 shares available for grant under the Non-Employee Directors Plan.

Total stock-based compensation expense associated with our incentive plans for the years ended December 31, 2023, 2022 and 2021 amounted to $39.0 million, $31.4 million and $18.8 million, respectively, and is included in Cost of goods sold and Selling, general and administrative expenses in the consolidated statements of income. Total related recognized tax benefits for the years ended December 31, 2023, 2022 and 2021 amounted to $4.6 million, $4.0 million and $2.3 million, respectively.

The following table summarizes information about the Company's fixed-price stock options as of and for the year ended December 31, 2023:

	Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Term (Years)	Aggregate Intrinsic Value (in thousands)
Outstanding at December 31, 2022	384,936	$ 114.24	6.3	$ 39,501
Granted	51,316	249.52		
Exercised	(3,124)	59.41		
Forfeited	(5,984)	207.12		
Outstanding at December 31, 2023	427,144	$ 129.59	5.8	$ 14,891
Exercisable at December 31, 2023	314,745	$ 102.14	4.9	$ 14,891

We granted 51,316, 57,348 and 62,479 stock options during 2023, 2022 and 2021, respectively. There were no significant modifications made to any share-based grants during these periods.

The fair value of each option granted during the years ended December 31, 2023, 2022 and 2021 was estimated on the date of grant using the Black-Scholes option-pricing model with the following weighted-average assumptions:

	Year Ended December 31,		
	2023	2022	2021
Dividend yield	1.26 %	1.32 %	1.43 %
Volatility	40.06 %	36.21 %	36.19 %
Average expected life (years)	6	6	6
Risk-free interest rate	3.95 %	1.97 %	1.44 %
Fair value of options granted	$ 98.66	$ 63.00	$ 49.42

Dividend yield is the average of historical yields and those estimated over the average expected life. The stock volatility is based on historical volatilities of our common stock. The average expected life represents the weighted average period of time that options granted are expected to be outstanding giving consideration to vesting schedules and our historical exercise patterns. The risk-free interest rate is based on the U.S. Treasury strip rate with stripped coupon interest for the period equal to the contractual term of the share option grant in effect at the time of grant.

The intrinsic value of options exercised during the years ended December 31, 2023, 2022 and 2021 was $0.5 million, $6.9 million and $37.2 million, respectively. The intrinsic value of a stock option is the amount by which the market value of the underlying stock exceeds the exercise price of the option.

Total compensation cost not yet recognized for nonvested stock options outstanding as of December 31, 2023 is approximately $4.2 million and is expected to be recognized over a remaining weighted-average period of 1.9 years. Cash proceeds from stock options exercised and tax benefits related to stock options exercised were $0.2 million and $0.1 million for the year ended December 31, 2023, respectively. The Company issues new shares of common stock upon exercise of stock options and vesting of restricted common stock awards.

The following table summarizes activity in performance unit awards as of and for the year ended December 31, 2023:

	Shares	Weighted-Average Grant Date Fair Value Per Share
Nonvested, beginning of period	224,548	$ 140.44
Granted	79,396	288.28
Vested	(73,060)	102.29
Forfeited	(7,028)	229.70
Nonvested, end of period	223,856	207.61

The weighted average grant date fair value of performance unit awards granted in 2023, 2022 and 2021 was $22.9 million, $13.1 million and $10.0 million, respectively. For all periods presented, half of the performance unit awards granted were based on the targeted return on invested capital ("ROIC Award"), while the other half were granted based on targeted market conditions ("TSR Award"). The fair value of each TSR Award was estimated on the date of grant using the Monte Carlo simulation model as these equity awards are tied to a service and market condition. The calculation used the following weighted-average assumptions:

	Year Ended December 31,		
	2023	2022	2021
Volatility	50.41 %	51.51 %	47.13 %
Risk-free interest rate	4.51 %	1.72 %	0.27 %

The weighted average fair value of performance unit awards that vested during 2023, 2022 and 2021 was $17.2 million, $11.9 million and $5.8 million, respectively, based on the closing prices of our common stock on the dates of vesting. Total compensation cost not yet recognized for nonvested performance unit awards outstanding as of December 31, 2023 is approximately $24.8 million, calculated based on current expectation of specific performance criteria, and is expected to be recognized over a remaining weighted-average period of approximately 1.5 years. Each performance unit represents one share of common stock.

The following table summarizes activity in non-performance based restricted stock and restricted stock unit awards as of and for the year ended December 31, 2023:

	Shares	Weighted-Average Grant Date Fair Value Per Share
Nonvested, beginning of period	300,953	$ 120.09
Granted	87,240	221.86
Vested	(183,258)	86.15
Forfeited	(6,788)	196.00
Nonvested, end of period	198,147	190.40

The weighted average grant date fair value of restricted stock and restricted stock unit awards granted in 2023, 2022 and 2021 was $19.4 million, $15.4 million and $10.6 million, respectively. The weighted average fair value of restricted stock and restricted stock unit awards that vested in 2023, 2022 and 2021 was $38.8 million, $17.8 million and $11.0 million, respectively, based on the closing prices of our common stock on the dates of vesting. Total compensation cost not yet recognized for nonvested, non-performance based restricted stock and restricted stock units as of December 31, 2023 is approximately $20.2 million and is expected to be recognized over a remaining weighted-average period of 1.9 years. The fair value of the non-performance based restricted stock and restricted stock units was estimated on the date of grant adjusted for a dividend factor, if necessary.

NOTE 20—Accumulated Other Comprehensive (Loss) Income:

The components and activity in Accumulated other comprehensive (loss) income (net of deferred income taxes) consisted of the following during the years ended December 31, 2023, 2022 and 2021 (in thousands):

	Foreign Currency Translation and Other	Net Investment Hedge[a]	Cash Flow Hedge[b]	Interest Rate Swap[c]	Total
Balance at December 31, 2020	$ (369,152)	$ 46,593	$ 6,449	$ (10,022)	$ (326,132)
Other comprehensive (loss) income before reclassifications	(74,478)	5,110	174	—	(69,194)
Amounts reclassified from accumulated other comprehensive loss	93	—	—	2,623	2,716
Other comprehensive (loss) income, net of tax	(74,385)	5,110	174	2,623	(66,478)
Amounts reclassified within accumulated other comprehensive income	51,703	(51,703)	—	—	—
Other comprehensive income attributable to noncontrolling interests	160	—	—	—	160
Balance at December 31, 2021	$ (391,674)	$ —	$ 6,623	$ (7,399)	$ (392,450)
Other comprehensive loss before reclassifications	(171,367)	—	(4,399)	—	(175,766)
Amounts reclassified from accumulated other comprehensive loss	72	—	—	7,399	7,471
Other comprehensive (loss) income, net of tax	(171,295)	—	(4,399)	7,399	(168,295)
Other comprehensive loss attributable to noncontrolling interests	83	—	—	—	83
Balance at December 31, 2022	$ (562,886)	$ —	$ 2,224	$ —	$ (560,662)
Other comprehensive income before reclassifications	26,337	—	5,986	—	32,323
Amounts reclassified from accumulated other comprehensive loss	66	—	(135)	—	(69)
Other comprehensive income, net of tax	26,403	—	5,851	—	32,254
Other comprehensive loss attributable to noncontrolling interests	(118)	—	—	—	(118)
Balance at December 31, 2023	$ (536,601)	$ —	$ 8,075	$ —	$ (528,526)

(a) During the first quarter of 2021, the net investment hedge was discontinued following the repayment of the 1.875% Euro-denominated senior notes. The balance of foreign exchange revaluation gains and losses associated with this discontinued net investment hedge have been reclassified to Foreign currency translation and other, and will remain within Accumulated other comprehensive loss until the hedged net investment is sold or liquidated.

(b) We entered into a foreign currency forward contract in the fourth quarter of 2019, which was designated and accounted for as a cash flow hedge under ASC 815, *Derivatives and Hedging*. See Note 22, "Fair Value of Financial Instruments," for additional information.

(c) The pre-tax portion of amounts reclassified from accumulated other comprehensive loss is included in interest expense. The balance of this interest rate swap was being amortized to Interest and financing expenses over the life of the 4.15% senior notes originally due in 2024. As discussed in Note 14, "Long-term Debt," the Company repaid these notes in the second quarter of 2022, and as a result, reclassified the remaining balance of this interest rate swap to interest expense during the same period as part of the early extinguishment of debt.

The amount of income tax benefit (expense) allocated to each component of Other comprehensive income (loss) for the years ended December 31, 2023, 2022 and 2021 is provided in the following tables (in thousands):

	Foreign Currency Translation and Other	Net Investment Hedge	Cash Flow Hedge	Interest Rate Swap	Total
2023					
Other comprehensive income, before tax	$ 23,964	$ —	$ 8,358	$ —	$ 32,322
Income tax expense	2,439	—	(2,507)	—	(68)
Other comprehensive income, net of tax	$ 26,403	$ —	$ 5,851	$ —	$ 32,254
2022					
Other comprehensive (loss) income, before tax	$ (168,953)	$ —	$ (4,399)	$ 9,739	$ (163,613)
Income tax expense	(2,342)	—	—	(2,340)	(4,682)
Other comprehensive (loss) income, net of tax	$ (171,295)	$ —	$ (4,399)	$ 7,399	$ (168,295)
2021					
Other comprehensive (loss) income, before tax	$ (76,544)	$ 6,552	$ 174	$ 3,336	$ (66,482)
Income tax benefit (expense)	2,159	(1,442)	—	(713)	4
Other comprehensive (loss) income, net of tax	$ (74,385)	$ 5,110	$ 174	$ 2,623	$ (66,478)

NOTE 21—Income Taxes:

Income before income taxes and equity in net income of unconsolidated investments, and current and deferred income tax expense (benefit) are composed of the following (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Income before income taxes and equity in net income of unconsolidated investments:			
Domestic	$ (461,897)	$ 952,799	$ (186,077)
Foreign	708,635	1,480,645	319,695
Total	$ 246,738	$ 2,433,444	$ 133,618
Current income tax expense (benefit):			
Federal	$ (54,250)	$ 33,230	$ 11,722
State	(3,395)	4,965	694
Foreign	387,045	259,054	55,530
Total	$ 329,400	$ 297,249	$ 67,946
Deferred income tax expense (benefit):			
Federal	$ (8,545)	$ 84,054	$ (38,413)
State	(4,154)	(3,511)	(5,544)
Foreign	113,576	12,796	5,457
Total	$ 100,877	$ 93,339	$ (38,500)
Total income tax expense	$ 430,277	$ 390,588	$ 29,446

The reconciliation of the U.S. federal statutory rate to the effective income tax rate is as follows:

	% of Income Before Income Taxes		
	2023	2022	2021
Federal statutory rate	21.0 %	21.0 %	21.0 %
State taxes, net of federal tax benefit	(2.8)	—	(3.5)
Change in valuation allowance[(a)]	98.8	(3.9)	33.7
Impact of foreign earnings, net[(b)(c)]	7.7	(0.1)	(40.5)
Global intangible low tax inclusion	4.2	0.3	12.3
Foreign-derived intangible income	—	(3.0)	—
Section 162(m) limitation	4.4	0.3	4.5
Subpart F income	(1.9)	0.2	4.8
Stock-based compensation	(3.9)	(0.3)	(7.2)
Depletion	(2.4)	(0.2)	(2.9)
U.S. federal return to provision	(6.1)	(0.4)	(1.7)
Revaluation of unrecognized tax benefits/reserve requirements[(d)]	39.1	2.3	3.0
Legal accrual[(e)]	18.6	—	—
Other items, net	(2.3)	(0.1)	(1.5)
Effective income tax rate	174.4 %	16.1 %	22.0 %

(a) Due to the Company being in a three-year cumulative loss position in China as of December 31, 2023, the year ended December 31, 2023 includes the establishment of a valuation allowance of $223.0 million on current year losses in one of our Chinese entities. The years ended December 31, 2022 and 2021 include benefits of $91.8 million and $6.0 million, respectively, due to the release of a foreign valuation allowance due to changes in expected profitability.

(b) The year ended December 31, 2021 includes a discrete tax benefit of $27.9 million related to the revision of an indemnification estimate for an ongoing tax-related matter in Germany.

(c) Our statutory rate is decreased by our share of the income of JBC, a Free Zones company under the laws of the Hashemite Kingdom of Jordan. The applicable provisions of the Jordanian law, and applicable regulations thereunder, do not have a termination provision and the exemption is indefinite. As a Free Zones company, JBC is not subject to income taxes on the profits of products exported from Jordan, and currently, substantially all of the profits are from exports. This resulted in a rate benefit of 20.1%, 3.2%, and 34.6% for the years ended December 31, 2023, 2022, and 2021, respectively.

(d) The year ended December 31, 2023 includes a $96.5 million expense recorded for a current year tax reserve related to an uncertain tax position in Chile.

(e) The year ended December 31, 2023 includes the tax impact of a non-deductible $218.5 million legal accrual recorded for the agreements to resolve a previously disclosed legal matter with the DOJ and SEC during the year ended December 31, 2023. See Note 17, "Commitments and Contingencies," for further details on this matter.

Deferred income tax assets and liabilities recorded on the consolidated balance sheets as of December 31, 2023 and 2022 consist of the following (in thousands):

	December 31,	
	2023	2022
Deferred tax assets:		
Accrued employee benefits	$ 31,917	$ 20,060
Operating loss carryovers	1,316,916	1,157,841
Pensions	23,527	26,229
Inventory reserves	83,136	3,600
Tax credit carryovers	1,431	3,750
Other[(a)]	103,517	118,733
Gross deferred tax assets	1,560,444	1,330,213
Valuation allowance	(1,349,924)	(1,087,505)
Deferred tax assets	210,520	242,708
Deferred tax liabilities:		
Depreciation	(541,245)	(446,942)
Intangibles	(54,413)	(84,690)
Other	(150,859)	(145,412)
Deferred tax liabilities	(746,517)	(677,044)
Net deferred tax liabilities	$ (535,997)	$ (434,336)
Classification in the consolidated balance sheets:		
Noncurrent deferred tax assets	$ 22,433	$ 46,434
Noncurrent deferred tax liabilities	(558,430)	(480,770)
Net deferred tax liabilities	$ (535,997)	$ (434,336)

Changes in the balance of our deferred tax asset valuation allowance are as follows (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Balance at January 1	$ (1,087,505)	$ (1,276,305)	$ (1,326,204)
Additions	(262,469)	(5,810)	(61,470)
Deductions	50	194,610	111,369
Balance at December 31	$ (1,349,924)	$ (1,087,505)	$ (1,276,305)

At December 31, 2023, we had approximately $1.4 million of domestic credits available to offset future payments of income taxes, expiring in varying amounts between 2024 and 2028. We have established valuation allowances for $0.1 million of those domestic credits since we believe that it is more likely than not that the related deferred tax assets will not be realized. We believe that sufficient taxable income will be generated during the carryover period in order to utilize the other remaining credit carryovers.

At December 31, 2023, we have on a pre-tax basis, domestic state net operating losses of $355.5 million, expiring between 2022 and 2041, which have pre-tax valuation allowances of $13.8 million established. In addition, we have on a pre-tax basis $5.2 billion of foreign net operating losses, which have pre-tax valuation allowances for $5.1 billion established. $643.5 million of these foreign net operating losses expire in 2028, $2.7 billion expire in 2035, $215.1 million expire in 2036. $19.7 million expire in 2037, $14.3 million expire at various other dates and $1.6 billion have an indefinite life. We have established valuation allowances for these deferred tax assets since we believe that it is more likely than not that the related deferred tax assets will not be realized. For the same reason, we established pre-tax valuation allowances of $250.9 million and $265.5 million for other state and foreign deferred tax assets, respectively, unrelated to net operating losses. The realization of the deferred tax assets is dependent on the generation of sufficient taxable income in the appropriate tax jurisdictions. Although realization is not assured, we believe it is more likely than not that the remaining deferred tax assets will be realized. However, the amount considered realizable could be reduced if estimates of future taxable income change.

As of December 31, 2023, we have not recorded taxes on approximately $11.1 billion of cumulative undistributed earnings of our non-U.S. subsidiaries and joint ventures. The TCJA imposed a mandatory transition tax on accumulated foreign earnings and generally eliminated U.S. taxes on foreign subsidiary distribution with the exception of foreign withholding taxes and other foreign local tax. We generally do not provide for taxes related to our undistributed earnings because such earnings either would not be taxable when remitted or they are considered to be indefinitely reinvested. If in the foreseeable future, we can no longer demonstrate that these earnings are indefinitely reinvested, a deferred tax liability will be recognized. A determination of the amount of the unrecognized deferred tax liability related to these undistributed earnings is not practicable due to the complexity and variety of assumptions necessary based on the manner in which the undistributed earnings would be repatriated.

Liabilities related to uncertain tax positions were $220.6 million and $83.7 million at December 31, 2023 and 2022, respectively, inclusive of interest and penalties of $42.0 million and $11.5 million at December 31, 2023 and 2022, respectively, and are reported in Other noncurrent liabilities as provided in Note 16, "Other Noncurrent Liabilities." These liabilities at December 31, 2023 and 2022 were reduced by $73.0 million and $32.4 million, respectively, for offsetting benefits from the corresponding effects of potential transfer pricing adjustments, state and local income taxes, and rate arbitrage related to foreign structure. These offsetting benefits are recorded in Other assets as provided in Note 11, "Other Assets." The resulting net liability of $105.6 million as of December 31, 2023 would favorably affect earnings if recognized and released, while the net liability of $39.8 million at December 31, 2022 would favorably affect earnings if recognized and released.

The liabilities related to uncertain tax positions, exclusive of interest, were $178.8 million and $72.2 million at December 31, 2023 and 2022, respectively. The following is a reconciliation of our total gross liability related to uncertain tax positions for 2023, 2022 and 2021 (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Balance at January 1	$ 72,162	$ 20,717	$ 11,639
Additions for tax positions related to prior years	6,216	1,673	75
Reductions for tax positions related to prior years	—	—	(6)
Additions for tax positions related to current year	101,179	50,531	10,911
Lapses in statutes of limitations/settlements	(770)	(995)	(1,931)
Foreign currency translation adjustment	(2)	236	29
Balance at December 31	$ 178,785	$ 72,162	$ 20,717

We are subject to income taxes in the U.S. and numerous foreign jurisdictions. Due to the statute of limitations, we are no longer subject to U.S. federal income tax audits by the Internal Revenue Service ("IRS") for years prior to 2020. Due to the statute of limitations, we also are no longer subject to U.S. state income tax audits prior to 2017.

With respect to jurisdictions outside the U.S., several audits are in process. We have audits ongoing for the years 2014 through 2022 related to Belgium, Canada, Chile, China, Germany and South Africa, some of which are for entities that have since been divested.

While we believe we have adequately provided for all tax positions, amounts asserted by taxing authorities could be greater than our accrued position. Accordingly, additional provisions on federal and foreign tax-related matters could be recorded in the future as revised estimates are made or the underlying matters are settled or otherwise resolved.

Since the timing of resolutions and/or closure of tax audits is uncertain, it is difficult to predict with certainty the range of reasonably possible significant increases or decreases in the liability related to uncertain tax positions that may occur within the next twelve months. Our current view is that it is reasonably possible that we could record an increase in the liability related to uncertain tax positions, relating to a number of issues, up to approximately $0.4 million as a result of closure of tax statutes.

NOTE 22—Fair Value of Financial Instruments:

In assessing the fair value of financial instruments, we use methods and assumptions that are based on market conditions and other risk factors existing at the time of assessment. Fair value information for our financial instruments is as follows:

Long-Term Debt—the fair values of our notes are estimated using Level 1 inputs and account for the difference between the recorded amount and fair value of our long-term debt. The carrying value of our remaining long-term debt reported in the accompanying consolidated balance sheets approximates fair value as substantially all of such debt bears interest based on prevailing variable market rates currently available in the countries in which we have borrowings.

	December 31,			
	2023		2022	
	Recorded Amount	Fair Value	Recorded Amount	Fair Value
	(In thousands)			
Long-term debt	$ 4,186,532	$ 4,021,693	$ 3,239,853	$ 2,993,027

Foreign Currency Forward Contracts—during the fourth quarter of 2019, we entered into a foreign currency forward contract to hedge the cash flow exposure of non-functional currency purchases during the construction of the Kemerton plant in Australia. This derivative financial instrument is used to manage risk and is not used for trading or other speculative purposes. This foreign currency forward contract has been designated as a hedging instrument under ASC 815, *Derivatives and Hedging*. At December 31, 2023 and 2022, we had outstanding designated foreign currency forward contracts with notional values totaling the equivalent of $994.5 million and $64.5 million, respectively.

We also enter into foreign currency forward contracts in connection with our risk management strategies that have not been designated as hedging instruments under ASC 815, *Derivatives and Hedging*, in an attempt to minimize the financial impact of changes in foreign currency exchange rates. These derivative financial instruments are used to manage risk and are not used for trading or other speculative purposes. The fair values of our non-designated foreign currency forward contracts are estimated based on current settlement values. At December 31, 2023 and 2022, we had outstanding non-designated foreign currency forward contracts with notional values totaling $7.1 billion and $2.8 billion, respectively, hedging our exposure to various currencies including the Chinese Renminbi, Euro, Australian Dollar, Chilean Peso and Japanese Yen.

The following table summarizes the fair value of our foreign currency forward contracts included in the consolidated balance sheets at December 31, 2023 and 2022 (in thousands):

	December 31,			
	2023		2022	
	Assets	Liabilities	Assets	Liabilities
Designated as hedging instruments				
Other current assets	$ 3,489	$ —	$ —	$ —
Other assets	11,704	—	—	—
Accrued expenses	—	446	—	3,159
Total designated as hedging instruments	15,193	446	—	3,159
Not designated as hedging instruments				
Other current assets	2,636	—	6,016	—
Accrued expenses	—	5,306	—	85
Total not designated as hedging instruments	2,636	5,306	6,016	85
Total	$ 17,829	$ 5,752	$ 6,016	$ 3,244

The following table summarizes the net gains (losses) recognized for our foreign currency forward contracts during the years ended December 31, 2023, 2022 and 2021 (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Designated as hedging instruments:			
Gains (losses) recognized in Other comprehensive income (loss)	$ 8,493	$ (4,398)	$ 174
Not designated as hedging instruments:			
Gains (losses) recognized in Other income (expenses), net[(a)]	$ 213,378	$ (41,088)	$ 1,068

(a) Fluctuations in the value of our foreign currency forward contracts not designated as hedging instruments are generally expected to be offset by changes in the value of the underlying exposures being hedged, which are also reported in Other income (expenses), net.

In addition, for the years ended December 31, 2023, 2022 and 2021, we recorded net cash receipts (settlements) of $218.0 million, ($44.4) million and ($2.4) million, respectively, primarily within Changes in current assets and liabilities, in our consolidated statements of cash flows.

Unrealized gains and losses related to the cash flow hedges will be reclassified to earnings over the life of the related assets when settled and the related assets are placed into service.

The counterparties to our foreign currency forward contracts are major financial institutions with which we generally have other financial relationships. We are exposed to credit loss in the event of nonperformance by these counterparties. However, we do not anticipate nonperformance by the counterparties.

NOTE 23—Fair Value Measurement:

Fair value is defined as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date (exit price). The inputs used to measure fair value are classified into the following hierarchy:

Level 1	Unadjusted quoted prices in active markets for identical assets or liabilities
Level 2	Unadjusted quoted prices in active markets for similar assets or liabilities, or unadjusted quoted prices for identical or similar assets or liabilities in markets that are not active, or inputs other than quoted prices that are observable for the asset or liability
Level 3	Unobservable inputs for the asset or liability

We endeavor to utilize the best available information in measuring fair value. Financial assets and liabilities are classified in their entirety based on the lowest level of input that is significant to the fair value measurement. The following tables set forth our financial assets and liabilities that were accounted for at fair value on a recurring basis as of December 31, 2023 and 2022 (in thousands):

	December 31, 2023	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Assets:				
Available for sale debt securities[a]	$ 289,307	$ —	$ —	$ 289,307
Investments under executive deferred compensation plan[b]	$ 33,564	$ 33,564	$ —	$ —
Public equity securities[c]	$ 168,928	$ 168,928	$ —	$ —
Private equity securities measured at net asset value[d][e]	$ 4,536	$ —	$ —	$ —
Foreign currency forward contracts[f]	$ 17,829	$ —	$ 17,829	$ —
Liabilities:				
Obligations under executive deferred compensation plan[b]	$ 33,564	$ 33,564	$ —	$ —
Foreign currency forward contracts[f]	$ 5,752	$ —	$ 5,752	$ —

	December 31, 2022	Quoted Prices in Active Markets for Identical Items (Level 1)	Quoted Prices in Active Markets for Similar Items (Level 2)	Unobservable Inputs (Level 3)
Assets:				
Available for sale debt securities[a]	$ 260,139	$ —	$ —	$ 260,139
Investments under executive deferred compensation plan[b]	$ 27,270	$ 27,270	$ —	$ —
Public equity securities[c]	$ 5,890	$ 5,890	$ —	$ —
Private equity securities measured at net asset value[d][e]	$ 6,375	$ —	$ —	$ —
Foreign currency forward contracts[f]	$ 6,016	$ —	$ 6,016	$ —
Liabilities:				
Obligations under executive deferred compensation plan[b]	$ 27,270	$ 27,270	$ —	$ —
Foreign currency forward contracts[f]	$ 3,244	$ —	$ 3,244	$ —

(a) Preferred equity of a Grace subsidiary acquired as a portion of the proceeds of the FCS sale on June 1, 2021. See Note 3, “Divestitures,” for further details on the material terms and conditions. A third-party estimate of the fair value was prepared using expected future cash flows over the period up to when the asset is likely to be redeemed, applying a discount rate that appropriately captures a market participant's view of the risk associated with the investment. These are considered to be Level 3 inputs.

(b) We maintain an EDCP that was adopted in 2001 and subsequently amended. The purpose of the EDCP is to provide current tax planning opportunities as well as supplemental funds upon the retirement or death of certain of our employees. The EDCP is intended to aid in attracting and retaining employees of exceptional ability by providing them with these benefits. We also maintain a Benefit Protection Trust (the "Trust") that was created to provide a source of funds to assist in meeting the obligations of the EDCP, subject to the claims of our creditors in the event of our insolvency. Assets of the Trust are consolidated in accordance with authoritative guidance. The assets of the Trust consist primarily of mutual fund investments (which are accounted for as trading securities and are marked-to-market on a monthly basis through the consolidated statements of income) and cash and cash equivalents. As such, these assets and obligations are classified within Level 1.

(c) Holdings in equity securities of public companies reported in Investments in the consolidated balance sheets. The fair value is measured using publicly available share prices of the investments, with any changes reported in Other income (expenses), net, in our consolidated statements of income. See Note 10, "Investments," for further details.

(d) Primarily consists of private equity securities reported in Investments in the consolidated balance sheets. The changes in fair value are reported in Other income (expenses), net in our consolidated statements of income.

(e) Holdings in certain private equity securities are measured at fair value using the net asset value per share (or its equivalent) practical expedient and have not been categorized in the fair value hierarchy.

(f) As a result of our global operating and financing activities, we are exposed to market risks from changes in foreign currency exchange rates which may adversely affect our operating results and financial position. When deemed appropriate, we minimize our risks from foreign currency exchange rate fluctuations through the use of foreign currency forward contracts. The foreign currency forward contracts are valued using broker quotations or market transactions in either the listed or over-the-counter markets. As such, these derivative instruments are classified within Level 2. See Note 22, "Fair Value of Financial Instruments," for further details about our foreign currency forward contracts.

The following tables set forth the reconciliation of the beginning and ending balance for the Level 3 recurring fair value measurements (in thousands):

	Available for Sale Debt Securities	
	Year Ended December 31,	
	2023	2022
Beginning balance	$ 260,139	$ 246,517
Accretion of discount	5,306	12,735
PIK dividends	19,307	—
Change in fair value	4,554	887
Ending balance	$ 289,306	$ 260,139

NOTE 24—Related Party Transactions:

Our consolidated statements of income include sales to and purchases from unconsolidated affiliates in the ordinary course of business as follows (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Sales to unconsolidated affiliates	$ 35,676	$ 51,906	$ 19,441
Purchases from unconsolidated affiliates[(a)]	$ 3,652,784	$ 1,920,476	$ 213,077

(a) Purchases from unconsolidated affiliates primarily relate to spodumene purchased from the Company's Windfield joint venture.

(b) Cost of goods sold on the consolidated statements of income included purchases from related unconsolidated affiliates of $2.3 billion, $656.7 million and $156.3 million for the years ended December 31, 2023, 2022 and 2021, respectively.

Our consolidated balance sheets include accounts receivable due from and payable to unconsolidated affiliates in the ordinary course of business as follows (in thousands):

	December 31,	
	2023	2022
Receivables from unconsolidated affiliates	$ 15,992	$ 21,495
Payables to unconsolidated affiliates[(a)]	$ 550,186	$ 518,377

(a) Payables to unconsolidated affiliates primarily relate to spodumene purchased from the Company's Windfield joint venture under normal payment terms.

NOTE 25—Segment and Geographic Area Information:

Effective January 1, 2023, the Company realigned its Lithium and Bromine global business units into a new corporate structure designed to better meet customer needs and foster talent required to deliver in a competitive global environment. In addition, the Company announced its decision to retain its Catalysts business under a separate, wholly-owned subsidiary renamed Ketjen. As a result, the Company's three reportable segments include: (1) Energy Storage; (2) Specialties; and (3) Ketjen. Each segment has a dedicated team of sales, research and development, process engineering, manufacturing and sourcing, and business strategy personnel and has full accountability for improving execution through greater asset and market focus, agility and responsiveness. This business structure aligns with the markets and customers we serve through each of the segments. This structure also facilitates the continued standardization of business processes across the organization, and is consistent with the manner in which information is presently used internally by the Company's chief operating decision maker to evaluate performance and make resource allocation decisions. The segment information for the prior year periods have been recast to conform to the current year presentation.

Summarized financial information concerning our reportable segments is shown in the following tables. The "All Other" category included only the FCS business that did not fit into any of the Company's core businesses. On June 1, 2021, the Company completed the sale of the FCS business. See Note 3, "Divestitures," for additional information. Amounts in the "All Other" category represent activity in this business until divested on June 1, 2021.

The Corporate category is not considered to be a segment and includes corporate-related items not allocated to the operating segments. Pension and other post-employment benefit ("OPEB") service cost (which represents the benefits earned by active employees during the period) and amortization of prior service cost or benefit are allocated to the reportable segments and Corporate, whereas the remaining components of pension and OPEB benefits cost or credit ("Non-operating pension and OPEB items") are included in Corporate. Segment data includes inter-segment transfers of raw materials at cost and allocations for certain corporate costs.

The Company's chief operating decision maker uses adjusted EBITDA (as defined below) to assess the ongoing performance of the Company's business segments and to allocate resources. The Company defines adjusted EBITDA as earnings before interest and financing expenses, income tax expenses, depreciation and amortization, as adjusted on a consistent basis for certain non-operating, non-recurring or unusual items in a balanced manner and on a segment basis. These non-operating, non-recurring or unusual items may include acquisition and integration related costs, gains or losses on sales of businesses, restructuring charges, facility divestiture charges, certain litigation and arbitration costs and charges, non-operating pension and OPEB items and other significant non-recurring items. In addition, management uses adjusted EBITDA for business and enterprise planning purposes and as a significant component in the calculation of performance-based compensation for management and other employees. The Company has reported adjusted EBITDA because management believes it provides additional useful measurements to review the Company's operations, provides transparency to investors and enables period-to-period comparability of financial performance. Total adjusted EBITDA is a financial measure that is not required by, or presented in accordance with, U.S. GAAP. Total adjusted EBITDA should not be considered as an alternative to Net (loss) income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP, or any other financial measure reported in accordance with U.S. GAAP.

Segment information for the years ended December 31, 2023, 2022 and 2021 were as follows (in thousands). Prior period amounts have been recast to reflect the current segment structure.

	Year Ended December 31,		
	2023	2022	2021
Net sales:			
Energy Storage	$ 7,078,998	$ 4,660,945	$ 1,067,430
Specialties	1,482,425	1,759,587	1,424,197
Ketjen	1,055,780	899,572	761,235
Total segment net sales	9,617,203	7,320,104	3,252,862
All Other	—	—	75,095
Total net sales	$ 9,617,203	$ 7,320,104	$ 3,327,957
Adjusted EBITDA:			
Energy Storage	$ 2,407,393	$ 3,032,260	$ 371,384
Specialties	298,506	527,318	468,836
Ketjen	103,872	28,732	106,941
Total segment adjusted EBITDA	2,809,771	3,588,310	947,161

See below for a reconciliation of total segment adjusted EBITDA to the companies consolidated Net income attributable to Albemarle Corporation, the most directly comparable financial measure calculated and reported in accordance with U.S. GAAP (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Total segment adjusted EBITDA	$ 2,809,771	$ 3,588,310	$ 947,161
All other adjusted EBITDA	—	—	29,858
Corporate expenses, net	(43,486)	(112,453)	(106,045)
Depreciation and amortization	(429,944)	(300,841)	(254,000)
Interest and financing expenses[(a)]	(116,072)	(122,973)	(61,476)
Income tax expense	(430,277)	(390,588)	(29,446)
Gain (loss) on change in interest in properties/sale of business, net[(b)]	71,190	(8,400)	295,971
Acquisition and integration related costs[(c)]	(26,767)	(16,259)	(12,670)
Goodwill impairment[(d)]	(6,765)	—	—
Non-operating pension and OPEB items	7,971	57,032	78,814
Mark-to-market (loss) gain on public equity securities[(e)]	(44,732)	4,319	—
Legal accrual[(f)]	(218,510)	—	(657,412)
Albemarle Foundation contribution[(g)]	—	—	(20,000)
Indemnification adjustments[(h)]	—	—	(39,381)
Other[(i)]	1,097	(8,331)	(47,702)
Net income attributable to Albemarle Corporation	$ 1,573,476	$ 2,689,816	$ 123,672

(a) Included in Interest and financing expenses is a loss on early extinguishment of debt of $19.2 million and $29.0 million for the years ended December 31, 2022 and 2021, respectively. See Note 14, "Long-term Debt," for additional information. In addition, Interest and financing expenses for the year ended December 31, 2022 includes the correction of an out of period error of $17.5 million related to the overstatement of capitalized interest in prior periods.

(b) Gain recorded during the year ended December 31, 2023 resulting from the restructuring of the MARBL joint venture with MRL. See Note 10, "Investments," for further details. $8.4 million and $132.4 million of expense recorded during the years ended December 31, 2022 and 2021, respectively, as a result of revised estimates of the obligation to construct certain lithium hydroxide conversion assets in Kemerton, Western Australia, due to cost overruns from supply chain, labor and COVID-19 pandemic related issues. The corresponding obligation was initially recorded in Accrued liabilities prior to being transferred to MRL, which held a 40% ownership interest in these Kemerton assets during those periods. See Note 2, "Acquisitions," for additional information. In addition, the year ended December 31, 2021, includes a $428.4 million gain related to the FCS divestiture. See Note 3, "Divestitures," for additional information on this gain.

(c) Costs related to the acquisition, integration and potential divestitures for various significant projects, recorded in Selling, general and administrative expenses ("SG&A").

(d) Goodwill impairment charge recorded in SG&A during the year ended December 31, 2023 related to our PCS business. See Note 12, "Goodwill and Other Intangibles," for further details.
(e) (Loss) gain recorded in Other income (expenses), net for the years ended December 31, 2023 and 2022 resulting from the change in fair value of investments in public equity securities.
(f) Loss recorded in SG&A for the agreements to resolve a previously disclosed legal matter with the DOJ and SEC during the year ended December 31, 2023. In addition, during the year ended December 31, 2021 the Company recorded a loss in Other income (expenses), net for related to the settlement of an arbitration ruling for a prior legal matter. See Note 17, "Commitments and Contingencies," for further details on both matters.
(g) Included in SG&A is a charitable contribution, using a portion of the proceeds received from the FCS divestiture, to the Albemarle Foundation, a non-profit organization that sponsors grants, health and social projects, educational initiatives, disaster relief, matching gift programs, scholarships and other charitable initiatives in locations where the Company's employees live and the Company operates. This contribution is in addition to the normal annual contribution made to the Albemarle Foundation by the Company, and is significant in size and nature in that it is intended to provide more long-term benefits in these communities.
(h) Included in Other income (expenses), net to revise an indemnification estimate for an ongoing tax-related matter of a previously disposed business in Germany. A corresponding discrete tax benefit of $27.9 million was recorded in Income tax expense during the same period, netting to an expected cash obligation of approximately $11.5 million.
(i) Included amounts for the year ended December 31, 2023 recorded in:
- Cost of goods sold - $15.1 million loss recorded to settle an arbitration matter with a regulatory agency in Chile, partially offset by a $4.1 million gain from an updated cost estimate of an environmental reserve at a site not part of our operations.
- SG&A - $9.5 million of separation and other severance costs to employees in Corporate and the Ketjen business which are primarily expected to be paid out during 2023, $2.3 million of facility closure expenses related to offices in Germany, $1.9 million of charges primarily for environmental reserves at sites not part of our operations and $1.8 million of various expenses including for certain legal costs and shortfall contributions for a multiemployer plan financial improvement plan.
- Other income (expenses), net - $19.3 million gain from PIK dividends of preferred equity in a Grace subsidiary, a $7.3 million gain resulting from insurance proceeds of a prior legal matter and $5.5 million of gains from the sale of investments and the write-off of certain liabilities no longer required, partially offset by $3.6 million of charges for asset retirement obligations at a site not part of our operations and $0.9 million of a loss resulting from the adjustment of indemnification related to previously disposed businesses.

Included amounts for the year ended December 31, 2022 recorded in:
- Cost of goods sold - $2.7 million of expense related to one-time retention payments for certain employees during the Catalysts strategic review and business unit realignment, and $0.5 million related to the settlement of a legal matter resulting from a prior acquisition.
- SG&A - $4.3 million primarily related to facility closure expenses of offices in Germany, $2.8 million of charges for environmental reserves at sites not part of our operations, $2.8 million of shortfall contributions for our multiemployer plan financial improvement plan, $1.9 million of expense related to one-time retention payments for certain employees during the Catalysts strategic review, partially offset by $4.3 million of gains from the sale of legacy properties not part of our operations.
- Other income (expenses), net - $3.0 million gain from the reversal of a liability related to a previous divestiture, a $2.0 million gain relating to the adjustment of an environmental reserve at non-operating businesses we previously divested and a $0.6 million gain related to a settlement received from a legal matter in a prior period, partially offset by a $3.2 million loss resulting from the adjustment of indemnification related to previously disposed businesses.

Included amounts for the year ended December 31, 2021 recorded in:
- Cost of goods sold - $10.5 million of expense related to a legal matter as part of a prior acquisition in our Lithium business.
- SG&A - $11.5 million of legal fees related to a legacy Rockwood legal matter noted above, $9.8 million of expenses primarily related to non-routine labor and compensation related costs that are outside normal compensation arrangements, a $4.0 million loss resulting from the sale of property, plant and equipment, $3.8 million of charges for environmental reserves at a sites not part of our operations and $3.2 million of facility closure costs related to offices in Germany, and severance expenses in Germany and Belgium.
- Other income (expenses), net - $4.8 million of net expenses primarily related to asset retirement obligation charges to update of an estimate at a site formerly owned by Albemarle.

	December 31,		
	2023	**2022**	**2021**
		(In thousands)	
Identifiable assets:			
Energy Storage[(a)]	$ 13,246,412	$ 10,471,949	$ 7,272,029
Specialties	1,696,307	1,396,583	1,344,038
Ketjen	1,355,743	1,214,482	1,149,592
Total segment identifiable assets	16,298,462	13,083,014	9,765,659
Corporate	1,972,190	2,373,508	1,208,459
Total identifiable assets	$ 18,270,652	$ 15,456,522	$ 10,974,118

(a) Increase in Energy Storage identifiable assets each year primarily due to capital expenditures for growth and capacity increases.

	Year Ended December 31,		
	2023	2022	2021
		(In thousands)	
Depreciation and amortization:			
Energy Storage	$ 258,436	$ 175,738	$ 123,295
Specialties	86,673	67,705	66,658
Ketjen	76,023	51,417	51,588
Total segment depreciation and amortization	421,132	294,860	241,541
All Other	—	—	1,870
Corporate	8,812	5,981	10,589
Total depreciation and amortization	$ 429,944	$ 300,841	$ 254,000
Capital expenditures:			
Energy Storage	$ 1,752,440	$ 980,410	$ 791,645
Specialties	214,039	183,658	92,194
Ketjen	132,510	66,319	49,312
Total segment capital expenditures	2,098,989	1,230,387	933,151
All Other	—	—	2,339
Corporate	50,292	31,259	18,177
Total capital expenditures	$ 2,149,281	$ 1,261,646	$ 953,667

	Year Ended December 31,		
	2023	2022	2021
		(In thousands)	
Net Sales[(a)]:			
United States	$ 930,838	$ 888,612	$ 730,738
Foreign[(b)]	8,686,365	6,431,492	2,597,219
Total	$ 9,617,203	$ 7,320,104	$ 3,327,957

(a) Net sales are attributed to countries based upon shipments to final destination.
(b) In 2023, net sales to South Korea, China and Japan represented 32%, 30% and 15%, respectively, of total net sales. In 2022, net sales to China, South Korea and Japan represented 33%, 22% and 15%, respectively, of total net sales. In 2021, net sales to China, Japan and South Korea represented 18%, 14% and 11%, respectively, of total net sales.

During 2023 and 2022, one customer in the Energy Storage business represented more than 10% of the Company's consolidated net sales.

	As of December 31,		
	2023	2022	2021
		(In thousands)	
Long-Lived Assets[(a)]:			
United States	$ 1,912,243	$ 1,371,347	$ 1,040,252
Australia	4,610,963	3,253,069	2,736,590
Chile	2,258,619	2,057,270	1,923,821
China	819,119	438,090	139,537
Jordan	292,870	267,612	262,392
Netherlands	186,963	167,264	177,405
Germany	91,979	77,845	80,956
France	56,876	52,894	49,740
Brazil	33,730	31,855	29,474
Other foreign countries	87,489	77,747	62,667
Total	$ 10,350,851	$ 7,794,993	$ 6,502,834

(a) Long-lived assets are comprised of the Company's Property, plant and equipment and joint ventures included in Investments.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure.

NONE

Item 9A. Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

Under the supervision and with the participation of our management, including our principal executive officer and principal financial officer, we conducted an evaluation of the effectiveness of the design and operation of our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act), as of the end of the period covered by this report. Based on this evaluation, our principal executive officer and principal financial officer concluded that, as of the end of the period covered by this report, our disclosure controls and procedures are effective to ensure that information required to be disclosed by us in the reports that we file or submit under the Exchange Act, is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and that such information is accumulated and communicated to our management, including our principal executive officer and principal financial officer, as appropriate, to allow timely decisions regarding required disclosure.

Management's report on internal control over financial reporting and the independent registered public accounting firm's report are included in Item 8 under the captions entitled "Management's Report on Internal Control over Financial Reporting" and "Report of Independent Registered Public Accounting Firm" and are incorporated herein by reference.

Changes in Internal Control over Financial Reporting

No changes in our internal control over financial reporting (as such term is defined in Exchange Act Rule 13a-15(f)) occurred during the fiscal quarter ended December 31, 2023 that materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information.

On February 9, 2024, Albemarle Corporation, Albemarle Europe Srl, the lenders party thereto and Bank of America, N.A., as administrative agent, entered into the first amendment (the "First Amendment") to that certain amended and restated credit agreement dated as of October 28, 2022 (the "2022 Credit Agreement"). The First Amendment modifies the leverage ratio financial maintenance covenant in the 2022 Credit Agreement by (a) temporarily increasing the 3.50:1.0 maximum leverage ratio permitted by the covenant to (i) 5.00:1.0 (for the second quarter of 2024), (ii) 5.50:1.0 (for the third quarter of 2024), (iii) 4.00:1.0 (for the fourth quarter of 2024) and (iv) 3.75:1.0 (for the first and second quarters of 2025) and (b) adjusting the calculation of the EBITDA and net debt components that form the basis of the calculation of the consolidated leverage ratio. The First Amendment includes certain other amendments to the 2022 Credit Agreement, including the addition of a financial covenant that will require Albemarle Corporation to maintain a specified minimum interest coverage ratio.

The foregoing description of the First Amendment does not purport to be complete and is qualified in its entirety by reference to the First Amendment, which is filed as Exhibit 10.52 to this Annual Report on Form 10-K.

Item 9C. Disclosure Regarding Foreign Jurisdictions That Prevent Inspections.

NONE

PART III

Item 10. Directors, Executive Officers and Corporate Governance.

The information required by this Item 10 will be contained in the Proxy Statement and is incorporated herein by reference. In addition, the information in "Executive Officers of the Registrant" appearing after Item 4 in Part I of this Annual Report, is incorporated herein by reference.

Code of Conduct

We have adopted a code of conduct and ethics for directors, officers and employees, known as the Albemarle Code of Conduct. The Albemarle Code of Conduct is available on our website, *www.albemarle.com*. Shareholders may also request a free copy of the Albemarle Code of Conduct from: Albemarle Corporation, Attention: Investor Relations, 4250 Congress Street, Suite 900, Charlotte, North Carolina 28209. We will disclose any amendments to, or waivers from, a provision of our Code of

Conduct that applies to the principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions that relates to any element of the Code of Conduct as defined in Item 406 of Regulation S-K by posting such information on our website.

New York Stock Exchange Certifications

Because our common stock is listed on the New York Stock Exchange ("NYSE"), our Chief Executive Officer is required to make, and he has made, an annual certification to the NYSE stating that he was not aware of any violation by us of the corporate governance listing standards of the NYSE. Our Chief Executive Officer made his annual certification to that effect to the NYSE as of May 10, 2023. In addition, we have filed, as exhibits to this Annual Report on Form 10-K, the certifications of our principal executive officer and principal financial officer required under Sections 906 and 302 of the Sarbanes-Oxley Act of 2002 to be filed with the Securities and Exchange Commission regarding the quality of our public disclosure.

Additional information will be contained in the Proxy Statement and is incorporated herein by reference.

Item 11. Executive Compensation.

The information required by this Item 11 will be contained in the Proxy Statement and is incorporated herein by reference.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

The information required by this Item 12 will be contained in the Proxy Statement and is incorporated herein by reference.

Item 13. Certain Relationships and Related Transactions, and Director Independence.

The information required by this Item 13 will be contained in the Proxy Statement and is incorporated herein by reference.

Item 14. Principal Accountant Fees and Services.

The information required by this Item 14 will be contained in the Proxy Statement and is incorporated herein by reference.

PART IV

Item 15. Exhibits and Financial Statement Schedules.

(a)(1) The following consolidated financial and informational statements of the registrant are included in Part II Item 8 on pages 80 to 131:

Management's Report on Internal Control Over Financial Reporting

Report of Independent Registered Public Accounting Firm (PCAOB ID 238)

Consolidated Balance Sheets as of December 31, 2023 and 2022

Consolidated Statements of Income, Comprehensive Income, Changes in Equity and Cash Flows for the years ended December 31, 2023, 2022 and 2021

Notes to the Consolidated Financial Statements

(a)(2) No financial statement schedules are provided in accordance with Item 15(a)(2) as the information is either not applicable, not required or has been furnished in the Consolidated Financial Statements or Notes thereto.

(a)(3) Exhibits

The following documents are filed as exhibits to this Annual Report on Form 10-K pursuant to Item 601 of Regulation S-K:

2.1	Agreement and Plan of Merger, dated as of July 15, 2014, among Albemarle Corporation, Albemarle Holdings Corporation and Rockwood Holdings, Inc. [filed as Exhibit 2.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on July 18, 2014, and incorporated herein by reference].
3.1	Amended and Restated Articles of Incorporation of Albemarle Corporation [filed as Exhibit 3.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on August 7, 2018, and incorporated herein by reference].
3.2	Amended and Restated Bylaws, effective October 23, 2023, of Albemarle Corporation [filed as Exhibit 3.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on October 26, 2023, and incorporated herein by reference].
4.1	Indenture, dated as of January 20, 2005, between Albemarle Corporation and The Bank of New York, as trustee [filed as Exhibit 4.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on January 20, 2005, and incorporated herein by reference].
4.2	Third Supplemental Indenture, dated as of November 24, 2014, among Albemarle Corporation, Albemarle Holdings Corporation (now Rockwood Holdings, Inc.) and Albemarle Holdings II Corporation (now Rockwood Specialties Group, Inc.) and U.S. Bank National Association, as trustee [filed as Exhibit 4.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 24, 2014, and incorporated herein by reference].
4.3	Fourth Supplemental Indenture, dated as of January 29, 2015, among Albemarle Corporation, Rockwood Holdings, Inc. (as successor by merger to Albemarle Holdings Corporation), Rockwood Specialties Group, Inc. (as successor by merger to Albemarle Holdings II Corporation), The Bank of New York Mellon Trust Company, N.A., a national banking association, as successor to The Bank of New York, as resigning trustee, and U.S. Bank National Association, as successor trustee [filed as Exhibit 4.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on January 29, 2015, and incorporated herein by reference].
4.4	Form of Global Security for the 5.450% Senior Notes due 2044 [filed as Exhibit 4.4 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 24, 2014, and incorporated herein by reference].
4.5	Form of 3.450% Note due 2029 [filed as Exhibit 4.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 25, 2019, and incorporated herein by reference].
4.6	Form of 1.125% Note due 2025 [filed as Exhibit 4.4 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 25, 2019, and incorporated herein by reference].
4.7	Form of 1.625% Note due 2028 [filed as Exhibit 4.5 to the Company's Current Report on Form 8-K (No. 1-12658) filed on November 25, 2019, and incorporated herein by reference].
4.8	Form of 4.650% Senior Notes due 2027 [filed as Exhibit 4.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on May 13, 2022, and incorporated herein by reference].
4.9	Form of 5.050% Senior Notes due 2032 [filed as Exhibit 4.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on May 13, 2022, and incorporated herein by reference].
4.10	Form of 5.650% Senior Notes due 2052 [filed as Exhibit 4.4 to the Company's Current Report on Form 8-K (No. 1-12658) filed on May 13, 2022, and incorporated herein by reference].
4.11	Description of Securities [filed on the Company's Current Report on Form 8-K (No. 1-12658) filed February 15, 2023, and incorporated herein by reference].
10.1#	2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors of Albemarle Corporation [filed as Annex A to the Company's definitive Proxy Statement on Schedule 14A (No. 1-12658) filed on March 28, 2013, and incorporated herein by reference].

10.2#	First Amendment to the 2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors of Albemarle Corporation [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on August 5, 2016, and incorporated herein by reference].
10.3#	Second Amendment to the 2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors of Albemarle Corporation [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on August 5, 2020, and incorporated herein by reference].
10.4#	Third Amendment to the 2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors of Albemarle Corporation [filed as Exhibit 10.56 to the Company's Annual Report on Form 10-K (No. 1-12658) filed on February 19, 2021 and incorporated herein by reference].
10.5#	Fourth Amendment to the 2013 Stock Compensation and Deferral Election Plan for Non-Employee Directors of Albemarle Corporation [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on August 4, 2021, and incorporated herein by reference].
10.6#	Albemarle Corporation 2023 Stock Compensation and Deferral Election Plan for Non-Employee Directors of Albemarle Corporation [filed as Annex A to the Company's definitive Proxy Statement on Schedule 14A (No. 1-12658) filed on March 21, 2023, and incorporated herein by reference].
10.7#	Albemarle Corporation 2008 Incentive Plan, as amended and restated as of April 20, 2010 [filed as Exhibit 10.1 to the Company's Registration Statement on Form S-8 (No. 333-166828) filed on May 14, 2010, and incorporated herein by reference].
10.8#	Form of Notice of Option Grant under the Albemarle Corporation 2008 Incentive Plan [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 2, 2016, and incorporated herein by reference].
10.9#	Albemarle Corporation 2017 Incentive Plan, adopted May 12, 2017 [filed as Appendix A to the Company's Definitive Proxy Statement filed on March 30, 2017, and incorporated herein by reference].
10.10#	Form of Notice of Option Grant under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 9, 2018, and incorporated herein by reference].
10.11#	Form of Notice of NEO Special Retention Restricted Stock Unit Award under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 4, 2020, and incorporated herein by reference].
10.12#	Form of Notice of Special Restricted Stock Unit Award under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.6 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 4, 2020, and incorporated herein by reference].
10.13#	Form of Restricted Stock Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 28, 2022, and incorporated herein by reference].
10.14#	Form of Adjusted ROIC Performance Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 28, 2022, and incorporated herein by reference].
10.15#	Form of TSR Performance Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 28, 2022, and incorporated herein by reference].
10.16#	Form of Stock Option Grant Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.4 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 28, 2022, and incorporated herein by reference].

10.17#	Form of Special Restricted Stock Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.5 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 28, 2022, and incorporated herein by reference].
10.18#	Form Notice of Special Retention Restricted Stock Unit Award under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.2 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on November 2, 2022, and incorporated herein by reference].
10.19#	Form of Stock Option Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 24, 2023, and incorporated herein by reference].
10.20#	Form of rTSR Performance Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 24, 2023, and incorporated herein by reference].
10.21#	Form of ROIC Performance Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 24, 2023, and incorporated herein by reference].
10.22#	Form of Restricted Stock Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.4 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 24, 2023, and incorporated herein by reference].
10.23#	Form of Special Restricted Stock Unit Award Agreement under the Albemarle Corporation 2017 Incentive Plan [filed as Exhibit 10.5 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 24, 2023, and incorporated herein by reference].
10.24#	Amended and Restated Albemarle Corporation Supplemental Executive Retirement Plan, effective as of January 1, 2005 [filed as Exhibit 10.13 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
10.25#	First Amendment to the Albemarle Corporation Supplemental Executive Retirement Plan, dated December 1, 2010 [filed as Exhibit 10.14 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
10.26#	Second Amendment to the Albemarle Corporation Supplemental Executive Retirement Plan, dated December 18, 2011 [filed as Exhibit 10.15 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
10.27#	Third Amendment to the Albemarle Corporation Supplemental Executive Retirement Plan, dated December 2, 2013 [filed as Exhibit 10.16 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
10.28#	Albemarle Corporation Severance Pay Plan, as revised effective as of December 13, 2006 [filed as Exhibit 10.6 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 18, 2006, and incorporated herein by reference].
10.29#	Form of Severance Compensation Agreement (Pension-Eligible Employees) [filed as Exhibit 10.19 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
10.30#	Form of Severance Compensation Agreement (Non-Pension-Eligible Employees) [filed as Exhibit 10.20 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].

10.31#	Form of Amendment to Severance Compensation Agreement [filed as Exhibit 10.21 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
10.32#	Form of Second Amendment to Severance Compensation Agreement between Scott Tozier and Albemarle Corporation [filed as Exhibit 10.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 9, 2016, and incorporated herein by reference].
10.33#	Amended and Restated Albemarle Corporation Benefits Protection Trust, effective as of December 13, 2006 [filed as Exhibit 10.9 to the Company's Current Report on Form 8-K (No. 1-12658) filed on December 18, 2006, and incorporated herein by reference].
10.34#	Albemarle Corporation Employee Relocation Policy [filed as Exhibit 10.33 to the Company's Quarterly Report on Form 10-Q for the quarter ended June 30, 2008 (No. 1-12658), and incorporated herein by reference].
10.35#	Amended and Restated Albemarle Corporation Executive Deferred Compensation Plan, effective as of January 1, 2013 [filed as Exhibit 10.23 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
10.36#	First Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of November 14, 2014 [filed as Exhibit 10.24 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2014 (No. 1-12658), and incorporated herein by reference].
10.37#	Second Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of February 12, 2015 [filed as Exhibit 10.28 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
10.38#	Third Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of July 31, 2015 [filed as Exhibit 10.29 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
10.39#	Fourth Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of December 17, 2015 [filed as Exhibit 10.30 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2015 (No. 1-12658), and incorporated herein by reference].
10.40#	Fifth Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of March 31, 2017 [filed as Exhibit 10.38 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (No. 1-12658), and incorporated herein by reference].
10.41#	Sixth Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of July 5, 2017 [filed as Exhibit 10.39 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (No. 1-12658), and incorporated herein by reference].
10.42#	Seventh Amendment to the Albemarle Corporation Executive Deferred Compensation Plan, dated as of November 9, 2017 [filed as Exhibit 10.40 to the Company's Annual Report on Form 10-K for the fiscal year ended December 31, 2017 (No. 1-12658), and incorporated herein by reference].
10.43#	Executive Employment Agreement with J. Kent Masters, dated April 20, 2020 [filed as Exhibit 10.3 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 11, 2020, and incorporated herein by reference].
10.44#	Change in Control Agreement with J. Kent Masters, dated April 20, 2020 [filed as Exhibit 10.4 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 11, 2020, and incorporated herein by reference].
10.45#	Notice of Restricted Stock Unit Award to J. Kent Masters, dated May 8, 2020 [filed as Exhibit 10.5 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 11, 2020, and incorporated herein by reference].

10.46#	Amended and Restated Executive Employment Agreement, dated March 15, 2023, between the Company and J. Kent Masters [filed as Exhibit 10.6 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 3, 2023, and incorporated herein by reference].
10.47#	Amended and Restated Severance Compensation Agreement, dated March 15, 2023, between the Company and J. Kent Masters [filed as Exhibit 10.7 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 3, 2023, and incorporated herein by reference].
10.48#	Letter Agreement with Raphael Crawford, dated November 3, 2021 [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on November 4, 2021, and incorporated herein by reference].
10.49	Sale, Purchase and Contribution Agreement, dated February 25, 2021 among Albemarle Corporation, W. R. Grace & Co.-Conn and Fine Chemical Manufacturing Services LLC [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on May 5, 2021, and incorporated herein by reference].
10.50	Second Amendment and Restatement Agreement, dated as of December 10, 2021, among Albemarle Corporation, the Lenders Party hereto, and JPMorgan Chase Bank, N.A., as Administrative Agent [filed as Exhibit 10.62 to the Company's Annual Report on Form 10-K (No. 1-12658) filed on February 18, 2022 and incorporated herein by reference].
10.51	Amended and Restated Credit Agreement, dated as of October 28, 2022, among Albemarle Corporation, certain other subsidiaries of the Company, the Lenders Party thereto, and Bank of America, N.A., as Administrative Agent for the Lenders [filed as Exhibit 10.1 to the Company's Quarterly Report on Form 10-Q (No. 1-12658) filed on November 2, 2022, and incorporated herein by reference].
10.52*	First Amendment to Credit Agreement, dated as of February 9, 2024, among Albemarle Corporation, certain other subsidiaries of the Company, the Lenders Party thereto, and Bank of America, N.A., as Administrative Agent for the Lenders.
10.53	Form of Employee Non-Solicitation, Non-Compete and Confidentiality Agreement [filed as Exhibit 10.1 to the Company's Current Report on Form 8-K (No. 1-12658) filed on March 9, 2022 and incorporated herein by reference].
10.54#*	Albemarle Corporation Amended and Restated Compensation Recoupment and Forfeiture Policy, effective as of December 1, 2023.
21.1*	Subsidiaries of the Company.
23.1*	Consent of PricewaterhouseCoopers LLP.
23.2*	Consent of SRK Consulting (U.S), Inc. regarding lithium reserves and resources.
23.3*	Consent of Fastmarkets Group Limited regarding market studies for lithium reserves and resources.
23.4*	Consent of RPS Energy Canada Ltd regarding bromine reserves and resources.
23.5*	Consent of RESPEC regarding bromine reserves and resources.
31.1*	Certification of Principal Executive Officer pursuant to Rule 13a-15(e) and 15d-15(e) of the Securities Exchange Act of 1934, as amended.
31.2*	Certification of Principal Financial Officer pursuant to Rule 13a-15(e) and 15d-15(e) of the Securities Exchange Act of 1934, as amended.
32.1*	Certification of Principal Executive Officer pursuant to 18 U.S.C. 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.

32.2*	Certification of Principal Financial Officer pursuant to 18 U.S.C. 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.
96.1*	SEC Technical Report Summary Pre-Feasibility Study Greenbushes Mine Western Australia, prepared by SRK Consulting (U.S), Inc., dated February 9, 2024.
96.2*	SEC Technical Report Summary Initial Assessment Wodgina Western Australia, prepared by SRK Consulting (U.S), Inc., dated February 14, 2023.
96.3	SEC Technical Report Summary, Pre-Feasibility Study, Salar de Atacama Region II, Chile, prepared by SRK Consulting (U.S), Inc., dated February 14, 2023 [filed as Exhibit 96.2 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 15, 2023 and incorporated herein by reference].
96.4	SEC Technical Report Summary Pre-Feasibility Study, Silver Peak Lithium Operation, Nevada, USA, prepared by SRK Consulting (U.S), Inc., dated February 14, 2023 [filed as Exhibit 96.3 to the Company's Current Report on Form 8-K (No. 1-12658) filed on February 15, 2023 and incorporated herein by reference].
96.5*	SEC Technical Report Summary for Jordan Bromine Operation, prepared by RPS Energy Canada Ltd and RESPEC Consulting Inc., dated February 14, 2024.
96.6*	SEC Technical Report Summary for Magnolia Field Bromine Reserves, prepared by RPS Energy Canada Ltd, dated February 14, 2024.
97*	Albemarle Corporation Incentive-Based Compensation Recovery Policy, effective as of December 1, 2023.
101*	Interactive Data Files (Annual Report on Form 10-K, for the fiscal year ended December 31, 2023, furnished in XBRL (eXtensible Business Reporting Language)).
	Attached as Exhibit 101 to this report are the following documents formatted in XBRL: (i) the Consolidated Statements of Income for the fiscal years ended December 31, 2023, 2022 and 2021, (ii) the Consolidated Statements of Comprehensive Income for the fiscal years ended December 31, 2023, 2022 and 2021, (iii) the Consolidated Balance Sheets at December 31, 2023 and 2022, (iv) the Consolidated Statements of Changes in Equity for the fiscal years ended December 31, 2023, 2022 and 2021, (v) the Consolidated Statements of Cash Flows for the fiscal years ended December 31, 2023, 2022 and 2021 and (vi) the Notes to Consolidated Financial Statements.
104*	Cover Page Interactive Data File (formatted as inline XBRL and contained in Exhibit 101).

\# Management contract or compensatory plan or arrangement.
* Included with this filing.

(c) In accordance with Regulation S-X Rule 3-09, the audited financial statements of Windfield Holdings Pty. Ltd. ("Windfield") for the year ended December 31, 2023, Windfield's fiscal year end, will be filed by amendment to this Annual Report on Form 10-K on or before June 30, 2024.

Item 16. Form 10-K Summary.

NONE

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

ALBEMARLE CORPORATION
(Registrant)

By: /s/ J. KENT MASTERS
(J. Kent Masters)
Chairman, President and Chief Executive Officer

Dated: February 14, 2024

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities indicated as of February 14, 2024.

Signature	Title
/s/ J. KENT MASTERS **(J. Kent Masters)**	Chairman, President and Chief Executive Officer (principal executive officer)
/s/ NEAL R. SHEOREY **(Neal R. Sheorey)**	Executive Vice President, Chief Financial Officer (principal financial officer)
/s/ JOHN C. BARICHIVICH III **(John C. Barichivich III)**	Vice President, Corporate Controller and Chief Accounting Officer (principal accounting officer)
/s/ M. LAUREN BRLAS **(M. Lauren Brlas)**	Director
/s/ RALF H. CRAMER **(Ralf H. Cramer)**	Director
/s/ GLENDA J. MINOR **(Glenda J. Minor)**	Director
/s/ JAMES J. O'BRIEN **(James J. O'Brien)**	Director
/s/ DIARMUID B. O'CONNELL **(Diarmuid B. O'Connell)**	Director
/s/ DEAN L. SEAVERS **(Dean L. Seavers)**	Director
/s/ GERALD A. STEINER **(Gerald A. Steiner)**	Director
/s/ HOLLY A. VAN DEURSEN **(Holly A. Van Deursen)**	Director
/s/ ALEJANDRO D. WOLFF **(Alejandro D. Wolff)**	Director

FIRST AMENDMENT TO CREDIT AGREEMENT

THIS FIRST AMENDMENT TO CREDIT AGREEMENT, dated as of February 9, 2024 (this "Amendment"), is entered into among ALBEMARLE CORPORATION, a Virginia corporation (the "Company"), ALBEMARLE EUROPE SRL, a *société à responsabilité limitée* organized under the laws of Belgium ("Belgian Borrower" and, together with the Company and any other Subsidiary of the Company party thereto pursuant to Section 2.14 thereof, collectively, the "Borrowers"), the Lenders party hereto, and BANK OF AMERICA, N.A., as Administrative Agent for the Lenders (in such capacity, the "Administrative Agent"). Capitalized terms used herein and not otherwise defined shall have the meanings ascribed thereto in the Credit Agreement (as defined below and as amended by this Amendment).

RECITALS

WHEREAS, the Borrowers, the Lenders and the Administrative Agent are parties to that certain Amended and Restated Credit Agreement, dated as of October 28, 2022 (the "Credit Agreement");

WHEREAS, the Company has requested certain amendments to the Credit Agreement; and

WHEREAS, the parties hereto have agreed to amend the Credit Agreement as provided herein.

NOW, THEREFORE, in consideration of the agreements contained herein, and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties hereto agree as follows:

AGREEMENT

1. Amendments to Credit Agreement: Effective upon satisfaction of the conditions precedent set forth in Section 2 below:

(a) Section 1.01 of the Credit Agreement is hereby amended to add the following new definitions in the appropriate alphabetical order to read as follows:

"Consolidated Interest Coverage Ratio" means, as of any date of determination, the ratio of (a) Consolidated EBITDA for the period of four fiscal quarters ending on such date to (b) Consolidated Interest Charges for the period of four fiscal quarters ending on such date.

"Consolidated Windfield-Adjusted EBITDA" means, for any period, for the Consolidated Group, an amount equal to the sum of (a) Consolidated Net Income for such period plus (b) the following, in each case to the extent deducted in calculating such Consolidated Net Income, without duplication: (i) Consolidated Interest Charges for such period, (ii) the provision for federal, state, local and foreign income taxes payable by the Consolidated Group for such period, (iii) the amount of depreciation and amortization expense for such period, (iv) non-cash expenses for such period (excluding any non-cash expense to the extent that it represents an accrual of or reserve for cash payments in any future period and any inventory valuation related charge), (v) non-cash goodwill impairment charges, (vi) any non-cash loss attributable to the mark-to-market adjustments in the valuation of pension liabilities (to the extent the cash impact resulting from such loss has not been realized) in accordance with Accounting Standards Codification 715 (ASC 715), (vii) any fees, expenses or charges (other than depreciation or amortization expense) related to any Acquisition, Disposition, issuance of equity interests, other transactions (excluding intercompany transactions) permitted by Section 8.02, or the incurrence of Indebtedness not prohibited by this Agreement (including any refinancing or amendment thereof) (in each case, whether or not consummated), including, but not limited to, such fees, expenses or charges related to this Agreement and the other Loan Documents and any amendment or other modification of this Agreement or the other Loan Documents, (viii) any expense to the extent that a corresponding amount is received during such period in cash by the Company or any of its Subsidiaries under any agreement providing for indemnification or reimbursement of such expenses, and (ix) any expense with respect to liability or casualty events or business interruption to the extent reimbursed to the Company or any of its Subsidiaries during such period by third party insurance, plus (c) the amount of dividends or distributions or other payments (including any ordinary course dividend, distribution or other payment) that are actually received in cash (or converted into cash) for such period by a member of the Consolidated Group from any Person that is not a member of the Consolidated Group or otherwise in respect of any unconsolidated investment (other than any such dividends, distributions and payments received from Windfield in respect of the Consolidated Group's ownership interest in Windfield), minus (d) to the extent included in calculating such Consolidated Net Income, (i) non-cash income during such period (excluding any non-cash income to the extent that it represents cash receipts in any future period and any inventory valuation related income), and (ii) any non-cash gains attributable to the mark-to-market adjustments in the valuation of pension liabilities in accordance with Accounting Standards Codification 715 (ASC 715), all as determined in accordance with GAAP plus (e) the Windfield Earnings Amount for such period.

"Windfield" means Windfield Holdings Pty. Ltd., a company incorporated in Australia.

"Windfield Earnings Amount" means, for any period, (i) the Consolidated Group's equity in net income of unconsolidated investments for such period attributable to Windfield, as disclosed in (or derivable from) the Company's Annual Report on Form 10-K or Quarterly Report on Form 10-Q, as applicable, divided by (ii) one minus the then prevailing Australian federal income tax rate for such period (expressed as a decimal). It is acknowledged and agreed that the prevailing Australian federal income tax rate as of December 31, 2023 is 30% (or 0.30 expressed as a decimal). Notwithstanding the foregoing, the Windfield Earnings Amount for the three-month periods ended March 31, 2023, June 30, 2023 and September 30, 2023 shall be $553,284,000, $779,919,000 and $665,616,000, respectively.

"Windfield Funded Debt" means, as of any date of determination, (i) the Funded Debt of Windfield and its Subsidiaries determined on a consolidated basis in accordance with International Financial Reporting Standards (and converted to Dollars by the Company based on the prevailing currency exchange rate in effect on such date) multiplied by (ii) the Windfield Ownership Percentage as of such date.

"Windfield Ownership Percentage" means, as of any date of determination, the percentage of the issued and outstanding ordinary shares in the capital of Windfield that are owned, directly or indirectly, by the Consolidated Group as of such date; provided that in the event Windfield becomes a member of the Consolidated Group then the Windfield Ownership Percentage shall be deemed to be zero at all times during which Windfield is a member of the Consolidated Group.

"Windfield Unrestricted Cash" means, as of any date of determination, (i) the cash and cash equivalents owned as of such date by Windfield or any of its Subsidiaries, determined on a consolidated basis in accordance with International Financial Reporting Standards (and converted to Dollars by the Company based on the prevailing currency exchange rate in effect on such date); provided that such cash and cash equivalents do not appear (and in accordance with International Financial Reporting Standards would not be required to appear) as "restricted" on the consolidated statement of financial position of Windfield prepared as of such date in accordance with International Financial Reporting Standards multiplied by (ii) the Windfield Ownership Percentage as of such date.

(b) Each of the references to "financial covenant" in (i) the definition of "Pro Forma Basis" in Section 1.01, (ii) Section 1.03(b), (iii) Section 1.08(a), (iv) Section 2.01(b)(xii) and (v) Section 7.02 of the Credit Agreement is hereby amended and replaced with "financial covenants".

(c) The definition of "Consolidated EBITDA" in Section 1.01 of the Credit Agreement is hereby amended to read as follows:

"Consolidated EBITDA" means, for any period, for the Consolidated Group, an amount equal to the sum of (a) Consolidated Net Income for such period plus (b) the following, in each case to the extent deducted in calculating such Consolidated Net Income, without duplication: (i) Consolidated Interest Charges for such period, (ii) the provision for federal, state, local and foreign income taxes payable by the Consolidated Group for such period, (iii) the amount of depreciation and amortization expense for such period, (iv) non-cash expenses for such period (excluding any non-cash expense to the extent that it represents an accrual of or reserve for cash payments in any future period and any inventory valuation related charge), (v) non-cash goodwill impairment charges, (vi) any non-cash loss attributable to the mark-to-market adjustments in the valuation of pension liabilities (to the extent the cash impact resulting from such loss has not been realized) in accordance with Accounting Standards Codification 715 (ASC 715), (vii) any fees, expenses or charges (other than depreciation or amortization expense) related to any Acquisition, Disposition, issuance of equity interests, other transactions (excluding intercompany transactions) permitted by Section 8.02, or the incurrence of Indebtedness not prohibited by this Agreement (including any refinancing or amendment thereof) (in each case, whether or not consummated), including, but not limited to, such fees, expenses or charges related to this Agreement and the other Loan Documents and any amendment or other modification of this Agreement or the other Loan Documents, (viii) any expense to the extent that a corresponding amount is received during such period in cash by the Company or any of its Subsidiaries under any agreement providing for indemnification or reimbursement of such expenses and (ix) any expense with respect to liability or casualty events or business interruption to the extent reimbursed to the Company or any of its Subsidiaries during such period by third party insurance, plus (c) the amount of dividends or distributions or other payments (including any ordinary course dividend, distribution or other payment) that are actually received in cash (or converted into cash) for such period by a member of the Consolidated Group from any Person that is not a member of the Consolidated Group or otherwise in respect of any unconsolidated investment, minus (d) to the extent included in calculating such Consolidated Net Income, (i) non-cash income during such period (excluding any non-cash income to the extent that it represents cash receipts in any future period and any inventory valuation related income) and (ii) any non-cash gains attributable to the mark-to-market adjustments in the valuation of pension liabilities in accordance with Accounting Standards Codification 715 (ASC 715), all as determined in accordance with GAAP.

(d) The definition of "Consolidated Leverage Ratio" in Section 1.01 of the Credit Agreement is hereby amended to read as follows:

"Consolidated Leverage Ratio" means, as of any date of determination, the ratio of (a) the difference of (i) the sum of (A) Consolidated Funded Debt as of such date plus (B) Windfield Funded Debt as of such date minus (ii) the sum of (A) Unrestricted Cash as of such date plus (B) Windfield Unrestricted Cash as of such date (in an amount not to exceed Windfield Funded Debt as of such date) to (b) Consolidated Windfield-Adjusted EBITDA for the period of the four fiscal quarters ending on such date; provided, however, that, for purposes of calculating the Consolidated Leverage Ratio, with respect to any PILOT Transaction: (x) the Attributable Principal Amount of the PILOT-Related Capital Lease shall be deemed to be equal to zero, (y) the Consolidated Interest Charges on any such Attributable Principal Amount (described in clause (x)) shall be deemed to be equal to zero, and (z) the net income from any interest earned with respect to any related Member-Held LRBs shall be deemed to be equal to zero.

(e) Section 7.01 of the Credit Agreement is hereby amended to (i) delete the "and" at the end of clause (a) thereof, (ii) replace the "." at the end of clause (b) thereof with "; and" and (iii) add a new clause (c) to read as follows:

(c) (i) as soon as available, but in any event within 120 days after the end of each fiscal year of the Company, a consolidated statement of financial position of Windfield and its Subsidiaries as of the end of such fiscal year, and the related consolidated statements of profit or loss and other comprehensive income, changes in equity and cash flows for such fiscal year, all in reasonable detail and prepared in accordance with International Financial Reporting Standards, audited and accompanied by a report and opinion of an independent certified public accountant, which report and opinion shall be prepared in accordance with generally accepted auditing standards and (ii) as soon as available, but in any event within 60 days after the end of each of the first three fiscal quarters of each fiscal year of the Company, a consolidated statement of financial position of Windfield and its Subsidiaries as of the end of such fiscal quarter, and the related consolidated statements of profit or loss and other comprehensive income and cash flows for such fiscal quarter and for the portion of Windfield's fiscal year then ended, without footnotes; provided that the Company and the Borrower shall not be required to furnish to the Administrative Agent any item described in this clause (c) that has not been received by the Company from Windfield after using commercially reasonable efforts to obtain the relevant item from Windfield.

(f) Section 8.01(y) of the Credit Agreement is hereby amended to read as follows:

(y) (i) Liens that are customary contractual rights of setoff or netting relating to (A) the establishment of depositary relations with banks not granted in connection with the issuance of Indebtedness, (B) pooled deposit or sweep accounts of the Company or any Subsidiary to permit satisfaction of overdraft or similar obligations or to secure negative cash balances in local accounts of foreign Subsidiaries incurred in the ordinary course of business of the Company or any Subsidiary, (C) purchase orders and other agreements entered into with customers of the Company or any Subsidiary in the ordinary course of business and (D) commodity trading or other brokerage accounts, and (ii) Liens on the proceeds of any Indebtedness incurred in connection with any transaction permitted hereunder, which proceeds have been deposited into an escrow account on customary terms to secure such Indebtedness pending the application of proceeds to finance such transaction;

(g) Section 8.01(dd) of the Credit Agreement is hereby amended to read as follows:

(dd) Liens other than those referred to in subparagraphs (a) through (cc) above, provided, however, that the aggregate principal amount of obligations secured by such Liens plus the aggregate principal amount of unsecured Indebtedness of Subsidiaries of the Company outstanding pursuant to Section 8.07(g) does not exceed 20% of Consolidated Net Tangible Assets as appearing in the latest balance sheet delivered pursuant to Section 7.01.

(h) Section 8.06 of the Credit Agreement is hereby amended to read as follows:

8.06 Financial Covenants.

(a) Consolidated Leverage Ratio. Permit the Consolidated Leverage Ratio as of the end of any four fiscal quarter period ending as of the end of any fiscal quarter of the Company to be greater than the maximum ratio set forth in the table below corresponding to such date:

Calendar Year	**March 31**	**June 30**	**September 30**	**December 31**
2023	3.50 to 1.0	3.50 to 1.0	3.50 to 1.0	3.50 to 1.0
2024	3.50 to 1.0	5.00 to 1.0	5.50 to 1.0	4.00 to 1.0
2025	3.75 to 1.0	3.75 to 1.0	3.50 to 1.0	3.50 to 1.0
thereafter	3.50 to 1.0	3.50 to 1.0	3.50 to 1.0	3.50 to 1.0

; provided, that, upon consummation of an Acquisition after June 30, 2025 with consideration that includes cash proceeds from the issuance of Funded Debt in excess of $500,000,000, the otherwise applicable maximum Consolidated Leverage Ratio, at the election of the Company (with prior written notice to the Administrative Agent), shall increase by 0.50:1.00 for four consecutive fiscal quarters beginning with the fiscal quarter in which such Acquisition occurs (the "Adjustment Period"). After any such Acquisition that results in an Adjustment Period, there must be at least two fiscal quarters subsequent to the end of the Adjustment Period before the Company shall be permitted to elect another Adjustment Period. The Company shall be permitted to request no more than two Adjustment Periods during the term of this Agreement; provided, however, in connection with each extension of the Maturity Date pursuant to Section 2.15, the Company shall have the right to request an additional Adjustment Period.

(b) Consolidated Interest Coverage Ratio. Permit the Consolidated Interest Coverage Ratio as of the end of any four fiscal quarter period ending as of (i) the fiscal quarter of the Company ending December 31, 2024, March 31, 2025 or June 30, 2025, to be less than 2.00 to 1.0 and (ii) any fiscal quarter of the Company thereafter, to be less than 3.00 to 1.0.

(i) Section 8.07(d) of the Credit Agreement is hereby amended to read as follows:

(d) obligations (contingent or otherwise) existing or arising under any Swap Contract (irrespective of whether such Swap Contract, when considered in isolation, mitigates or increases risk); provided that (i) such Swap Contract is entered into for a bona fide business purpose and (ii) at the time of entering into any such Swap Contract the obligations thereunder will not result in a material financial loss (as determined by the Company in good faith, taking into account any and all financial or commercial arrangements in place at such time, whether or not related to the transaction giving rise to such Swap Contract);

(j) Section 8.07(g) of the Credit Agreement is hereby amended to read as follows:

(g) other Indebtedness, provided that the aggregate outstanding principal amount of such Indebtedness shall not exceed the difference between (i) 20% of Consolidated Net Tangible Assets as appearing in the latest balance sheet delivered pursuant to Section 7.01 minus (ii) the aggregate outstanding principal amount of Indebtedness of the Company secured by Liens permitted by Section 8.01(dd);

(k) Exhibit D to the Credit Agreement is hereby amended to read as Exhibit D attached hereto.

2. Effectiveness; Conditions Precedent. This Amendment shall be and become effective as of the date when all of the conditions set forth in this Section 2 shall have been satisfied.

(a) Execution of Counterparts of Amendment. The Administrative Agent shall have received counterparts of this Amendment, which collectively shall have been duly executed on behalf of each of the Borrowers, the Administrative Agent and the Required Lenders.

(b) Consent Fees. The Company shall have paid all separately agreed consent fees to each Lender executing this Amendment.

3. Expenses. The Borrowers agree to reimburse the Administrative Agent for all reasonable and documented out-of-pocket costs and expenses of the Administrative Agent in connection with the preparation, execution and delivery of this Amendment, including without limitation the reasonable and documented fees and expenses of Moore & Van Allen PLLC.

4. Ratification. Each Borrower acknowledges and consents to the terms set forth herein and agrees that this Amendment does not impair, reduce or limit any of its obligations under the Loan Documents, as amended hereby. This Amendment is a Loan Document.

5. Authority/Enforceability. Each Borrower represents and warrants as follows:

(a) It has taken all necessary action to authorize the execution, delivery and performance of this Amendment.

(b) This Amendment has been duly executed and delivered by such Borrower and constitutes its legal, valid and binding obligations, enforceable in accordance with its terms, except as such enforceability may be subject to (i) applicable Debtor Relief Laws, (ii) fraudulent transfer or conveyance laws, and (iii) general principles of equity (regardless of whether such enforceability is considered in a proceeding at law or in equity).

(c) No consent, approval, authorization or order of, or filing, registration or qualification with, any court or Governmental Authority or third party is required in connection with the execution, delivery or performance by such Borrower of this Amendment, except for those the failure to obtain, occur or make would not reasonably be expected to have a Material Adverse Effect.

(d) The execution and delivery of this Amendment does not (i) violate, contravene or conflict with any provision of its Organization Documents or (ii) violate, contravene or conflict with any Laws applicable to it, except in the case of clause (ii), to the extent that it would not reasonably be expected to have a Material Adverse Effect.

6. Representations and Warranties of the Borrowers. Each Borrower represents and warrants to the Lenders that after giving effect to this Amendment (a) the representations and warranties set forth in Article VI of the Credit Agreement are true and correct in all material respects as of the date hereof unless they specifically refer to an earlier date, in which case they shall be true and correct in all material respects as of such earlier date, and (b) no Default exists.

7. Counterparts/Telecopy. This Amendment may be executed in any number of counterparts, each of which when so executed and delivered shall be an original, but all of which shall constitute one and the same instrument. Delivery of executed counterparts of this Amendment by telecopy or other secure electronic format (.pdf) shall be effective as an original.

8. GOVERNING LAW. THIS AMENDMENT AND THE RIGHTS AND OBLIGATIONS OF THE PARTIES HEREUNDER SHALL BE GOVERNED BY AND CONSTRUED IN ACCORDANCE WITH THE LAWS OF THE STATE OF NEW YORK.

9. Successors and Assigns. This Amendment shall be binding upon and inure to the benefit of the parties hereto and their respective successors and assigns.

10. Headings. The headings of the sections hereof are provided for convenience only and shall not in any way affect the meaning or construction of any provision of this Amendment.

11. Severability. If any provision of this Amendment is held to be illegal, invalid or unenforceable, (a) the legality, validity and enforceability of the remaining provisions of this Amendment shall not be affected or impaired thereby and (b) the parties shall endeavor in good faith negotiations to replace the illegal, invalid or unenforceable provisions with valid provisions the economic effect of which comes as close as possible to that of the illegal, invalid or unenforceable provisions. The invalidity of a provision in a particular jurisdiction shall not invalidate or render unenforceable such provision in any other jurisdiction.

[*signature pages follow*]

Each of the parties hereto has caused a counterpart of this Amendment to be duly executed and delivered as of the date first above written.

BORROWERS: ALBEMARLE CORPORATION,
a Virginia corporation

By: /s/ Amy M. Dunbar
Name: Amy M. Dunbar
Title: Vice President and Treasurer

ALBEMARLE EUROPE SRL,
a *société à responsabilité limitée* organized under the laws of Belgium

By: /s/ Theo Moons
Name: Theo Moons
Title: Managing Director

ADMINISTRATIVE
AGENT: BANK OF AMERICA, N.A.,
as Administrative Agent

By: /s/ DeWayne D. Rosse
Name: DeWayne D. Rosse
Title: Assistant Vice President

LENDERS: BANK OF AMERICA, N.A.,

as a Lender, Swing Line Lender and L/C Issuer

By: /s/ Bettina Buss

Name: Bettina Buss

Title: Director

JPMORGAN CHASE BANK, N.A.,
as a Lender and L/C Issuer

By: /s/ Kody J. Nerios
Name: Kody J. Nerios
Title: Authorized Officer

HSBC BANK USA, NATIONAL ASSOCIATION,
as a Lender and L/C Issuer

By: /s/ Peggy Yip
Name: Peggy Yip
Title: Director

MIZUHO BANK, LTD.,
as a Lender and L/C Issuer

By: /s/ Donna DeMagistris
Name: Donna DeMagistris
Title: Executive Director

BANCO SANTANDER, S.A., NEW YORK BRANCH,
as a Lender

By: /s/ Andres Barbosa
Name: Andres Barbosa
Title: Managing Director

By: /s/ Arturo Prieto
Name: Arturo Prieto
Title: Managing Director

GOLDMAN SACHS BANK USA,
as a Lender

By: /s/ Priyankush Goswami
Name: Priyankush Goswami
Title: Authorized Signatory

MUFG BANK, LTD., as a Lender

By: /s/ Jorge Georgalos
Name: Jorge Georgalos
Title: Authorized Signatory

SUMITOMO MITSUI BANKING CORPORATION,
as a Lender

By: /s/ Jun Ashley______
Name: Jun Ashley
Title: Director

TRUIST BANK,
as a Lender

By: /s/ Iryna Kolos
Name: Iryna Kolos
Title: Vice President

U.S. BANK NATIONAL ASSOCIATION,
as a Lender

By: /s/ Sawyer Johnson
Name: Sawyer Johnson
Title: Vice President

BANK OF CHINA, NEW YORK BRANCH,
as a Lender

By: /s/ Raymond Qiao
Name: Raymond Qiao
Title: Executive Vice President

THE NORTHERN TRUST COMPANY,
as a Lender

By: /s/ Andrew D. Holtz
Name: Andrew D. Holtz
Title: Senior Vice President

Exhibit D

FORM OF COMPLIANCE CERTIFICATE

☐ Check for distribution to public and private side Lenders[1]

Financial Statement Date: , 20__

To: Bank of America, N.A., as Administrative Agent

Re: Amended and Restated Credit Agreement dated as of October 28, 2022 (as amended, restated, extended, supplemented or otherwise modified in writing from time to time, the "Credit Agreement") among Albemarle Corporation, a Virginia corporation (the "Company"), Albemarle Europe SRL, a private limited liability company organized under the laws of Belgium ("*société à responsabilité limitée*") (the "Belgian Borrower" and together with the Company and any other Subsidiary of the Company party to the Credit Agreement pursuant to Section 2.14 thereof, collectively, the "Borrowers"), the Lenders from time to time party thereto, and Bank of America, N.A., as Administrative Agent and Swing Line Lender. Capitalized terms used but not otherwise defined herein have the meanings provided in the Credit Agreement.

Ladies and Gentlemen:

The undersigned Responsible Officer hereby certifies as of the date hereof that [he/she] is the ____ of the Company, and that, in [his/her] capacity as such, [he/she] is authorized to execute and deliver this Certificate to the Administrative Agent on the behalf of the Company, and that:

[Use following paragraph 1 for fiscal year-end financial statements:]

[1. Attached hereto as Schedule 1 are the audited financial statements required by Section 7.01(a) of the Credit Agreement for the fiscal year of the Company ended as of the above date, together with the report and opinion of an independent certified public accountant required by such section.]

[Use following paragraph 1 for fiscal quarter-end financial statements:]

[1. Attached hereto as Schedule 1 are the unaudited financial statements required by Section 7.01(b) of the Credit Agreement for the fiscal quarter of the Company ended as of the above date. Such financial statements fairly present the financial condition, results of operations and cash flows of the Consolidated Group in all material respects in accordance with GAAP as of the above date and for such period, subject only to normal year-end audit adjustments and the absence of footnotes.]

[Use following paragraph 1 for year-end financial statements of Windfield and its Subsidiaries:][2]

[1. Attached hereto as Schedule 1 is the consolidated statement of financial position of Windfield and its Subsidiaries, and the related consolidated statements of profit or loss and other comprehensive income,

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[1] If this box is not checked, this certificate will only be posted to private side Lenders.

[2] To be removed if not delivered together with the Albemarle financial statements.

changes in equity and cash flows for such fiscal year, required by Section 7.01(c)(i) of the Credit Agreement for the fiscal year of the Company ended as of the above date, together with the report and opinion of an independent certified public accountant required by such section.]

[Use following paragraph 1 for quarter-end financial statements of Windfield and its Subsidiaries:][3]

[1. Attached hereto as Schedule 1 is the consolidated statement of financial position of Windfield and its Subsidiaries, and the related consolidated statements of profit or loss and other comprehensive income and cash flows for such fiscal quarter and for the portion of Windfield's fiscal year then ended, required by Section 7.01(c)(ii) of the Credit Agreement for the fiscal quarter of the Company ended as of the above date.]

[select one:][4]

[2. To the best knowledge of the undersigned during such fiscal period, no Default or Event of Default exists as of the date hereof.]

[or:]

[the following is a list of each existing Default or Event of Default, the nature and extent thereof, and the proposed actions of the Borrowers with respect thereto:]

3. The representations and warranties of the Borrowers contained in Article VI of the Credit Agreement, or which are contained in any document furnished at any time under or in connection with the Loan Documents, are true and correct in all material respects on and as of the date hereof, except to the extent that such representations and warranties specifically refer to an earlier date, in which case they are true and correct in all material respects as of such earlier date, and except that for purposes of this Compliance Certificate, the representations and warranties contained in subsections (a) and (b) of Section 6.05 of the Credit Agreement shall be deemed to refer to the most recent financial statements furnished pursuant to clauses (a) and (b), respectively, of Section 7.01 of the Credit Agreement, including the statements in connection with which this Compliance Certificate is delivered.

4. The financial covenant analyses and information set forth on Schedule 2 attached hereto (i) are true and accurate on and as of the date of this Certificate and (ii) demonstrate compliance with Section 8.06 of the Credit Agreement.

5. Set forth below is a summary of all material changes in GAAP affecting the Company and in the consistent application thereof by the Company occurring during the most recent fiscal quarter ending prior to the date hereof, the effect on the financial covenants resulting therefrom, and a reconciliation between calculation of the financial covenants before and after giving effect to such changes:

Delivery of an executed counterpart of a signature page of this Certificate by fax transmission or other electronic mail transmission (e.g. "pdf" or "tif") shall be effective as delivery of a manually executed counterpart of this Certificate.

[*signature page follows*]

[3] To be removed if not delivered together with the Albemarle financial statements.

[4] Items 2-4 are to be included in connection with the delivery of the financial statements of the Consolidated Group.

IN WITNESS WHEREOF, the undersigned has executed this Certificate as of __________ ___, ______.

ALBEMARLE CORPORATION,
a Virginia corporation

By:__________
Name:
Title:

Schedule 1
to Compliance Certificate

[Use the option below for the delivery of financial statements of the Consolidated Group]

[Financial statements for the fiscal [year][quarter] of the Company ended as of __________, 20__]

[Use the option below for delivery of financial statements of Windfield and its Subsidiaries]

[Financial statements for the fiscal [year][quarter] of the Company ended as of ________, 20__]

[*see attached*]

Schedule 2
to Compliance Certificate

Computation of Financial Covenants[5]

1. Consolidated Leverage Ratio[6]

(a) Consolidated Funded Debt as of such date:

(i) all obligations for borrowed money, whether current or long-term (including the Obligations under the Credit Agreement), and all obligations evidenced by bonds, debentures, notes, loan agreements or other similar instruments, including convertible debt instruments $____

(ii) all purchase money indebtedness (including indebtedness and obligations in respect of conditional sales and title retention arrangements, except for customary conditional sales and title retention arrangements with suppliers that are entered into in the ordinary course of business) and all indebtedness and obligations in respect of the deferred purchase price of property or services (other than trade accounts payable incurred in the ordinary course of business and payable on customary trade terms) $____

(iii) all contingent obligations under letters of credit (including standby and commercial), bankers' acceptances, bank guaranties, surety bonds and similar instruments $____

(iv) the Attributable Principal Amount of capital leases and Synthetic Leases $____

(v) the Attributable Principal Amount of Securitization Transactions $____

(vi) all preferred stock and comparable equity interests providing for mandatory redemption, sinking fund or other like payments within 91 days following the Maturity Date currently in effect $____

(vii) Guarantees in respect of Funded Debt of another Person $____

(viii) Funded Debt of any partnership or joint venture or other similar entity in which such Person is a general partner or joint venturer,

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[5] In the event of any conflict between the formulas set forth herein and the formulas provided in the Credit Agreement, the Credit Agreement shall govern.

[6] With respect to any PILOT Transaction: (a) the Attributable Principal Amount of the PILOT-Related Capital Lease shall be deemed to be equal to zero, (b) the Consolidated Interest Charges on any such Attributable Principal Amount (described in the prior clause (a)) shall be deemed to be equal to zero, and (c) the net income from any interest earned with respect to any related Member-Held LRBs shall be deemed to be equal to zero.

and, as such, has personal liability for such obligations, but only to the extent there is recourse to such Person for payment thereof $____

(ix) Consolidated Funded Debt[7]
[1(a)(i) + 1(a)(ii) + 1(a)(iii) + 1(a)(iv) + 1(a)(v) + 1(a)(vi) + 1(a)(vii) + 1(a)(viii)] $____

(b) Windfield Funded Debt as of such date

(i) the Funded Debt of Windfield and its Subsidiaries determined on a consolidated basis in accordance with International Financial Reporting Standards (and converted to Dollars by the Company based on the prevailing currency exchange rate in effect on such date) $____

(ii) the Windfield Ownership Percentage as of such date $____

(iii) Windfield Funded Debt
[1(b)(i) x 1(b)(ii)] $____

(c) Unrestricted Cash as of such date $____

(d) Windfield Unrestricted Cash as of such date

(i) the cash and cash equivalents owned as of such date by Windfield or any of its Subsidiaries, determined on a consolidated basis in accordance with International Financial Reporting Standards (and converted to Dollars by the Company based on the prevailing currency exchange rate in effect on such date); provided that such cash and cash equivalents do not appear (and in accordance with International Financial Reporting Standards would not be required to appear) as "restricted" on the consolidated statement of financial position of Windfield prepared as of such date in accordance with International Financial Reporting Standards $____

(ii) the Windfield Ownership Percentage as of such date $____

(iii) Windfield Unrestricted Cash (not to exceed Windfield Funded Debt (1(b)(iii)) as of such date)
[1(d)(i) x 1(d)(ii)] $____

(e) Consolidated Windfield-Adjusted EBITDA for the period of the four fiscal quarters ending on such date:

[7] The amount of Funded Debt shall be determined based on the outstanding principal amount in the case of borrowed money indebtedness under clause (a) and purchase money indebtedness and the deferred purchase obligations under clause (b), based on the maximum amount available to be drawn in the case of letter of credit obligations and the other obligations under clause (c), and based on the outstanding principal amount of Funded Debt that is the subject of the Guarantees in the case of Guarantees under clause (g) or, if less, the amount expressly guaranteed.

(i) Consolidated Net Income for such period $____

To the extent deducted in calculating such Consolidated Net Income without duplication, items 1(e)(ii) – 1(e)(x):

(ii) Consolidated Interest Charges for such period $____

(iii) the provision for federal, state, local and foreign income taxes payable by the Consolidated Group for such period $____

(iv) the amount of depreciation and amortization expense for such period $____

(v) non-cash expenses for such period (excluding any non-cash expense to the extent that it represents an accrual of or reserve for cash payments in any future period and any inventory valuation related charge) $____

(vi) non-cash goodwill impairment charges $____

(vii) any non-cash loss attributable to the mark-to-market adjustments in the valuation of pension liabilities (to the extent the cash impact resulting from such loss has not been realized) in accordance with Accounting Standards Codification 715 (ASC 715) $____

(viii) any fees, expenses or charges (other than depreciation or amortization expense) related to any Acquisition, Disposition, issuance of equity interests, other transactions (excluding intercompany transactions) permitted by Section 8.02 of the Credit Agreement, or the incurrence of Indebtedness not prohibited by the Credit Agreement (including any refinancing or amendment thereof) (in each case, whether or not consummated), including, but not limited to, such fees, expenses or charges related to the Credit Agreement and the other Loan Documents and any amendment or other modification of the Credit Agreement or the other Loan Documents $____

(ix) any expense to the extent that a corresponding amount is received during such period in cash by the Company or any of its Subsidiaries under any agreement providing for indemnification or reimbursement of such expenses $____

(x) any expense with respect to liability or casualty events or business interruption to the extent reimbursed to the Company or any of its Subsidiaries during such period by third party insurance $____

(xi) the amount of dividends or distributions or other payments (including any ordinary course dividend, distribution or other payment) that are actually received in cash (or converted into cash) for such period by a member of the Consolidated Group from any Person that is not a member of the Consolidated Group or otherwise in respect of any unconsolidated investment (other than any such dividends, distributions and payments received from Windfield in respect of the Consolidated Group's ownership interest in Windfield) $____

To the extent included in calculating such Consolidated Net Income, items 1(e)(xii) and 1(e)(xiii):

(xii) non-cash income during such period (excluding any non-cash income to the extent that it represents cash receipts in any future period and any inventory valuation related income) $____

(xiii) any non-cash gains attributable to the mark-to-market adjustments in the valuation of pension liabilities in accordance with Accounting Standards Codification 715 (ASC 715) $____

(xiv) the Windfield Earnings Amount for such period

(1) the Consolidated Group's equity in net income of unconsolidated investments for such period attributable to Windfield, as disclosed in the Company's Annual Report on Form 10-K or Quarterly Report on Form 10-Q, as applicable $____

(2) the then prevailing Australian federal income tax rate for such period (expressed as a decimal) ____

(3) the Windfield Earnings Amount
[1(e)(xiv)(1) / (1 – 1(e)(xiv)(2))] $____

(xv) Consolidated Windfield-Adjusted EBITDA
[1(e)(i) + 1(e)(ii) + 1(e)(iii) + 1(e)(iv) + 1(e)(v) + 1(e)(vi) + 1(e)(vii) + 1(e)(viii) + 1(e)(ix) + 1(e)(x) + 1(e)(xi) – 1(e)(xii) – 1(e)(xiii) + 1(e)(xiv)(3)]

$____

(f) Consolidated Leverage Ratio
[((1(a)(ix) + 1(b)(iii)) – (1(c) + 1(d)(iii))) / 1(e)(xv)] __________:1.0

2. Consolidated Interest Coverage Ratio

(a) Consolidated EBITDA for the period of the four fiscal quarters ending on such date:

(i) Consolidated Net Income for such period $____

To the extent deducted in calculating such Consolidated Net Income (other than clause (c)(xi) below), without duplication:

(ii) Consolidated Interest Charges for such period $____

(iii) the provision for federal, state, local and foreign income taxes payable by the Consolidated Group for such period $____

(iv) the amount of depreciation and amortization expense for such period $____

(v) non-cash expenses for such period (excluding any non-cash expense to the extent that it represents an accrual of or reserve for cash payments in any future period and any inventory valuation related charge) $____

(vi) non-cash goodwill impairment charges $____

(vii) any non-cash loss attributable to the mark-to-market adjustments in the valuation of pension liabilities (to the extent the cash impact resulting from such loss has not been realized) in accordance with Accounting Standards Codification 715 (ASC 715) $____

(viii) any fees, expenses or charges (other than depreciation or amortization expense) related to any Acquisition, Disposition, issuance of equity interests, other transactions (excluding intercompany transactions) permitted by Section 8.02 of the Credit Agreement, or the incurrence of Indebtedness not prohibited by the Credit Agreement (including any refinancing or amendment thereof) (in each case, whether or not consummated), including, but not limited to, such fees, expenses or charges related to the Credit Agreement and the other Loan Documents and any amendment or other modification of the Credit Agreement or the other Loan Documents $____

(ix) any expense to the extent that a corresponding amount is received during such period in cash by the Company or any of its Subsidiaries under any agreement providing for indemnification or reimbursement of such expenses $____

(x) any expense with respect to liability or casualty events or business interruption to the extent reimbursed to the Company or any of its Subsidiaries during such period by third party insurance $____

(xi) the amount of dividends or distributions or other payments (including any ordinary course dividend, distribution or other payment) that are actually received in cash (or converted into cash) for such period by a member of the Consolidated Group from any Person that is not a member of the Consolidated Group or otherwise in respect of any unconsolidated investment $____

To the extent included in calculating such Consolidated Net Income:

(xii) non-cash income during such period (excluding any non-cash income to the extent that it represents cash receipts in any future period and any inventory valuation related income) $____

(xiii) any non-cash gains attributable to the mark-to-market adjustments in the valuation of pension liabilities in accordance with Accounting Standards Codification 715 (ASC 715) $____

(xiv) Consolidated EBITDA
[2(a)(i) + 2(a)(ii) + 2(a)(iii) + 2(a)(iv) + 2(a)(v) + 2(a)(vi) + 2(a)(vii) + 2(a)(viii) + 2(a)(ix) + 2(a)(x) + 2(a)(xi) – 2(a)(xii) – 2(a)(xiii)] $____

(b) Consolidated Interest Charges for the period of four fiscal quarters ending on such date:

$____

(c) Consolidated Interest Coverage Ratio
[2(a)(xiv) / 2(b)] __________:1.0

ALBEMARLE CORPORATION
COMPENSATION RECOUPMENT AND FORFEITURE POLICY

Section 1. *Purpose*. The purpose of this policy (this "*Policy*") is to enable Albemarle Corporation (the "*Corporation*") to recover erroneously awarded compensation upon Misconduct. This Policy is effective on December 1, 2023. Where the context requires, references to the Corporation include the Corporation's subsidiaries and affiliates.

Section 2. *Recovery of Incentive Compensation*. This Policy applies to incentive compensation received by a participant in any incentive compensation arrangement maintained by the Corporation (including time-based equity awards). If the Corporation determines that a participant engaged in Misconduct, the Corporation may, in its discretion, recover incentive compensation received by the participant during and after the period in which the Misconduct occurred. Misconduct must have occurred within the three years preceding the date on which the Corporation determines that the Misconduct has occurred. The Corporation will determine the amount of incentive compensation to be recovered in its discretion based upon the relevant participant's relative degree of fault and involvement, the impact of the conduct on the Corporation, the magnitude of any loss caused and other relevant facts and circumstances. The Corporation may effect recovery in any manner consistent with applicable law.

Section 3. *Misconduct*. "*Misconduct*" means: (a) any intentional misconduct by a participant, including misappropriation, fraud, embezzlement, unethical behavior, or theft, in connection with the participant's duties to the Corporation, that causes, or is reasonably likely to cause, material harm to the Corporation, financially, reputationally, or otherwise; or (b) knowing and material violation of specific prohibitions or requirements in the Corporation's policies, codes of conduct or agreements or arrangements between the Corporation and the participant (including confidentiality, solicitation and post-employment obligations).

Section 4. *Miscellaneous*. The provisions in this Policy are intended to be applied to the fullest extent of the law. To the extent that any provision of this Policy is found to be unenforceable or invalid under any applicable law, the provision will be applied to the maximum extent permitted. The Corporation may amend this Policy from time to time in its discretion. This Policy will not limit the rights of the Corporation to take any other actions under any other Corporation policy or applicable law. All determinations and decisions made by the Corporation pursuant to the provisions of this Policy will be final, conclusive and binding. This Policy supersedes any existing policy of the Corporation with respect to the subject matter hereof.

Exhibit 21.1

SUBSIDIARIES OF ALBEMARLE CORPORATION

NAME	PLACE OF FORMATION
ACI Cyprus, L.L.C.	Delaware
Albemarle Amendments, LLC	Delaware
Albemarle Argentina S.R.L.	Argentina
Albemarle Australia Company Pty Ltd	Australia
Albemarle Australia Holding Company Pty Ltd	Australia
Albemarle Chemical Canada Ltd.	Canada
Albemarle Chemicals (Shanghai) Co., Ltd.	China
Albemarle Chemicals Ltd	Cyprus
Albemarle Chemicals SAS	France
Albemarle Chemicals South Africa (Proprietary) Limited	South Africa
Albemarle Chemicals Trading Ltd	United Arab Emirates
Albemarle Delaware Holdings 1 LLC	Delaware
Albemarle Delaware Holdings 2 LLC	Delaware
Albemarle Dutch Holdings B.V.	Netherlands
Albemarle Europe SRL	Belgium
Albemarle Finance Company B.V.	Netherlands
Albemarle Foundation	Virginia
Albemarle Germany GmbH	Germany
Albemarle Hilfe GmbH Unterstützungskasse	Germany
Albemarle Holdings Company Limited	Turks & Caicos
Albemarle Holdings Limited	Hong Kong
Albemarle Hungary Ltd.	Hungary
Albemarle India New Materials Private Limited	India
Albemarle Italy S.r.l.	Italy
Albemarle Japan Corporation	Japan
Albemarle Japan Holdings B.V.	Netherlands
Albemarle Knight Lux 1 Holdings Corporation	Delaware
Albemarle Korea Corporation	Korea
Albemarle Limitada	Chile
Albemarle Lithium Holding Corporation	Delaware
Albemarle Lithium Holding GmbH	Germany
Albemarle Lithium (Jiangsu) Co., Ltd.	China
Albemarle Lithium Pty Ltd	Australia
Albemarle Lithium Spain S.L.	Spain
Albemarle Lithium UK Limited	United Kingdom
Albemarle Management (Shanghai) Co., Ltd.	China
Albemarle Middle East FZE	United Arab Emirates
Albemarle Middle East Trading Company L.L.C.	United Arab Emirates
Albemarle Netherlands B.V.	Netherlands
Albemarle New Holding GmbH	Germany
Albemarle Overseas Employment Corporation	Virginia
Albemarle Saudi Trading Company	Saudi Arabia
Albemarle Sichuan New Materials Co., Ltd.	China
Albemarle Specialties Trading Company	Saudi Arabia

NAME	PLACE OF FORMATION
Albemarle Specialty Products Singapore Pte. Ltd.	Singapore
Albemarle Taiwan Limited	Taiwan
Albemarle U.S., Inc.	Delaware
Albemarle Wodgina Pty Ltd	Australia
CMC Lithium Pty Ltd	Australia
Dynamit Nobel GmbH	Germany
Dynamit Nobel Unterstützungsfonds GmbH	Germany
Excalibur Realty Company	Delaware
Excalibur II Realty Company	Delaware
Foote Chile Holding Company	Delaware
Foote Minera e Inversiones Limitada	Chile
Genesis Voyager Pty Ltd	Australia
Guangxi Albemarle Lithium Co., Ltd.	China
Jiangxi Albemarle Lithium Co., Ltd.	China
Jordan Bromine Company Ltd.	Jordan
Ketjen Belgium SRL	Belgium
Ketjen Brazil Holdings Limitada	Brazil
Ketjen Brazil Limitada	Brazil
Ketjen Canada Limited	Canada
Ketjen Catalysts (Shanghai) Company Limited	China
Ketjen Corporation	Delaware
Ketjen Hungary Limited Liability Company	Hungary
Ketjen India Private Limited	India
Ketjen Italy S.r.l.	Italy
Ketjen Japan GK	Japan
Ketjen Korea Limited	Republic of Korea
Ketjen Limited Liability Company	Delaware
Ketjen Malaysia Sdn Bhd.	Malaysia
Ketjen Netherlands B.V.	Netherlands
Ketjen Netherlands Holdings B.V.	Netherlands
Ketjen Netherlands Holdings 2 B.V.	Netherlands
Ketjen Singapore Private Limited	Singapore
Ketjen Spain, S.L.	Spain
Ketjen Taiwan Company Limited	Taiwan
Ketjen (Thailand) Co., Ltd.	Thailand
Ketjen UK Limited	United Kingdom
Ketjen Vietnam Limited Liability Company	Vietnam
Knight Lux 1 S.à r.l.	Luxembourg
Knight Lux 2 S.à r.l.	Luxembourg
MARBL Lithium Operations Pty Ltd	Australia
Metalon Environmental Management & Solutions GmbH	Germany
Outfield Limited	Canada
PT Ketjen Catalysts Indonesia	Indonesia
Rockwood Holdings, Inc.	Delaware
Rockwood Lithium Japan K.K.	Japan
Rockwood Lithium Korea LLC	Republic of Korea

NAME	PLACE OF FORMATION
Rockwood Lithium (Shanghai) Co., Ltd.	China
Rockwood Lithium Taiwan Co., Ltd.	Taiwan
Rockwood Specialties GmbH	Germany
Rockwood Specialties Group, LLC	Delaware
Rockwood Specialties LLC	Delaware
Rockwood Specialties Limited	United Kingdom
RSG Immobilien GmbH	Germany
RT Lithium Limited	United Kingdom
Sales de Magnesio Limitada	Chile
Shandong Sinobrom Albemarle Bromine Chemicals Company Limited	China
Sichuan Guorun New Material Co., Ltd.	China
Titus Minerals Pty Ltd	Australia
Voyager Holding Company Pty Ltd	Australia
Western Lithium Pty Ltd	Australia

Exhibit 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statements on Form S-3 (No. 333-269815) and on Form S-8 (No. 333-150694, 333-166828, 333-188599, 333-223167 and 333-271578) of Albemarle Corporation of our report dated February 14, 2024 relating to the financial statements and the effectiveness of internal control over financial reporting, which appears in this Form 10-K.

/s/ PricewaterhouseCoopers LLP
Charlotte, North Carolina
February 14, 2024

Exhibit 23.2

February 14, 2024

CONSENT OF QUALIFIED PERSON

SRK Consulting (U.S.), Inc. (“SRK”), in connection with Albemarle Corporation’s Annual Report on Form 10-K for the year ended December 31, 2023 (the “Form 10-K”), consents to:

- the public filing by the Company and use of:

  1. the technical report titled “SEC Technical Report Summary Pre-Feasibility Study Greenbushes Mine Western Australia” (the “Greenbushes Technical Report Summary”), with an effective date of June 30, 2023 and dated February 9, 2024;

  2. the technical report titled “SEC Technical Report Summary Pre-Feasibility Study Salar de Atacama Region II, Chile” (the “Salar de Atacama Technical Report Summary”), with an effective date of August 31, 2022 and dated February 14, 2023; and

  3. the technical report titled “SEC Technical Report Summary Pre-Feasibility Study Silver Peak Lithium Operation Nevada, USA” (the “Silver Peak Technical Report Summary”), with an effective date of September 30, 2022 and dated February 14, 2023; and

  4. the technical report titled “SEC Technical Report Summary Initial Assessment Wodgina Western Australia” (the “Wodgina Technical Report Summary” and together with the Greenbushes Technical Report Summary, the Salar de Atacama Technical Report Summary and the Silver Peak Technical Report Summary, the “Technical Report Summaries”), with an effective date of December 31, 2022 and dated February 14, 2023

  that were prepared in accordance with Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission and filed as exhibits to this Form 10-K (with the exception of the Salar de Atacama Technical Report Summary and the Silver Peak Technical Report Summary, which were filed as exhibits to the Current Report on Form 8-K filed on February 15, 2023 (the “Form 8-K”) and referenced in the Form 10-K).

- the incorporation by reference of the Technical Report Summaries into the Company’s Registration Statements on Form S-3 (No. 333-269815) and the Registration Statements on Form S-8 (No. 333-150694, 333-166828, 333-188599, 333-223167 and 333-271578) (collectively, the “Registration Statements”);

- the use of and references to our name, including our status as an expert or “qualified person” (as defined in Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission), in connection with the Form 10-K, the Form 8-K, the Registration Statements and the Technical Report Summaries; and

- any extracts from or a summary of the Technical Report Summaries in the Form 10-K and incorporated by reference in the Registration Statements and the use of any information derived, summarized, quoted, or referenced from the Technical Report Summaries, or portions thereof, that was prepared by us, that we supervised the preparation of, and/or that was reviewed and approved by us, that is included or incorporated by reference in the Form 10-K and Registration Statements.

SRK is responsible for authoring, and this consent pertains to, the Technical Report Summary. SRK certifies that it has read the Form 10-K and that it fairly and accurately represents the information in the Technical Report Summary for which it is responsible.

/s/ SRK Consulting (U.S.), Inc.

SRK Consulting (U.S.), Inc.

February 14, 2024

CONSENT OF QUALIFIED PERSON

Fastmarkets Group Limited ("Fastmarkets"), in connection with Albemarle Corporation's Annual Report on Form 10-K for the year ended December 31, 2023 (the "Form 10-K"), consents to:

- the public filing by the Company and use of:

    1. the technical report titled "SEC Technical Report Summary Pre-Feasibility Study Salar de Atacama Region II, Chile" (the "Technical Report Summary"), which contains Fastmarkets' report on market studies in Section 16 thereof (the "Salar Market Studies Report") with an effective date of August 31, 2022 and dated February 14, 2023;

    2. the technical report titled "SEC Technical Report Summary Pre-Feasibility Study Silver Peak Lithium Operation Nevada, USA", which contains Fastmarkets' report on market studies in Section 16 thereof (the "Silver Peak Market Studies Report") with an effective date of September 30, 2022 and dated February 14, 2023; and

    3. the technical report titled "Technical Report Summary Pre-Feasibility Study Greenbushes Mine Western Australia", which contains Fastmarkets' report on market studies in Section 16 thereof (the "Greenbushes Market Studies Report", and, together with the Salar Market Studies Report and the Silver Peak Market Report, the "Market Studies Reports") with an effective date of June 30, 2023 and dated February 1, 2024

  that were prepared in accordance with Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission, as exhibits to this Form 10-K (with the exception of the Salar de Atacama Technical Report Summary and the Silver Peak Technical Report Summary, which were filed as exhibits to the Current Report on Form 8-K filed on February 15, 2023 (the "Form 8-K") and referenced in the Form 10-K).

- the incorporation by reference of the Market Studies Reports into the Company's Registration Statements on Form S-3 (No. 333-269815) and the Registration Statements on Form S-8 (No. 333-150694, 333-166828, 333-188599, 333-223167 and 333-271578) (collectively, the "Registration Statements");

- the use of and references to our name, including our status as an expert or "qualified person" (as defined in Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission), in connection with the Form 10-K, the Form 8-K, the Registration Statements and the Market Studies Reports; and

- any extracts from or a summary of the Market Studies Reports in the Form 10-K and incorporated by reference in the Registration Statements and the use of any information derived, summarized, quoted, or referenced from the Market Studies Reports, or portions thereof, that was prepared by us, that we supervised the preparation of, and/or that was reviewed and approved by us, that is included or incorporated by reference in the Form 10-K and Registration Statements.

Fastmarkets is responsible for authoring, and this consent pertains to, the Market Studies Reports. Fastmarkets certifies that it has read the Form 10-K and that it fairly and accurately represents the information in the Market Studies Reports for which it is responsible.

Fastmarkets

8 Bouverie Street
London
EC4Y 8AX

By: /s/ Brian Levich

Name: Mr. Brian Levich
Title: Consultancy and Special Projects Director

February 14, 2024

CONSENT OF QUALIFIED PERSON

RPS Energy Canada Ltd. (“RPS”), in connection with Albemarle Corporation’s Annual Report on Form 10-K for the year ended December 31, 2023 (the “Form 10-K”), consents to:

- the public filing by the Company and use of:
  - the technical report titled “SEC Technical Report Summary for Jordan Bromine Operation” (the “Jordan Bromine Technical Report Summary”), with an effective date of December 31, 2023 and dated February 14, 2024;
  - the technical report titled “SEC Technical Report Summary for Magnolia Field Bromine Reserves” (the “Magnolia Technical Report Summary” and together with the Jordan Bromine Technical Report Summary, the “Technical Report Summaries”), with an effective date of December 31, 2023 and dated February 14, 2024

  that were prepared in accordance with Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission and filed as exhibits to this Form 10-K;
- the incorporation by reference of the Technical Report Summaries into the Company’s Registration Statements on Form S-3 (No. 333-269815) and the Registration Statements on Form S-8 (No. 333-150694, 333-166828, 333-188599, 333-223167 and 333-271578) (collectively, the “Registration Statements”);
- the use of and references to our name, including our status as an expert or “qualified person” (as defined in Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission), in connection with the Form 10-K, the Registration Statements and the Technical Report Summaries; and
- any extracts from or a summary of the Technical Report Summaries in the Form 10-K and incorporated by reference in the Registration Statements and the use of any information derived, summarized, quoted, or referenced from the Technical Report Summaries, or portions thereof, that was prepared by us, that we supervised the preparation of, and/or that was reviewed and approved by us, that is included or incorporated by reference in the Form 10-K and the Registration Statements.

RPS is responsible for authoring, and this consent pertains to, the Technical Report Summaries. RPS certifies that it has read the Form 10-K and that it fairly and accurately represents the information in the Technical Report Summaries for which it is responsible.

RPS Energy Canada Ltd.

By: /s/ Michael Gallup

Name: Michael Gallup
Title: Technical Director - Engineering

February 14, 2024

CONSENT OF QUALIFIED PERSON

RESPEC, in connection with Albemarle Corporation's Annual Report on Form 10-K for the year ended December 31, 2023 (the "Form 10-K"), consents to:

- the public filing by the Company and use of the technical report titled "SEC Technical Report Summary for Jordan Bromine Operation" (the "Jordan Bromine Technical Report Summary"), with an effective date of December 31, 2023 and dated February 14, 2024, that was prepared in accordance with Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission, as an exhibit to this Form 10-K;

- the incorporation by reference of the Jordan Bromine Technical Report Summary into the Company's Registration Statements on Form S-3 (No. 333-269815) and the Registration Statements on Form S-8 (No. 333-150694, 333-166828, 333-188599, 333-223167 and 333-271578) (collectively, the "Registration Statements");

- the use of and references to our name, including our status as an expert or "qualified person" (as defined in Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission), in connection with the Form 10-K, the Registration Statements and the Jordan Bromine Technical Report Summary; and

- any extracts from or a summary of the Jordan Bromine Technical Report Summary in the Form 10-K and incorporated by reference in the Registration Statements and the use of any information derived, summarized, quoted, or referenced from the Jordan Bromine Technical Report Summary, or portions thereof, that was prepared by us, that we supervised the preparation of, and/or that was reviewed and approved by us, that is included or incorporated by reference in the Form 10-K and the Registration Statements.

RESPEC is responsible for authoring, and this consent pertains to, the Jordan Bromine Technical Report Summary. RESPEC certifies that it has read the Form 10-K and that it fairly and accurately represents the information in the Jordan Bromine Technical Report Summary for which it is responsible.

RESPEC Company, LLC

By: /s/ Peter Christensen

Name: Peter Christensen
Title: Principal Consultant

Exhibit 31.1

CERTIFICATION OF PRINCIPAL EXECUTIVE OFFICER

I, J. Kent Masters, certify that:

1. I have reviewed this Annual Report on Form 10-K of Albemarle Corporation for the period ended December 31, 2023;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 14, 2024

/s/ J. KENT MASTERS

J. Kent Masters
Chairman, President and Chief Executive Officer

Exhibit 31.2

CERTIFICATION OF PRINCIPAL FINANCIAL OFFICER

I, Neal R. Sheorey, certify that:

1. I have reviewed this Annual Report on Form 10-K of Albemarle Corporation for the period ended December 31, 2023;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: February 14, 2024

/s/ NEAL R. SHEOREY

Neal R. Sheorey
Executive Vice President and Chief Financial Officer

Exhibit 32.1

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report on Form 10-K of Albemarle Corporation (the "Company") for the period ended December 31, 2023 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, J. Kent Masters, principal executive officer of the Company, certify, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that:

(1) the Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and
(2) the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ J. Kent Masters

J. Kent Masters
Chairman, President and Chief Executive Officer
February 14, 2024

Exhibit 32.2

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Annual Report on Form 10-K of Albemarle Corporation (the “Company”) for the period ended December 31, 2023 as filed with the Securities and Exchange Commission on the date hereof (the “Report”), I, Neal R. Sheorey, principal financial officer of the Company, certify, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that:

(1) the Report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and
(2) the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ NEAL R. SHEOREY

Neal R. Sheorey
Executive Vice President and Chief Financial Officer
February 14, 2024

Exhibit 96.1

SEC Technical Report Summary
Pre-Feasibility Study
Greenbushes Mine
Western Australia

Effective Date: June 30, 2023
Report Date: February 9, 2024

Report Prepared for

Albemarle Corporation

4350 Congress Street
Suite 700
Charlotte, North Carolina 28209

Report Prepared by

SRK Consulting (U.S.), Inc.
999 Seventeenth Street, Suite 400
Denver, CO 80202

SRK Project Number: USPR001765

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List of Abbreviations

The metric system has been used throughout this report. Tonnes are metric of 1,000 kg, or 2,204.6 lb. All currency is in U.S. dollars (US$) unless otherwise stated.

Abbreviation	**Unit or Term**
A	ampere
AA	atomic absorption
A/m^2	amperes per square meter
ANFO	ammonium nitrate fuel oil
Ag	silver
Au	gold
AuEq	gold equivalent grade
°C	degrees Centigrade
CCD	counter-current decantation
CIF	cost-insurance-freight
CIL	carbon-in-leach
CoG	cut-off grade
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
cfm	cubic feet per minute
ConfC	confidence code
CRec	core recovery
CSS	closed-side setting
CTW	calculated true width
°	degree (degrees)
dia.	diameter
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
EDA	exploratory data analysis
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EOY	end-of-year
FA	fire assay
FOS	fine ore stockpile
FoS	factor of safety
ft	foot (feet)
ft^2	square foot (feet)
ft^3	cubic foot (feet)
g	gram
gal	gallon
g/L	gram per liter
g-mol	gram-mole
gpm	gallons per minute
g/t	grams per tonne
ha	hectares
HDPE	High Density Polyethylene
hp	horsepower
HTW	horizontal true width
ICP	induced couple plasma

ID2	inverse-distance squared
ID3	inverse-distance cubed
IFC	International Finance Corporation
ILS	Intermediate Leach Solution
ILUA	Indigenous Land Use Agreement
IRMA	Initiative for Responsible Mining
kA	kiloamperes
kg	kilograms
km	kilometer
km^2	square kilometer
koz	thousand troy ounce
kt	thousand tonnes
kt/d	thousand tonnes per day
kt/y	thousand tonnes per year
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
kWh/t	kilowatt-hour per metric tonne
L	liter
LCE	Lithium Carbonate Equivalent
L/s	liters per second
L/s/m	liters per second per meter
lb	pound
LHD	Load-Haul-Dump
LLDDP	Linear Low Density Polyethylene Plastic
LOI	Loss On Ignition
LoM	Life-of-Mine
m	meter
m^2	square meter
m^3	cubic meter
masl	meters above sea level
mg/L	milligrams/liter
mm	millimeter
mm^2	square millimeter
mm^3	cubic millimeter
MME	Mine & Mill Engineering
Moz	million troy ounces
Mt	million tonnes
MTW	measured true width
MW	million watts
m.y.	million years
NGO	non-governmental organization
NI 43-101	Canadian National Instrument 43-101
NN	nearest neighbor
OSC	Ontario Securities Commission
oz	troy ounce
%	percent
PLC	Programmable Logic Controller
PLS	Pregnant Leach Solution
PMF	probable maximum flood
PMLU	Post-Mining Land Use

ppb	parts per billion
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
QKNA	quantitative kriging neighborhood analysis
RC	rotary circulation drilling
RoM	Run-of-Mine
RQD	Rock Quality Description
SEC	U.S. Securities & Exchange Commission
sec	second
SG	specific gravity
SPT	standard penetration testing
st	short ton (2,000 pounds)
t	tonne (metric ton) (2,204.6 pounds)
t/h	tonnes per hour
t/d	tonnes per day
t/y	tonnes per year
TRP	tailings retreatment plant
TSF	tailings storage facility
TSP	total suspended particulates
µm	micron or microns
V	volts
VFD	variable frequency drive
W	watt
XRD	x-ray diffraction
y	year

1 Executive Summary

This report was prepared as a Prefeasibility-level Technical Report Summary in accordance with the Securities and Exchange Commission (SEC) S-K regulations (Title 17, Part 229, Items 601 and 1300 until 1305) for Albemarle Corporation (Albemarle) by SRK Consulting (U.S.), Inc. (SRK) on the Greenbushes Mine (Greenbushes). This report is an update of the previous report titled "SEC Technical Report Summary, Pre-Feasibility Study, Greenbushes Mine, Western Australia" with an effective date of December 31, 2022 and a report date of February 14, 2023.

Greenbushes is held within the operating entity, Talison Lithium Australia Pty Ltd (Talison), of which Albemarle is a 49% owner with the remaining 51% ownership controlled by a Joint Venture (Tianqi/IGO JV) between Tianqi Lithium (Tianqi) and IGO Ltd (IGO) with ownership of 26.01% and 24.99%respectively.

SRK's Mineral Reserve estimate is based on the production of chemical grade spodumene concentrate from three existing processing facilities (two chemical grade plants (CGP1 and CGP2) and one technical grade (TGP) spodumene plant), as well as two planned chemical grade plants (CGP3 and CGP4). Talison's technical grade plant will continue to produce technical grade spodumene products in the future. However, the identification of Mineral Resources that are suitable for achieving technical grade product specifications does not occur until the grade-control drilling stage and therefore adequate data is not yet available to characterize production from this plant as technical grade for the purposes of the Mineral Reserve estimate. Instead, production from this plant has been assumed as lower value (on average) chemical grade product.

Talison is operating a processing facility to recover lithium from historic tailings (tailings retreatment plant or TRP). SRK has excluded the TRP from its reserve estimate due to limited materiality and technical data underlying the resource.

.1 Property Description

The Greenbushes property is a large mining operation located in Western Australia extracting lithium and tantalum products from a pegmatite orebody. In addition to being the longest continuously operated mine in Western Australia, the Greenbushes pegmatite is one of the largest known spodumene pegmatite resources in the world. The Greenbushes Lithium Operations property area is approximately 2,000 ha, which is a smaller subset of a larger 10,067 hectares (ha) land package controlled by Talison. Talison holds 100% of 10,067 ha of mineral tenements which cover the Greenbushes Lithium Operations area and surrounding exploration areas.

.2 Geology and Mineralization

The Greenbushes pegmatite deposit consists of a primary pegmatite intrusion (Central Lode) with a smaller, sub-parallel pegmatite to the east (Kapanga). The primary intrusion and its subsidiary dikes and pods are concentrated within shear zones within a metamorphic belt consisting of granofels, ultramafic schists and amphibolites. The pegmatites are crosscut by mafic dolerite dikes. The Central Lode pegmatite is over 3 kilometers (km) long (north by northwest), up to 300 meters (m) wide (normal to dip), strikes north to north-west and dips moderately to steeply west to south-west. The Kapanga deposit sits approximately 300 m to the east of the Central Lode deposit with strike length of 1.8 km, thickness averaging 150 m and dips between 40° and 60° toward the west. Current drilling has defined the Kapanga deposit to approximately 450 m depth below surface.

Overall, the Greenbushes lithium rich portion of the Central lode pegmatite averages approximately 2.1% Li_2O, with the Kapanga domain reporting slightly lower at 1.8% Li_2O. Major minerals are quartz, spodumene, albite, and K-feldspar. Primary lithium-bearing minerals are spodumene, $LiAlSi_2O_6$ (approximately 8% Li_2O) and spodumene varieties kunzite and hiddenite. Minor lithium minerals include lepidolite (mica), amblygonite and lithiophilite (phosphates).

.3 Status of Exploration, Development and Operations

SRK notes that the property is an active mining operation with a long history of tin, tantalum, and lithium mining. The results and interpretation from exploration data are supported by extensive drilling and active mining exposure of the orebody in multiple pits on the property. The area around the current Greenbushes Lithium Operations has been extensively mapped, sampled, and drilled over several decades of exploration work. For the purposes of this report, SRK used exploration drilling with an effective date of June 30, 2023 to update the geologic model and Mineral Resource estimate. In addition to the updated drilling, the active mining, drilling, and in-pit mapping are considered robust for exploration work to support the current Mineral Resource estimation.

.4 Mineral Processing and Metallurgical Testing

Greenbushes operates Chemical Grade Plant-1 (CGP1) to recover spodumene from ore containing about 2.5% Li_2O into lithium concentrates containing about 6% Li_2O. The CGP1 process flowsheet utilizes unit operations that are standard to the industry including: ball mill grinding, HMS (heavy media separation), WHIMS (wet high intensity magnetic separation), coarse mineral flotation and conventional fine mineral flotation. During 2019 Greenbushes completed the construction of Chemical Grade Plant-2 (CGP2) which was designed to process 2.4 million tonnes per year (Mt/y) of ore at an average grade of 1.7% Li_2O to produce final concentrates containing about 6% Li_2O and meet the specification for Greenbushes' SC6.0 product. The CGP2 flowsheet is very similar to CGP1 but was designed with a number of modifications based on HPGR (high pressure grinding rolls) comminution studies and CGP1 operational experience. The most notable modifications included:

- Replacement of the ball mill grinding circuit with HPGRs
- Plant layout to simplify material flow and pumping duties
- Orientation of the HMS circuit to allow the sink and float products to be conveyed to the floats WHIMS circuit and sinks tantalum circuit
- Locating the coarse flotation circuits above the regrind mill to allow flow steams to gravity feed directly into the mill
- Orientation of the fines flotation cells in a staggered arrangement to allow the recleaner and cleaner flotation tails to flow by gravity into the cleaner and rougher cells, respectively
- Orientation of the concentrate filtration circuit to allow the sinks to be conveyed to the sinks filter
- Provision for sufficient elevation for the deslime and dewatering cyclone clusters to gravity feed to the thickener circuits located at ground level

CGP2 commissioning began during September 2019 and continued intermittently into 2021. During 2021 CGP2 recovered only 50.5% of the contained lithium versus a predicted recovery of 73.2%. In an effort to resolve the performance issues with CGP2, Greenbushes retained MinSol Engineering

(MinSol) to undertake a performance assessment of CGP2 and identify areas where improvements in the plant could be made to increase lithium recovery. MinSol issued a report on October 27, 2022, which presented their findings and a path forward to improve CGP2 performance.

These optimization changes have resulted in increasing average lithium recovery from about 50.5% reported for 2021 to 67.9% reported for the first half of 2023. This represents an almost 18% increase in lithium recovery. However, overall lithium recovery remains about 5% less than the design recovery. MinSol has identified the following process areas that could be further optimized in an effort to further improve overall lithium recovery:

- Blending of ore on the ROM pad to decrease plant feed variability
- Redirecting fines flotation cleaner tailings to allow for additional reagent conditioning
- Improve reagent conditioning efficiency of the fines flotation conditioner
- Improve reagent conditioning in the hydrofloat reagent conditioners.
- Prescreening HPGR feed to reduce slimes generation
- Add a scavenger flotation circuit
- Add a scavenger WHIMS circuit

.5 Mineral Resource Estimates

The Mineral Resources disclosed are based on a property-wide resource block model comprised of the updated 2023 Central Lode and the 2023 Kapanga deposit models. Changes from the previous resource statement include the inclusion of the latest exploration drilling, grade control, revised geological model to improve definition of the dolerite dikes and depletion of the Central Lode model due to mining activities through June 30, 2023. A review of the reasonable prospects for eventual economic extraction (RPEEE) has been updated to reflect the latest economic assumptions and costs, including revised pit optimization and cut-off grade (CoG) parameters.

The Mineral Resource statement disclosed in this TRS has an effective date of June 30, 2023. These reflect adjustments in property topography, economics, drilling, geology models, and block models.

Mineral resources have been estimated by SRK and are based on a spodumene concentrate sales price of US$1,650 CIF China, which is US$1,525/t of concentrate at the mine gate after deducting for transportation and government royalty. The applied resource CoG reflects current operational practices at 0.7% Li_2O . All resources are categorized in a manner consistent with SEC definitions. Current Mineral Resources, exclusive of reserves, are summarized in Table 1-1.

SRK notes changes in the mineral resources on a year-by-year basis. The changes in the mineral resources noted in the tables below are mainly attributed to the following key factors:

- Depletion of mineral resources from 2022 to 2023
- New drilling has been completed since end-of-year (EOY) 2022 reporting; this includes an additional 92 holes for 29,562 m across the Greenbushes property.
- Upgrade of 2022 Inferred mineral resources as a result of the additional drilling completed and reinterpretation of geological model adding confidence to the geological continuity for both the pegmatites and internal waste from the dolerite dikes
- Impact of new drilling on the deposit reducing the tonnage and grades at Kapanga
- Changes in the geological models which form the basis for the current estimate

Table 1-1: Greenbushes Summary Mineral Resources Exclusive of Mineral Reserves as of June 30, 2023, Based on US$1,525/t of Concentrate at Mine Gate, SRK Consulting (U.S.), Inc.

Can Area	Category	100% Tonnes (Mt)	Attributable Tonnes (Mt)	Li_2O (%)	Mass Yield
Open Pit 2023	Indicated	75.8	37.1	1.48	15.7
	Inferred	11.8	5.8	1.19	11.8

Source: SRK, 2023

- Albemarle's attributable portion of Mineral Resources is 49%.
- Mineral resources are reported exclusive of Mineral Reserves. Mineral resources are not Mineral Reserves and do not have demonstrated economic viability.
- Resources have been reported as in situ (hard rock within an optimized pit shell).
- Resources have been categorized subject to the opinion of a QP based on the quality of informing data for the estimate, consistency of geological/grade distribution, and data quality.
- Resources which are contained within the Mineral Reserve pit design may be excluded from reserves due to an Inferred classification.
- All Indicated stockpiled resources have been converted to Mineral Reserves.
- Open Pit Mineral resources are reported considering a nominal set of assumptions for reporting purposes:
  - Chemical grade plant weight recovery (mass yield) varies as a function of Li_2O% grade. The mass yield (MY) equation used for RPEE pit optimization is MY%=9.362 x Li_2O%^1.319 – 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. Recovery is set to zero when the mass yield equation result for a block is less than zero.
  - Derivation of economic CoG for resources is based on the mine gate pricing of US$1,525/t of 6% Li_2O concentrate. The mine gate price is based on US$1,650/t-conc CIF less US$125/t-conc for government royalty and transportation to China.
  - Costs estimated in Australian Dollars were converted to U.S. dollars based on an exchange rate of 1.00AU$:0.68US$.
  - The economic CoG calculation is based on US$2.67/t-ore incremental ore mining cost, US$31.90/t-ore processing cost, US$9.24/t-ore G&A cost, and US$2.35/t-ore sustaining capital cost. Incremental ore mining costs are the costs associated with the RoM loader, stockpile rehandling, grade control assays and rockbreaker
  - The price, cost and mass yield parameters produce a calculated resource economic CoG of 0.576% Li_2O. However, due to the internal constraints of the current operations, an elevated resource CoG of 0.7% Li_2O has been applied. SRK notes actual economic CoG is lower, but it is the QP's opinion to use a 0.7% Li_2O CoG to align with current site practices.
  - An overall 40° (east side) and 47° (west side) pit slope angle, 0% mining dilution, and 100% mining recovery.
  - Resources were reported above the assigned 0.7% Li_2O CoG and are constrained by an optimized 0.90 revenue factor pit shell.
  - No infrastructure movement capital costs have been added to the optimization.
- Mineral resources tonnage and contained metal have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding.
- SRK Consulting (U.S.) Inc. is responsible for the Mineral Resources with an effective date: June 30, 2023.

.6 Mining Methods and Mineral Reserve

The conversion of Mineral Resources to Mineral Reserves has been completed in accordance with United States Security and Exchange Commission (SEC) regulations CFR 17, Part 229 (S-K 1300). Mineral reserves were determined based on a spodumene concentrate sales price of US$1,500/t of concentrate CIF China (or US$1,383/t of concentrate at the mine gate after deducting for transportation and government royalty). The Mineral Reserves are based on PFS level study as defined in §229.1300 *et seq*.

The Mineral Reserve calculations for the Greenbushes Central Lode lithium deposit have been carried out by a Qualified Person as defined in §229.1300 et seq. SRK Consulting (U.S.) Inc. is responsible for the Mineral Reserves reported herein. Table 1-2 shows the Greenbushes Mineral Reserves with an effective date of June 30, 2023.

Table 1-2: Greenbushes Summary Mineral Reserves at June 30, 2023, Based on US$1,383/t of Concentrate Mine Gate, SRK Consulting (U.S.), Inc.

Classification	Type	100% Tonnes (Mt)	Attributable Tonnes (Mt)	Li_2O%	Mass Yield (%)
Probable Mineral Reserves	In situ	145.4	71.2	1.82	19.9%
	Stockpiles	2.9	1.4	2.43	19.9%
	In situ + Stockpiles	148.3	72.6	1.83	19.9%

Source: SRK, 2023
Notes to Accompany Mineral Reserve Table

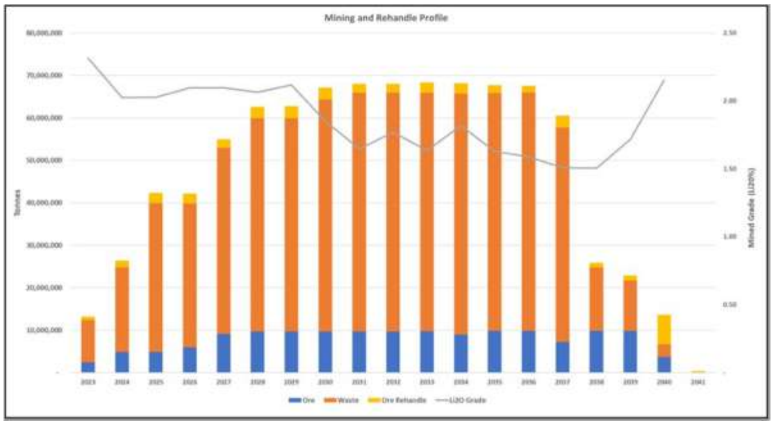
- Albemarle's attributable portion of Mineral Resources and reserves is 49%.
- Mineral reserves are reported exclusive of Mineral Resources.
- Indicated in situ resources have been converted to Probable reserves.
- Indicated stockpile resources have been converted to Probable Mineral Reserves.
- Mineral reserves are reported considering a nominal set of assumptions for reporting purposes:
  - Mineral reserves are based on a mine gate price of US$1,383/t of chemical grade concentrate (6% Li_2O).
  - Mineral reserves assume 93% global mining recovery.
  - Mineral reserves are diluted at approximately 5% at zero grade for all Mineral Reserve blocks in addition to internal dilution built into the resource model (2.8% with the assumed selective mining unit of 5 m x 5 m x 5 m).
  - The mass yield (MY) for reserves processed through the chemical grade plants is estimated based on mass yield formulas that vary depending on the Li_2O% grade of the plant feed. For CGP1, the formula is MY%=9.362 x Li_2O%^1.319, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.5%. For CGP2, CGP3 and CGP4, the formula is MY%=9.362 x Li_2O%^1.319 – 1.5 subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. The weighted average LoM mass yield for the four chemical grade plants is 19.5%.
  - The formula for MY for reserves processed through the technical grade plant is MY%=26.629 x Li_2O% - 60.455 . There is approximately 3.2 Mt of technical grade plant feed at 3.7% Li_2O. The average LoM mass yield for the technical grade plant is 38.0%.
  - Although Greenbushes produces a technical grade product from the current operation, it is assumed that the reserves reported herein will be sold as a chemical grade product. This assumption is necessary because feed for the technical grade plant is currently only defined at the grade control or blasting level. Therefore, it is conservatively assumed that concentrate produced by the technical grade plant will be sold at the chemical grade product price.
  - Derivation of economic CoG for reserves is based on mine gate pricing of US$1,383/t of 6% Li_2O concentrate. The mine gate price is based on US$1,500/t-conc CIF less US$117/t-conc for government royalty and transportation.
  - Costs estimated in Australian Dollars were converted to U.S. dollars based on an exchange rate of 1.00AU$:0.68US$.
  - The economic CoG calculation is based on US$2.67/t-ore incremental ore mining cost, US$31.90/t-ore processing cost, US$9.24/t-ore G&A cost, and US$2.35/t-ore sustaining capital cost. Incremental ore mining costs are the costs associated with the RoM loader, stockpile rehandling, grade control assays and rockbreaker
  - The price, cost and mass yield parameters produce a calculated economic CoG of 0.606% Li_2O. However, due to the internal constraints of the current operations, an elevated Mineral Reserves CoG of 0.7% Li_2O has been applied.
  - The CoG of 0.7% Li_2O was applied to reserves that are constrained by the ultimate pit design and are detailed in a yearly mine schedule.
  - Stockpile reserves have been previously mined and are reported at a 0.7% Li_2O CoG.
- Waste tonnage within the reserve pit is 716.6 Mt at a strip ratio of 4.93:1 (waste to ore – not including reserve stockpiles)
- Mineral reserve tonnage, grade and mass yield have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding:
  - Mt = millions of metric tonnes
  - Reserve tonnes are rounded to the nearest hundred thousand tonnes
- SRK Consulting (U.S.) Inc. is responsible for the Mineral Reserves with an effective date: June 30, 2023.

1.6.1 Mining Operations

Greenbushes is an operating mine using conventional open pit mining methods to extract Mineral Reserves containing economic quantities of Li_2O to produce both chemical and technical grade spodumene concentrates. Drilling, blasting, and load and haul activities are performed by contractors. Grade control is performed with reverse circulation (RC) drills that sample on 2.5 m intervals. In ore areas, mining occurs on 5 m benches and in waste areas, 10 m benches are used. Ore is hauled to the run-of-mine (RoM) pad or to long-term ore stockpiles. Waste rock is hauled to a waste dump adjacent to the open pit.

The 2023 geotechnical field program collected significant additional data on geotechnical conditions. For the most part, the new data confirms previous strength estimates, with the exception of the pegmatite shear zone which is weaker than previously estimated. The pit design has been checked for geotechnical stability. Rock mass parameters based on characterization work have been input according to structural domain into a limit equilibrium stability analysis. Results of the stability analyses indicate that all slopes meet the minimum acceptability criteria of factor of safety greater than 1.3.

The life-of-mine (LoM) production profile is shown in Figure 1-1. The peak annual mining rate (ex-pit) is approximately 66 million tonnes (Mt) and mining spans approximately 18 years plus a final partial year with only stockpile rehandling to the plants occurring. The LoM average strip ratio (w:o) is 4.93.



Source : SRK, 2023

Figure 1-1: Mine Production Profile

.7 Processing and Recovery Methods

Greenbushes currently has two ore crushing facilities (CR1 and CR2) and three ore processing plants which include a technical grade plant (TGP), chemical grade plant-1 (CGP1) and chemical grade plant-2 (CGP2) with a nominal capacity of 4.5 Mt/y of pegmatite feed to produce a nominal 1.3

Mt/y of spodumene concentrate from all three plants combined. TGP is a relatively small plant that processes approximately 350,000 t/y of ore at an average grade of about 3.8% Li_2O and produces about 150,000 t of spodumene concentrate products. TGP produces a variety of product grades identified as SC7.2, SC6.8, SC5.5 and SC5.0. as well as a tantalum concentrate.

During the period 2017 – 2023 (Jan-Jun) ore tonnes processed ranged from 343,760 to 373,643 t (excluding 2020 production which was impacted by COVID) and ore grades ranged from 3.72% to 3.96% Li_2O. Overall lithium recovery ranged from 69.8% to 75.1% into six separate products (SC7.2-Standard, SC7.2-Premium, SC6.8, SC6.5, SC6.0 and SC5.0). Overall mass yield during this period ranged from 38.4% to 44.9%. Mass

CGP1 and CGP2 process spodumene ore into lithium concentrates containing a minimum of 6% Li_2O and a maximum iron content of 1% iron oxide (Fe_2O_3). The process flowsheets utilized by both CGP1 and CGP2 are similar and include the following major unit operations to produce chemical grade spodumene concentrates:

- Crushing
- Grinding and classification
- Heavy media separation
- Wet high intensity magnetic separation (WHIMS)
- Coarse mineral flotation
- Regrinding
- Regrind coarse mineral flotation
- Fine mineral flotation
- Concentrate filtration
- Final tailings thickening and storage at the tailing storage facility

During 2022 CGP1 processed 1.79 Mt of ore at an average grade of 2.69% Li_2O with 72.1% of the contained lithium recovered into concentrates averaging 6.05% Li_2O. During 2023 (Jan – Jun) CGP1 processed 881,032 t of ore at an average grade of 2.70% Li_2O and recovered 75.4% of the contained lithium into concentrates averaging 5.95% Li_2O.

CGP2 commissioning began during September 2019 and continued through April 2020. During the period from March 2020 to April 2021 operations were suspended due to market demand considerations. Operations resumed during May 2021 and have continued.

During 2022 CGP2 processed 2.00 Mt of ore at an average grade of 1.96% Li_2O and recovered 64.0% of the lithium (versus a modeled recovery of 74.3%) into 419,246 t of concentrate at an average grade of 5.98% Li_2O. Concentrate yield for this period averaged 21.0% versus the model yield projection of 24.4%. CGP2 performance improved steadily during 2022 with significant improvement during the fourth quarter. During the fourth quarter of 2022 lithium recovery averaged 68.2% versus the modeled recovery of 75.4% and the mass yield to concentrate was 22.5% versus the modeled yield of 24.7%.

During 2023 (Jan-Jun) CGP2 processed 1.04 Mt of ore at an average grade of 2.18% Li_2O and recovered 67.9% of the lithium versus a modeled recovery of 76.9% into 256,512 t of concentrate at an average grade of 6.00% Li_2O. Concentrate yield for this period averaged 24.7% versus the model yield projection of 28.0%. The improved plant performance is attributed to improved operating availability, steady-state operation and ongoing efforts to improve performance of individual unit operations.

SRK notes that that CGP2 and CGP1 flowsheets are similar and both plants process ore from the same mining operation, as such, SRK believes that it is reasonable to expect that CGP2 will eventually achieve performance similar to CGP1.

Greenbushes is currently constructing Chemical Grade Plant-3 (CGP3), which will be identical to CGP2 with a capacity of 2.4 Mt/y. CGP3 is scheduled to come on-line during Q1 2025. Greenbushes also has plans to construct Chemical Grade Plant-4 (CGP4), which will also be based on CGP2. CGP4 is currently planned to commence production during Q1 2027.

SRK recommends that Greenbushes' CGP1 yield model continue to be used for resource and reserve modeling for ore processed at CGP1 and recommends using the modified CGP2 yield model shown below for resource and reserve calculations for ore processed at CGP2, CGP3 and CGP4. The revised yield equation applied to CGP2 for 2023 is given as:

Modified CGP2 Yield % = (9.362 * (Plant Feed Li_2O%) $^{1.319}$) – 1.5

.8 Infrastructure

Greenbushes is a mature operating lithium hard rock open pit mining and concentration project that produces 6% spodumene concentrate. Access to the site is by paved highway off a major Western Australian highway. Employees travel to the project from various communities in the region. The established facilities on the site include security fencing and guard house access, communications systems, access roads and interior site roads, administrative and other offices, change houses, existing mine services area (MSA), warehousing, shops, crushing plants, processing plants (CGP1/CGP2/TGP/TRP), tailings facilities, new explosives storage facilities, water supply and distribution system with associated storage dams, power supply and distribution system, laboratory, fuel storage and delivery system, reverse-osmosis water treatment plant, health-safety-training offices, mine rescue area, storage sheds, mine waste storage area, miscellaneous waste storage facilities, and engineering offices. The concentrate is shipped by truck to port facilities located at Bunbury 90 km to the west of the Project. These facilities are in place and functional. An abandoned rail line is present north of the project but not currently used but being studied as an option for future concentrate transport.

Several modifications to the infrastructure are currently in construction or planned. An upgraded 132 kV power line was placed in service in 2023. The new Mine Service Area (MSA) is near completion and is planned to be operating in late-2023 to provide mine heavy and light equipment maintenance facilities and technical services offices as the existing MSA will be impacted by the planned pit progression. A mine access road will be added to reduce truck traffic through Greenbushes. The warehouse and laboratories are planned to be expanded. The tailings facilities are being expanded with the addition of a new two cell facility known as TSF4 located adjacent to and south of the existing TSF2 and TSF1 facilities. TSF1 will be expanded late in the mine life to meet tailings storage needs. The waste rock facilities will continue to expand on the west side of the pit toward the highway and south toward the permit boundary adjacent to TSF4. A new mine village will be constructed starting in 2023 to provide additional housing. It is expected to be completed in 2024.

.9 Market Studies

Fastmarkets has developed a marketing study on behalf of Albemarle to support lithium pricing assumptions. This market study does not consider by- or co-products that may be produced alongside the lithium production process.

Battery demand is now responsible for 75.0% of all lithium consumed. Looking forward, Fastmarkets expects demand from eMobility, especially battery electric vehicles (BEVs), to continue to drive lithium demand. The market tightness is expected to ease in 2023, with a small deficit. Thereafter the market is expected to be almost neutral, but with a slowly increasing deficit that reaches 7% by 2033.

With demand forecasted to stay strong over the coming decades, the market will need to continue to add fresh supply to satisfy demand. Fastmarkets expects prices to hold above incentive prices to justify development of new projects.

Fastmarkets recommends that a real price of US$20/kg for lithium carbonate CIF China Japan Korea and of US$1,500/t for spodumene SC6 CIF China should be utilized by Albemarle for the purposes of Mineral Reserve estimation. Recommended prices are on the lower end of Fastmarkets low-case scenario.

.10 Environmental Studies, Permitting, and Plans, Negotiations, or Agreements with Local Individuals or Groups

The Project has been in operation as a hard rock mine since 1983 and is fully permitted for its current operations. The Project is in the process of obtaining further approvals for expansion. Talison holds the mining rights to lithium at the Project and Global Advanced Metals (GAM) holds the rights to non-lithium minerals. GAM processes tantalum and tin extracted by Talison during mining activities within the Project area under their own operating license, and GAM are, therefore, responsible for the environmental management of their premises. Under agreement, Talison provides services to GAM consisting of laboratory analyses and environmental reporting, and shared use of some water circuit infrastructure.

1.10.1 Environmental Study Results

The Project is in the southwest of Western Australia in the Shire of Bridgetown-Greenbushes. The town of Greenbushes is located on the northern boundary of the mine. The majority of the Project is within the Greenbushes Class A State Forest (State Forest 20) which covers 6,088 ha and is managed by the Department of Biodiversity, Conservation and Attractions (DBCA) as public reserve land under the Conservation and Land Management Act 1984 (CALM Act). The DBCA manages State Forest 20 in accordance with the approved Forest Management Plan that aims to maintain the overall area of native forest and plantation available for forest produce, including biodiversity and ecological integrity. The remaining land in the Project area is privately owned.

During development and subsequent modifications to the mine, environmental studies and impact assessments have been completed to support project approval applications, including studies related to:

- Flora and vegetation
- Terrestrial and aquatic fauna
- Surface water and groundwater

- Material characterization (geochemistry)
- Air quality and greenhouse gas assessment
- Noise, vibration and visual amenity
- Cultural Heritage

1.10.2 Environmental Management and Monitoring

The Project operates under approvals that contain conditions for environmental management that include waste and tailings disposal, site monitoring, and water management. Primary approvals are authorized under the federal Environment Protection and Biodiversity and Conservation Act 1999 (EPBC Act) via approvals EPBC 2018/8206 and EPBC 2013/6904, the State Environmental Protection Act 1986 (EP Act) including the environmental impact assessment approval for the proposed mine expansion (Ministerial Statement 1111), the operation of a prescribed premises (Licence L4247/ 1991/13), approval for the construction and commissioning of a prescribed premises for the proposed mine expansion (W6283/2019/1), and under the Mining Act 1978, under an approved Mine Closure Plan (Reg ID 60857) and several Mining Proposals (section 17.3) conditions.

Specific requirements for compliance and ambient monitoring are defined in the Licence (L4247/1991/13) and Works Approval (W6283/2019/1). The monitoring results must be reported to the regulators (Department of Water and Environmental Regulation (DWER) and Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)) on an annual basis.

1.10.3 Project Permitting Requirements

Australia has a robust and well-developed legislative framework for the management of the environmental impacts from mining activities. Primary environmental approvals are governed by the federal EPBC Act and the environmental impact assessment process in Western Australia is administered under Part IV of the EP Act. Additional approvals in Western Australia are principally governed by Part V of the EP Act and by the Mining Act, as well as several other regulatory instruments. Primary and other key approvals are discussed in Section 17.

1.10.4 Environmental Compliance

The Project has not incurred any significant environmental incidents. Reportable incidents in the 2022-2023 AER period totaled approximately 100 incidents and consist primarily of spills, followed by water or tailings incidents, flora and fauna incidents, and dust incidents. The Project is responsible for contamination of five sites due to hydrocarbons and metals in soil, and elevated concentrations of metals in groundwater and surface water (Site IDs 34013, 73571, 73572, 75019, and 75017). These sites are classified as “Contaminated – Restricted use” and only permit commercial and industrial uses. This will need to be reviewed for final land use options for closure.

1.10.5 Local Individuals and Groups

The mining tenure for the Project was granted in 1983 and, therefore, is not a future act as defined under the Native Title Act 1993 (a ‘future act’ is an act done after January 1, 1994, which affects Native Title). The Project is, therefore, not required by law to have obtained agreements with the local native title claimant groups. Nonetheless, Talison regularly engages and maintains strong ties and working relationships with local Aboriginal people and Traditional Custodians of the area, including, but not necessarily limited to, policies and practices regarding employment, contracting, establishing advisory groups, etc. Talison recognizes the Traditional Custodians' whose traditional lands intersect the land on which Talison operates and works.

Greenbushes is within the South West Native Title Settlement agreement area between the Noongar people and the Western Australian (WA) Government. The Settlement, in the form of six Indigenous Land Use Agreements (ILUA), is intended to elevate economic, social, and community outcomes of the Noongar people.

Also, as part of its efforts to build stronger communities, six multi-year partnerships have been established with key groups which directly influence local communities. These partnerships have a strong focus on education and health for people of all ages. In 2022, Talison signed two new multi-year partnerships.

The Project lies immediately south of the town of Greenbushes and maintains an active stakeholder engagement program and information sessions to groups such as the "Grow Greenbushes." Senior mine management reside in the town. Talison promotes local education (the Greenbushes Primary School and tertiary sponsorships) and provides support to community groups with money and services (allocated in the Environmental and Community budget).

Talison has two agreements in place with local groups:

- Blackwood Basin Group (BBG) Incorporated – offset management agreement whereby BBG have agreed to manage and improve the condition of native vegetation for the purpose of the Black Cockatoo offset requirements.
- Tonebridge Grazing Pty Ltd. – site conservation agreement for the protection and improvement of native vegetation to protect Black Cockatoo habitat.

In addition, Talison entered into a revised MOU for the delivery of environmental offsets with the Department of Biodiversity, Conservation and Attractions (DBCA) in 2022.

1.10.6 Mine Closure

Talison has updated the mine closure plan in 2022 to incorporate changes and proposed expansions to the current operations and the results of additional studies including a pit lake study and additional geochemical characterization work.

Western Australia does not require a company to post performance or reclamation bonds. All relevant tenement holders in Western Australia are required to annually report disturbance and to make contributions to a pooled fund based on the type and extent of disturbance under the Mining Rehabilitation Fund Act of 2012 (MRF Act). The pooled fund can be used by DEMIRS to rehabilitate mines where the tenement holder/operator has failed to meet their rehabilitation obligations and finances have not been able to be recovered. The interest earned on the pooled fund is used for administration and to rehabilitate legacy abandoned mine sites.

A cost estimate for immediate (unplanned) closure of Greenbushes has been prepared by Talison using the Victorian Government Rehabilitation bond calculator (dpi-bond-calculator-24-feb-2011) as a template to assist them in identifying and costing the rehabilitation, decommissioning, and monitoring requirements for the Greenbushes site. The Victorian Government bond calculator uses predefined third-party unit rates based on the typical current market 'third party rates' as of July 2010, which may overestimate or underestimate closure costs for Western Australia. Talison has been escalating these unit rates since 2013.

The September 2023 closure cost estimate for Greenbushes only addresses immediate mine closure. SRK was not provided a LoM closure cost estimate, which, although not a regulatory requirement, is industry best practice. This estimate includes facilities that currently exist on site and expansion of Floyd's dump. The closure cost estimate totaled AU$62,434,282, of which AU $59,235,736.40 represents Talison's portion of the operation.

The Victorian Government model used by Talison to estimate closure costs was created in 2011 and uses fixed unit rates rather than using site-specific rates developed by a consultant to the government. These rates have been increased for inflation since that time using Perth CPI indices. There is no documentation on the basis of the unit rates used in the Victorian model and the government of Victoria was unable to provide any information regarding the accuracy of the rates. Because of this, SRK cannot validate any of the unit rates used in the model or the overall closure cost estimate.

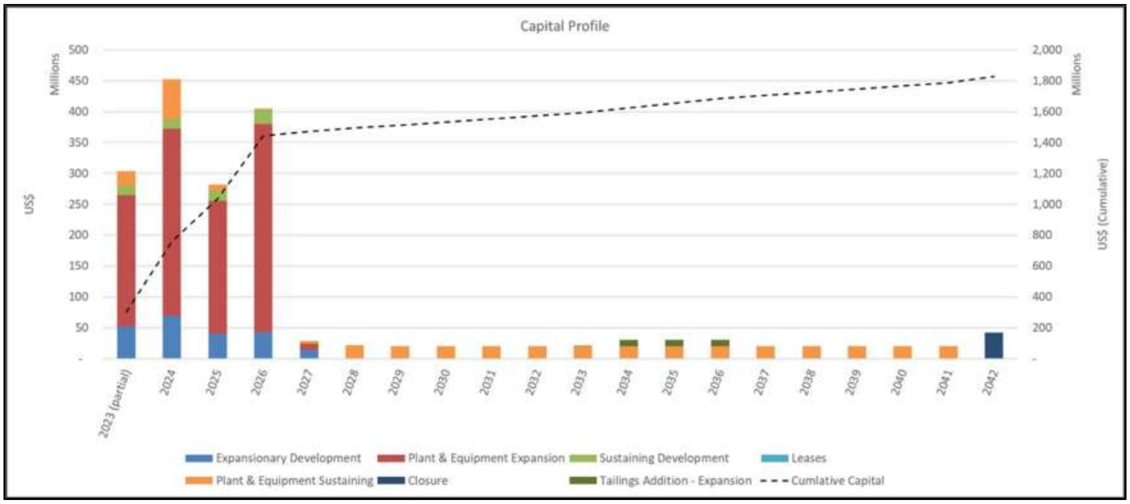
Furthermore, because closure of the site is not expected until 2042, the closure cost estimate represents future costs based on current site conditions. In all probability, site conditions at closure will be different than currently expected and, therefore, the current estimate of closure costs is unlikely to reflect the actual closure cost that will be incurred in the future.

Currently, the site must treat mine water collecting in the Southampton and Cowan Brook Dams prior to discharge due to elevated levels of arsenic and lithium in the water. The sources of elevated lithium and arsenic in the mine water circuit include dewatering water from the open pit. Although some testing in early 2023 indicates that seepage from tailings solids will improve over time, the tests also indicate the potential for arsenic to remain above the freshwater aquatic and drinking water guidelines after closure.

If perpetual, or even long-term, treatment of water is required to comply with discharge requirements, the closure cost estimate provided by Talison could be materially deficient.

.11 Capital and Operating Costs

Capital cost forecasts were developed in Australian dollars. The cost associated with the sustaining capital at the operation are presented in Figure 1-2. The total sustaining capital spend over life of mine is forecast at US$1.83 billion.



Source: SRK

Figure 1-2: Sustaining Capital Profile (Tabular Data in Table 19-12)

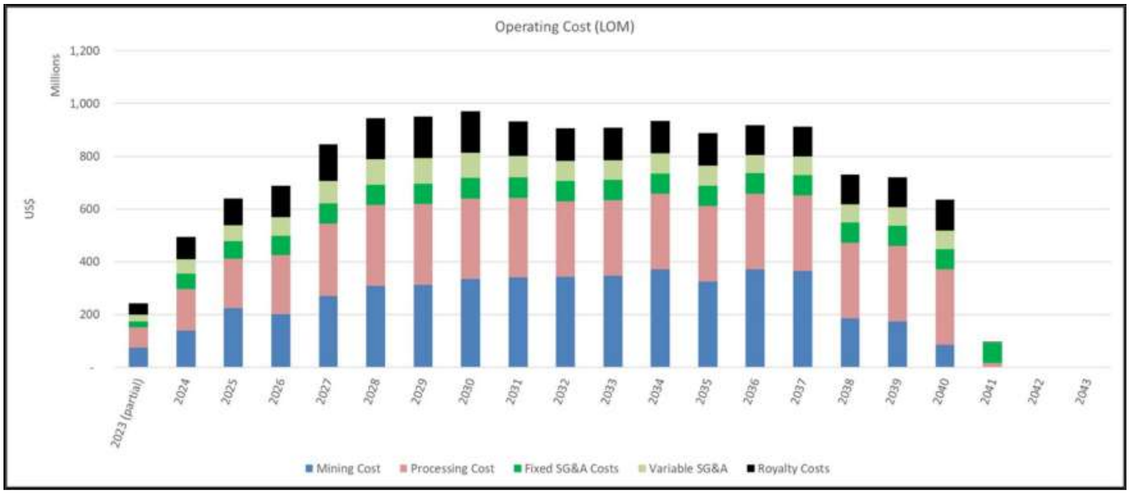
Operating costs were forecast in Australian dollars and are categorized as mining, processing and SG&A costs. Mining costs include the costs to move the ore and waste material to waste dumps, stockpiles or plant feed locations. Processing costs include the costs to process the ore into a concentrate. SG&A costs include the general and administrative costs of running the operation and the selling expenses associated with the concentrate product. A summary of the life of mine average for mining, processing and SG&A costs is presented in Table 1-3.

Table 1-3: Life of Mine Operating Cost Averages

Category	Unit	Value
Mining Cost	US$/t mined	5.55
Processing Cost	US$/t processed	31.90
SG&A Cost	US$/t concentrate	91.17

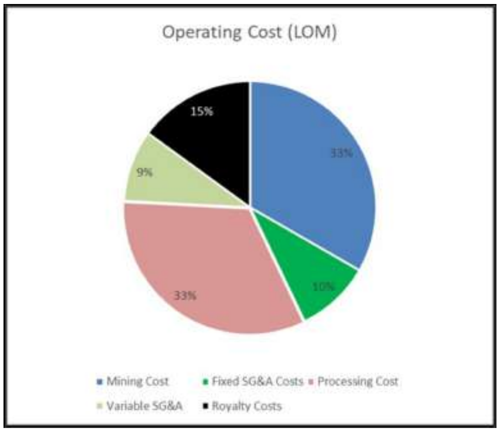
Source: SRK, 2023

These costs are typically broken out into fixed and variable costs. A life of mine summary of the operating cost breakdown is presented in Figure 1-3 and Figure 1-4.



Source: SRK, 2023

Figure 1-3: Life of Mine Operating Cost Profile (Tabular Data in Table 19-12)



Source: SRK

Figure 1-4: Life of Mine Operating Cost Summary

.12 Economic Analysis

Economic analysis, including estimation of capital and operating costs is inherently a forward-looking exercise. These estimates rely upon a range of assumptions and forecasts that are subject to change depending upon macroeconomic conditions, operating strategy and new data collected through future operations and therefore actual economic outcomes often deviate significantly from forecasts.

The Greenbushes operation consists of an open pit mine and several processing facilities fed primarily by the open pit mine. The operation is expected to have a 19 year life.

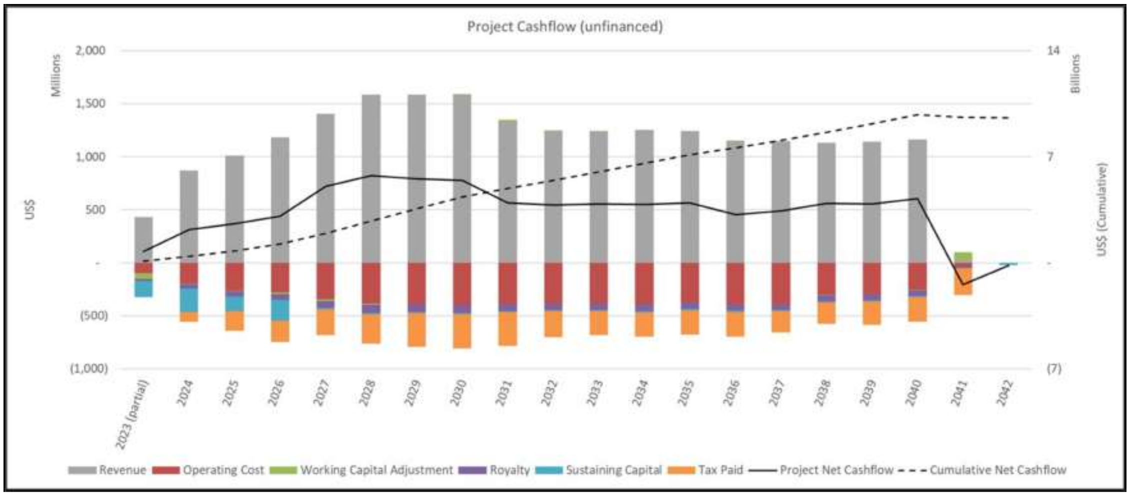
The economic analysis metrics are prepared on annual after tax basis in US$. The results of the analysis are presented in Table 1-4. The results indicate that, at a CIF China chemical grade concentrate price of US$1,500/t, the operation returns an after-tax NPV at 10% of US$8.86 billion (US$4.34 billion attributable to Albemarle). Note, that because the mine is in operation and is valued on a total project basis with prior costs treated as sunk, IRR and payback period analysis are not relevant metrics.

Table 1-4: Indicative Economic Results (Albemarle)

LoM Cash Flow (Unfinanced)	**Units**	**Value**
Total Revenue	**US$ million**	**21,716**
Total Opex	**US$ million**	**(5,981)**
Operating Margin	US$ million	15,735
Operating Margin Ratio	%	72%
Taxes Paid	US$ million	(4,219)
Free Cashflow	US$ million	9,565
Before Tax		
Free Cash Flow	US$ million	13,785
NPV at 10%	US$ million	6,120
After Tax		
Free Cash Flow	US$ million	9,565
NPV at 10%	US$ million	4,339

Source: SRK

A summary of the cashflow on an annual basis is presented in Figure 1-5.



Source: SRK, 2023

Figure 1-5: Annual Cashflow Summary (Albemarle) (Tabular Data in Table 19-12)

1.13 Conclusions and Recommendations

1.13.1 Property Description and Ownership

The property is well known in terms of descriptive factors and ownership, and there are no additional recommendations at this time.

1.13.2 Geology and Mineralization

Geology and mineralization are well understood through decades of active mining, however, SRK recommends evaluating the plunge to pegmatites and the Li_2O mineralization in Central Lode and Kapanga. Understanding this trend has the potential to improve exploration drilling success, delineate high-grade “shoots” within the pegmatites and properly represent the continuity of high-grade and low-grade domains.

1.13.3 Status of Exploration, Development and Operations

The status of exploration, development, and operations is advanced and active. Assuming that exploration and mining continue at Greenbushes using the current mining method, there are no additional recommendations at this time.

1.13.4 Mineral Resource

SRK recommends Talison continue with updating the property-wide geological and resource block model from a first principles perspective to generate a continuous geological interpretation across the Central Lode and Kapanga deposits as well as incorporating all recent geological data. Generation of a 3D structural wireframe model will aid in the geological interpretation and understanding of structural influence on local uncertainties in the pegmatite. Lastly, SRK recommends annual exploration and condemnation drilling to continue to assess the property for additional pegmatite resources:

- Continue to utilize the property-wide geologic model and resource block model that aligns the Central Lode and Kapanga deposits
- Consider alternative modeling methods to improve the geologic model specifically for the Kapanga pegmatite and dolerite dikes
- Construct a detailed 3D wireframe structural model across the property to support the geological model update and provide aid to geotechnical design assumptions
- Further work and focus on additional geological data should be collected to aid in the evaluation of technical parameters such as geotechnical, hydrogeological and metallurgical to consider potential for underground resources in future estimates.

1.13.5 Reserves and Mining Methods

SRK has reported Mineral Reserves that, in our opinion as QP, are appropriate for public disclosure. The mine plan, which is based on the Mineral Reserves, spans approximately 18 years. Annual mining requirements are reasonable, with a peak ex-pit mining rate of approximately 66 million tonnes (Mt) of combined ore and waste per year. SRK notes that a significant increase over the current mining rate will be required in future years. Accordingly, SRK recommends that Greenbushes make arrangements with the mining contractor to mobilize additional equipment to achieve increased mining rates starting in 2024.

Over the life of the project, approximately 716.6 Mt of waste will be mined from the open pit. A feasible surface waste dump design exists to accommodate 63% of the LoM waste quantity; the remaining waste tonnage will have to be dumped back into the southern portion of the Central Lode pit and the Kapanga pit after all ore has been mined from those areas. SRK recommends that Greenbushes closely monitor the mining sequence as mining progresses to ensure timely availability of in-pit dumps.

1.13.6 Processing and Recovery Methods

A comparison of the CGP1 yield model with actual CGP1 plant performance shows that the CGP1 yield model is generally a good predictor of CGP1 plant performance. However, a comparison of the CGP2 yield model with actual CGP2 plant performance during commissioning shows that CGP2 has significantly underperformed the CGP2 yield model.

Greenbushes retained MinSol Engineering to undertake a performance assessment of CGP2 and identify areas where improvements in the plant could be made to increase lithium recovery. MinSol identified and coordinated process plant improvements which resulted in increasing lithium recovery from about 50% reported for 2021 to an average of 67.9% during the first half of 2023.

SRK notes that that CGP2 and CGP1 flowsheets are similar and both plants process ore from the same mining operation, as such, SRK believes that it is reasonable to expect that CGP2 will eventually achieve performance similar to CGP1. SRK is of the opinion that the incrementally higher lithium recovery included in Greenbushes CGP2 yield model (attributed to the inclusion of the HPGR in CGP2's comminution circuit) is not warranted as it has been determined that the HPGR results in higher unrecoverable lithium slimes production than had been anticipated. SRK recommends that Greenbushes' CGP1 yield model continue to be used for resource and reserve modeling for ore processed at CGP1 and recommends using the modified CGP2 yield model shown below for resource and reserve calculations for ore processed at CGP2:

Modified CGP2 Yield % = $(9.362 * (\text{Plant Feed } Li_2O\%)^{1.319}) - 1.5$

Greenbushes is currently constructing Chemical Grade Plant-3 (CGP3), which will be identical to CGP2 with a capacity of 2.4 Mt/y. CGP3 is scheduled to come on-line during Q1 2025. Greenbushes also has plans to construct Chemical Grade Plant-4 (CGP4), which will also be based CGP2. CGP4 is currently planned to commence production during Q1 2027. For the current period, SRK recommends that the modified CGP2 yield model be used to estimate future production from CGP3 and CGP4.

1.13.7 Infrastructure

The infrastructure at Greenbushes is installed and functional. Expansion projects have been identified and are at the appropriate level of design depending on their expected timing of the future expansion. Tailings and waste rock are flagged as risks due to the potential for future expansion and location of future resources that are in development. SRK recommends a detailed review of long-term storage options for both tailings and waste rock to allow timely planning and identification of alternative storage options for future accelerated expansion if needed.

1.13.8 Environmental Studies, Permitting, and Plans, Negotiations, or Agreements with Local Individuals or Groups

The Project has been in operation as a hard rock mine since 1983 and is fully permitted for its current operations. The Project is in the process of obtaining further approvals for expansion.

During development and subsequent modifications to the mine, environmental studies and impact assessments have been completed to support project approval applications. Many of these studies have been or are being updated as part of the expansion efforts. Some of the key findings from previous studies include:

- No Threatened Ecological Communities, Priority Ecological Communities or threatened flora have been reported in the vicinity of the mine site.
- There have been seven conservation significant fauna species recorded in the mine development area.
- Surface water drains through tributaries of the Blackwood River which is registered as a significant Aboriginal site that must be protected under the State Aboriginal Heritage Act 1972.
- Groundwater is not a resource in the local area due to the low permeability of the basement rock.
- Earlier studies indicated that the pits would overflow approximately 300 years after mine closure; however, more recent modeling suggests that water levels will stabilize in approximately 500 to 900 years and remain 20 m below the pit rims (i.e., no overflow).
- Background groundwater quality data are limited due to a lack of monitoring wells upgradient of the mine, and as monitoring wells are located close to the TSFs and/or in the historically dredged channels; some of these wells have been impacted by seepage and are under investigation and remediation efforts.
- Waste rock is not typically acid generating, though some potentially acid generating (PAG) granofels (metasediments) do occur in the footwall of the orebody. Significant acid neutralizing capacity (ANC) has been shown to exist in waste rock and pit walls.
- Studies into the potential for radionuclides have consistently returned results that are below trigger values.
- There are no other cultural sites listed within the mining development area.

The Project operates under approvals that contain conditions for environmental management that include waste and tailings disposal, site monitoring, and water management. The Project has not incurred any significant environmental incidents (EPA, 2021).

There has been no predictive modeling of the pit lake quality as far as SRK is aware, and this is recommended to inform closure management strategies. There is potential for site water management to be required post-closure until seepage from TSF2 attenuates.

The Project has contaminated five sites listed which encompass the entire mine area due to known or suspected contaminated site due to hydrocarbons and metals in soil, and elevated concentrations of metals in groundwater and surface water. These sites are classified as “Contaminated – Restricted use” and only permit commercial and industrial uses. This will need to be reviewed for final land use options for closure.

Talison has agreements in place with two local groups.

Mine Closure

Talison has updated the mine closure plan in 2022 to incorporate changes and proposed expansions to the current operations and the results of additional studies including a pit lake study and additional geochemical characterization work.

Western Australia does not require a company to post performance or reclamation bonds. All relevant tenement holders in Western Australia are required to annually report disturbance and to make contributions to a pooled fund based on the type and extent of disturbance under the Mining Rehabilitation Fund Act 2012 (MRF Act). The pooled fund can be used by DEMIRS to rehabilitate mines where the tenement holder/operator has failed to meet their rehabilitation obligations and finances have not been able to be recovered. The interest earned on the pooled fund is used for administration and to rehabilitate legacy abandoned mine sites.

A cost estimate for immediate (unplanned) closure of Greenbushes has been prepared by Talison using the Victorian Government Rehabilitation bond calculator (dpi-bond-calculator-24-feb-2011) as a template to assist them in identifying and costing the rehabilitation, decommissioning, and monitoring requirements for the Greenbushes site. The Victorian Government bond calculator uses predefined third-party unit rates based on the typical current market 'third party rates' as of July 2010, which may overestimate or underestimate closure costs for Western Australia. Talison has been escalating these unit rates since 2013.

The September 2023 closure cost estimate for Greenbushes only addresses immediate mine closure. SRK was not provided a LoM closure cost estimate, which, although not a regulatory requirement, is industry best practice. This estimate includes facilities that currently exist on site and expansion of Floyd's dump. The closure cost estimate totaled AU$62,434,282, of which AU $59,235,736.40 represents Talison's portion of the operation.

1.13.9 Summary Capital and Operating Cost Estimates

Greenbushes cost forecasts are based on mature mine budgets that have historical accounting data to support the cost basis and forward looking mine plans as a basis for future operating costs as well as forward looking capital estimates based on engineered estimates for expansion capital and historically driven sustaining capital costs. Forecast costs were provided in AU$. SRK notes that the global economic environment continues to drive cost increases and that forward looking forecasting is inherently limited in its ability to predict macroeconomic variability. In SRK's opinion, the estimates are reasonable in the context of the current reserve and mine plan.

1.13.10Economics

The operation is forecast to generate positive cashflow over the life of the reserves with the exception of the final year of operations where minimal material is processed, based on the assumptions detailed in this report. This estimated cashflow is inherently forward-looking and dependent upon numerous assumptions and forecasts, such as macroeconomic conditions, mine plans and operating strategy, that are subject to change.

As modeled for this analysis, the operation is forecast to produce 29.5 Mt of spodumene concentrate to be sold at a CIF price of US$1,500/t. This yields an after-tax project NPV at 10% of US$8.86 billion, of which, US$4.34 billion is attributable to Albemarle.

The analysis performed for this report indicates that the operation's NPV is most sensitive to variations in the grade of ore mined, the commodity price received and plant performance.

2 Introduction

This Technical Report Summary (TRS) was prepared in accordance with the Securities and Exchange Commission (SEC) S-K regulations (Title 17, Part 229, Items 601 and 1300 through 1305) for Albemarle Corporation (Albemarle) by SRK Consulting (U.S.), Inc. (SRK) on the Greenbushes Mine (Greenbushes). Greenbushes is held within the operating entity, Talison Lithium Australia Pty Ltd (Talison), of which Albemarle is a 49% owner with the remaining 51% ownership controlled by Tianqi/IGO JV.

.1 Terms of Reference and Purpose

The quality of information, conclusions, and estimates contained herein are consistent with the level of effort involved in SRK's services, based on i) information available at the time of preparation and ii) the assumptions, conditions, and qualifications set forth in this report. This report is intended for use by Albemarle subject to the terms and conditions of its contract with SRK and relevant securities legislation. The contract permits Albemarle to file this report as a Technical Report Summary with American securities regulatory authorities pursuant to the SEC S-K regulations, more specifically Title 17, Subpart 229.600, item 601(b)(96) - Technical Report Summary and Title 17, Subpart 229.1300 - Disclosure by Registrants Engaged in Mining Operations. Any other uses of this report by any third party are at that party's sole risk. The responsibility for this disclosure remains with Albemarle.

The Greenbushes property consists of two spodumene-bearing pegmatite dike areas: the actively mined Central Lode deposit and the undeveloped Kapanga deposit located immediately east of the Central Lode. The on-site Greenbushes facilities produce a range of spodumene concentrate products that are sold into technical and chemical lithium markets. However, for the purposes of developing the reserve estimate herein, SRK has based its economic analysis on the sale of only chemical grade spodumene concentrate. This is because Talison's ability to predict lithium production for technical grade product at a level that meets the standard of uncertainty for a reserve requires grade control drilling. Therefore, instead of assuming sale of technical grade concentrates, SRK has assumed that all product is sold into chemical markets. In SRK's opinion, from a geological standpoint this is a reasonable assumption as any material that is appropriate to feed technical grade production can also be used for chemical grade feed.

Greenbushes has developed and is operating a Tailings Reprocessing Plant (TRP) to reprocess tailings from Tailings Storage Area 1 (TSF1). In SRK's opinion, due to the high level of inherent variability in mineral contained in a tailings storage facility, establishing geological, processing and production data to adequately meet the standard of uncertainty required to support an estimate of reserves is difficult. Further, the quantity of potential production from TSF1 is minimal in the context of the overall Greenbushes reserve. Therefore, the potential spodumene concentrate production from the reprocessing effort has not been included in the reserve estimate.

Further discussion and reference information for completeness on the TGP and TRP is provided in Section 21.

The purpose of this Technical Report Summary is to report Mineral Resources and Mineral Reserves. The effective date of this report is June 30, 2023.

This report is an update of the previous report titled "SEC Technical Report Summary, Pre-Feasibility Study, Greenbushes Mine, Western Australia" with an effective date of December 31, 2022 and a report date of February 14, 2023.

.2 Sources of Information

This report is based in part on internal Company technical reports, previous feasibility studies, maps, published government reports, company letters and memoranda, and public information as cited throughout this report and listed in the References Section (Section 24).

Reliance upon information provided by the registrant is listed in Section 25 when applicable.

.3 Details of Inspection

Table 2-1 summarizes the details of the personal inspections on the property by a representative of each Qualified Person, or, if applicable, the reason why a personal inspection has not been completed.

Table 2-1: Site Visits

Expertise	Date(s) of Visit	Details of Inspection	Reason Why a Personal Inspection Has Not Been Completed
Environmental/ Closure	August 19-20, 2020	Day 1: Site overview presentation with Craig Dawson (General Manager – Operations) and meeting with Site Environmental Team. Proceeded to Cornwall Pit, which is currently used for water capture, followed on to C1/C2/C3 Open pit lookout, inspection of the progressive rehabilitation at Floyds WRL, Tailings retreatment plant and finished with a tour of the technical and chemical grade processing plants. Day 2: Inspection of the rehabilitation at TSF3, then to the seepage collection point just below Tin Shed Dam. Inspection of the buttress at TSF 2 and corresponding rehab of buttress, together with the new under drainage on the west side of TSF 2 to capture seepage. Visited Cowen Brook Dam. Overview of the WTP to be commissioned in September 2020 and visited the storage dams Clearwater, Austins and Southampton. Finished the tour with a visit to the 3 year old rehab to the west of Maranup Ford Road.	
Resource/ Geology	October 12-14, 2022	Site overview meeting, met with resource/geology team, pit tour and review of core, site laboratory tour.	
Mining/ Reserves	October 12-14, 2022	Site overview meeting, meetings with mining / reserves team and review of process/procedures, site mine-wide tour including pit and area infrastructure.	
Metallurgy/ Process	October 12-14, 2022	Site overview meeting, meetings with process personnel, tour of CGP1, CGP2, TRP, Tailings area, meetings with capital projects lead and projects overview.	
Infrastructure/ Tailings	October 12-14, 2022	Site overview meeting, meetings with process personnel, tour of CGP1, CGP2, TRP, tailings, overall site tour including infrastructure, pit, waste dump areas, meetings with capital projects lead and projects overview, meeting with infrastructure lead and review of infrastructure.	

.4 Report Version Update

The user of this document should ensure that this is the most recent Technical Report Summary for the property.

This report is an update of a previously filed report titled "SEC Technical Report Summary, Pre-Feasibility Study, Greenbushes Mine, Western Australia" with an effective date of December 31, 2022 and a report date of February 14, 2023.

.5 Qualified Person

This report was prepared by SRK Consulting (U.S.), Inc., a third-party firm comprising mining experts in accordance with § 229.1302(b)(1). The marketing sections of the report (Sections 1.9 and 16) were prepared by Fastmarkets, a third-party firm with lithium market expertise in accordance with § 229.1302(b)(1). Albemarle has determined that SRK and Fastmarkets meet the qualifications specified under the definition of qualified person in § 229.1300. References to the Qualified Person (QP) in this report are references to SRK Consulting (U.S.), Inc. and Fastmarkets respectively and not to any individual.

3 Property Description

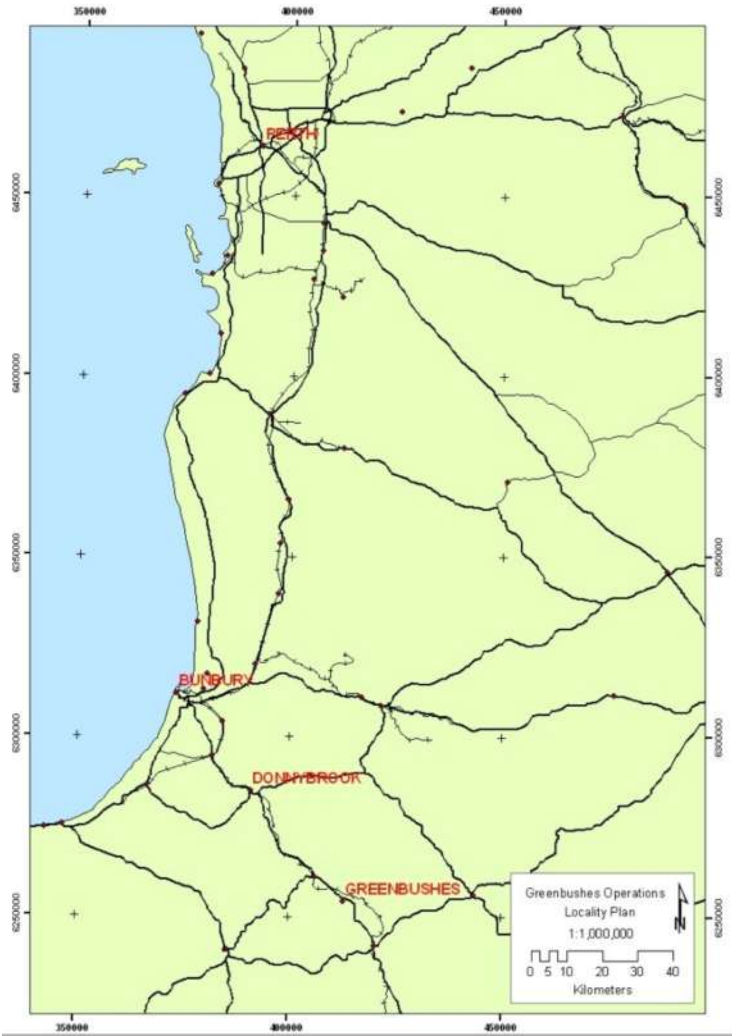
The Greenbushes property is a large mining operation located in Western Australia (Figure 3-1) extracting lithium and tantalum products from the Central Lode pegmatite deposit with the adjacent, undeveloped Kapanga pegmatite deposit located just east of the Central Lode. Historically, the operation also produced tin. Active mining of tin began in 1888, with tantalum production commencing in 1942, and lithium production beginning in 1983. In addition to being the longest continuously operated mine in Western Australia, the Greenbushes pegmatite is one of the largest known spodumene pegmatite resources in the world.

.1 Property Location

Greenbushes is located directly south of and immediately adjacent to the town of Greenbushes (Figure 3-2) approximately 250 km south of Perth, at latitude 33° 52´S and longitude 116° 04´ E, and 90 km south-east of the Port of Bunbury, a major bulk handling port in the southwest of Western Australia (WA). It is situated approximately 300 meters above mean sea level (mamsl).

Source: Talison, 2018

Figure 3-1: General Location Map, Greenbushes Mine

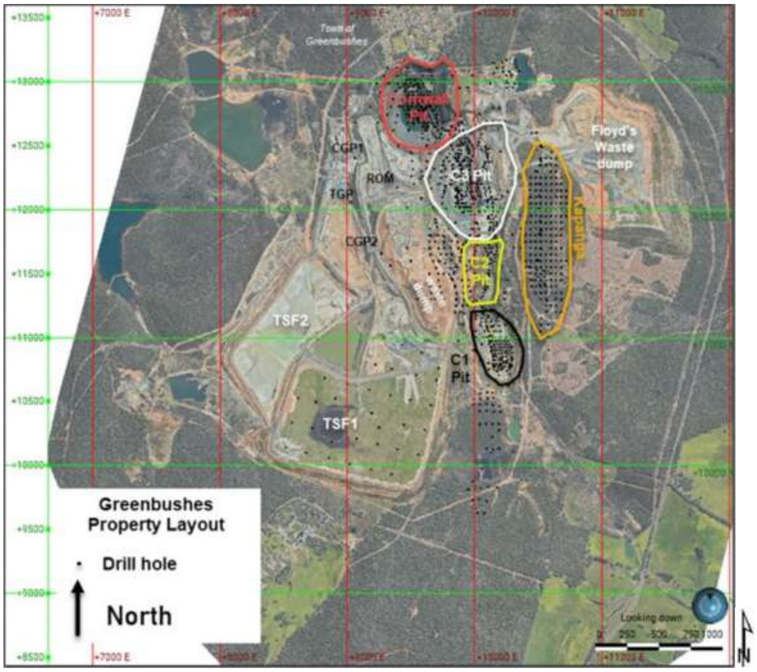


Source: Talison, 2018

Figure 3-2: Greenbushes Regional Location Map

3.1.1 Property Area

The Greenbushes property area is approximately 3,500 ha, which is a smaller subset of a larger 10,067 ha land package controlled by Talison. A general layout of the operating property utilizing a 2017 aerial photo is shown in Figure 3-3, along with drilling collars used for exploration of the primary pegmatite bodies discussed herein. Mineralized pegmatites occur over the property area, generally trending north – south.



Source: SRK, 2023

Figure 3-3: Property Area Layout with Drilling Collars

.2 Mineral Title

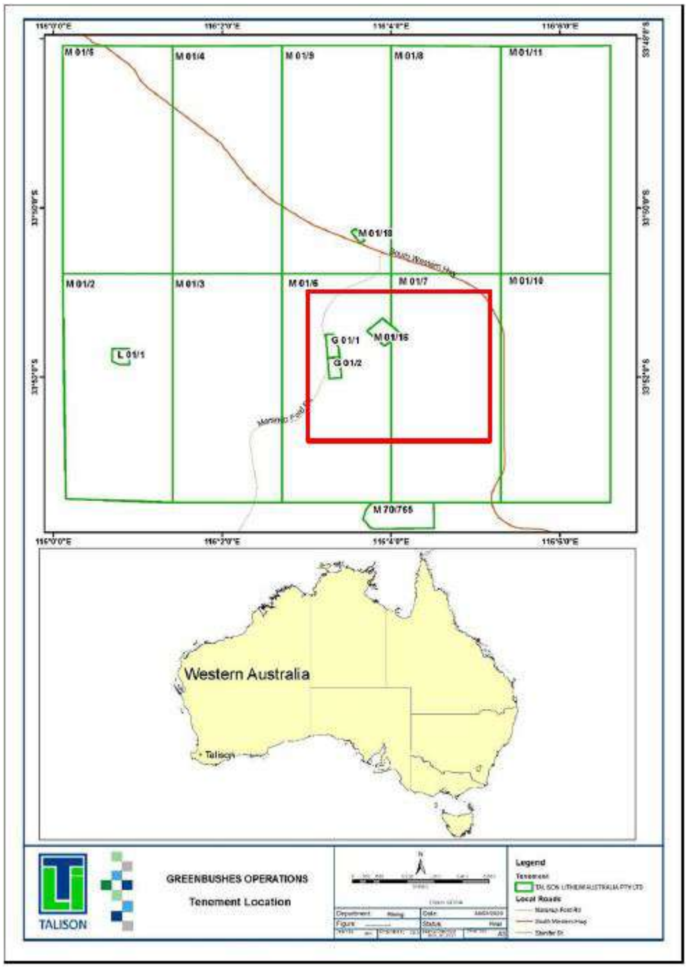
Talison holds 10,067 ha of mineral tenements which cover the Greenbushes area and surrounding exploration areas. As noted in Table 3-1, some types of title are noted as general purpose leases, while others are discrete mining leases. Active mining and exploration are completely contained within mining leases or other Licences as appropriate. SRK notes that the entirety of the Mineral Resources and Mineral Reserves disclosed herein are contained within titles 100% controlled by

Talison and summarized in Table 3-1. The layout of the relevant property boundaries is shown in Figure 3-4.

Table 3-1: Land Tenure Table

Claim ID	Owner(s)	As Reported Type	Status	Date Granted	Expiry Date	Source As Of Date	Area (Ha)
G 01/1	Talison Lithium Australia Pty Ltd	General Purpose Lease	Active/ Granted	11/14/1986	6/5/2028	11/30/2020	10
G 01/2	Talison Lithium Australia Pty Ltd	General Purpose Lease	Active/ Granted	11/14/1986	6/5/2028	11/30/2020	10
L 01/1	Talison Lithium Australia Pty Ltd	Miscellaneous Licence	Active/ Granted	3/19/1986	12/27/2026	11/30/2020	9
M 01/6	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	985
M 01/5	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	999
M 70/765	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	6/15/1994	6/19/2036	11/30/2020	71
M 01/3	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	1,000
M 01/7	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	998
M 01/4	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	999
M 01/8	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	999
M 01/10	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	1,000
M 01/11	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	999
M 01/16	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	6/3/1986	6/5/2028	11/30/2020	19
M 01/9	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	997
M 01/18	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	9/16/1994	9/27/2036	11/30/2020	3
M 01/2	Talison Lithium Australia Pty Ltd	Mining Lease	Active/ Granted	12/28/1984	12/27/2026	11/30/2020	969

Source: Department of Mines and Petroleum (W. Australia), 2020 (Verified, 2023)



Source: Talison, 2020 (Verified 2023)

Generalized Greenbushes operations area shown in red box.

Figure 3-4: Greenbushes Land Tenure Map

Mining leases entitle the tenement holder to work and mine the land. The operating mine and processing plant area covers a total area of about 3,500 ha and generally sits on mining leases M01/06, M01/07 and M01/16. Talison holds the mining rights for all lithium minerals on these tenements, while Global Advanced Metals (GAM) holds the mining rights to all minerals other than lithium through a reserved mineral rights agreement dated November 13, 2009.

All tenements are registered with the mining registrars located in the State of WA. They have been surveyed and constituted under the Mining Act 1978 (WA) (BDA, 2012). Talison continues to review all tenements on an annual basis and ensures compliance with relevant regulatory requirements and fees for maintenance of these tenements.

.3 Encumbrances

SRK is not aware of any material encumbrances that would impact the current resource or reserve disclosure as presented herein. Infrastructure movement or modifications which could be related to further expansion or development of the current Mineral Resource or Mineral Reserve are detailed in Section 15 of this report.

.4 Royalties or Similar Interest

In WA, a royalty of 5% of the value of lithium concentrate sales is payable for lithium mineral production as prescribed under the Mining Act. The royalty value is the difference between the gross invoice value of the sale and the allowable deductions on the sale. The gross invoice value of the sale is the Australian dollar value obtained by multiplying the amount of the mineral sold by the price of the mineral as shown in the invoice. Allowable deductions are any costs in Australian dollars incurred for transport of the mineral quantity by the seller after the shipment date. For minerals exported from Australia, the shipment date is deemed to be the date on which the ship or aircraft transporting the minerals first leaves port in WA (BDA, 2012).

.5 Other Significant Factors and Risks

SRK is not aware of any other significant factors or risk that may affect access, title, or the right or ability to perform work on the property.

4 Accessibility, Climate, Local Resources, Infrastructure and Physiography

.1 Topography, Elevation and Vegetation

Excerpted from BDA, 2012.

The Greenbushes site is situated approximately 300 m AMSL. The operations area lies on the Darling Plateau and is dominated by a broad ridgeline which runs from the Greenbushes township (310 m) towards the south-east (270 m) with the open pits located along this ridgeline (300 m). The current operating waste rock dump is located on an east facing hill slope which descends to 266 m and adjoins the South Western Highway, while the process plant area is located on the west facing hill slope which descends to 245 m. The tailings storage areas are located south of the mining and plant areas at 265 m.

.2 Means of Access

Access to the property is via the paved major South Western Highway between Bunbury and Bridgetown to the Greenbushes Township, and via Maranup Ford Road to the mine. A major international airport is located in Perth, WA, approximately 250 km north of the mine area (BDA, 2012).

.3 Climate and Length of Operating Season

Excerpted from BDA, 2012.

The Greenbushes area has a temperate climate that is described as mild Mediterranean, with distinct summer and winter seasons. The mean minimum temperatures range from 4°C to 12°C, while the mean maximum temperatures range from 16°C to 30°C. The hottest month is January (mean maximum temperature 30ºC), while the coldest month is August (mean minimum temperature 4ºC). There is a distinct rainfall pattern for winter, with most of the rain occurring between May and October. The area averages about 970 mm per annum with a range of about 610 mm to 1,680 mm per annum. The evaporation rate for the area is calculated at approximately 1,190 mm per annum. The area is surrounded by vegetation broadly described as open Jarrah/Marri forest with a comparatively open understorey.

Mining and processing operations at Greenbushes operate throughout the year.

.4 Infrastructure Availability and Sources

4.4.1 Water

Water is currently supplied from developed surface water impoundments for capture of precipitation runoff, pumping from sumps within the mining excavations and recycled from multiple tailing storage facilities (TSFs). No mine water is sourced directly from groundwater aquifers through production or dewatering wells. The majority of these water sources and impoundments are linked through constructed surface pumps and conveyance.

4.4.2 Electricity

Power is provided by utility line power from existing Western Power transmission that runs along the east side of the deposit. 22 kV transmission lines feed off the Western power transmission line from both the north and south to form a loop configuration. The 22 kV transmission then feeds local power distribution to the various loads on the project.

4.4.3 Personnel

The mine and processing facilities are located about 3 km south of the community of Greenbushes part of Bridgetown-Greenbushes Shire and the community of Greenbushes is the closest community to the site. Personnel working at the project typically live within a thirty-minute drive of the project. A number of local communities are within 30 minutes of the site. Skilled labor is available in the region, but supplemental camps are provided for additional workforce from outside the region. Talison has an established work force with skilled labor. The current labor levels are approximately 1,350 people with over 700 additional contract personnel doing construction on site.

4.4.4 Supplies

Supplies are readily available from established vendors and services from the local communities and from the regional capital Perth located 250 km to the north.

5 History

Mining in the Greenbushes area has continued since tin was first discovered at Greenbushes in 1886. Greenbushes is recognized as the longest continuously operated mine in WA (BDA, 2012).

.1 Previous Operations

Excerpted from BDA, 2012.

5.1.1 Tin

Since it was first discovered at Greenbushes in 1886, tin has been mined almost continuously in the Greenbushes area, although in more recent times lower tin prices and the emergence of lithium and tantalum as major revenue earners have relegated tin to the position of a by-product. Tin was first mined at Greenbushes by the Bunbury Tin Mining Co in 1888. However, there was a gradual decline in tin production between 1914 and 1930. Vultan Mines carried out sluicing operations of the weathered tin oxides between 1935 and 1943, while between 1945 and 1956 modern earth moving equipment was introduced and tin dredging commenced. Greenbushes Tin NL was formed in 1964 and open cut mining of the softer oxidized rock commenced in 1969.

5.1.2 Tantalum

Tantalum mining at Greenbushes commenced in the 1940s with the advancement in electronics. Tantalum hard-rock operations started in 1992 with an ore processing capacity of 800,000 t/y. By the late 1990s demand for tantalum reached all-time highs and the existing high grade Cornwall Pit was nearing completion. In order to meet increasing demand a decision was made to expand the mill capacity to 4 Mt/y and develop an underground mine, to provide higher grade ore for blending with the lower grade ore from the Central Lode pits. An underground operation was commenced at the base of the Cornwall Pit in April 2001 to access high grade ore prior to the completion of the available open pit high-grade resource.

In 2002, the tantalum market collapsed due to a slow-down in the electronics industry and subsequently the underground operation was placed on care and maintenance. The underground operation was restarted in 2004 due to increased demand but again placed on care and maintenance the following year. The lithium open pit operation has continued throughout recent times and mining is now focused on the Central Lode zone. Only lithium minerals are currently mined from the open pits. The tantalum mining operation and processing plants have been on care and maintenance since 2005.

5.1.3 Lithium Minerals

The mining of lithium minerals is a relatively recent event in the history of mining at Greenbushes with Greenbushes Limited commencing production of lithium minerals in 1983 and commissioned at 30,000 t/y lithium mineral concentrator two years later in 1984 and 1985. The lithium assets were acquired by Lithium Australia Ltd in 1987 and Sons of Gwalia in 1989. Production capacity was increased to 100,000 t/y of lithium concentrate in the early 1990s and to 150,000 t/y of lithium concentrate by 1997, which included the capacity to produce a lithium concentrate for the lithium chemical converter market.

The Talison Minerals Group was incorporated in 2007 for the purpose of acquiring the assets of the Advanced Minerals Division of Sons of Gwalia by a consortium of US private equity companies led by Resource Capital Funds. The Talison Mineral Group's assets included the Wodgina tantalum mine located about 1,500 km north of Perth and 120 km south of Port Hedland in the Pilbara region of WA as well as the Greenbushes Lithium Operations. Upon completion of the reorganization of the Talison Minerals Group in 2010, Talison acquired the Greenbushes Lithium Operations, and the remainder of the assets were acquired by GAM.

There are two lithium processing plants that recover and upgrade the spodumene mineral using gravity, heavy media, flotation, and magnetic processes into a range of products for bulk or bagged shipment. In the period of 2005 to 2008, demand from the Chinese chemical producers was satisfied by using the Greenbushes primary tantalum plant which had been on care and maintenance. Products from that plant had a lower grade than preferred by the Chinese customers and were supplied as a temporary measure until Talison's lithium concentrate production capacity was increased.

In 2009, Talison's processing plants were upgraded to total nominal capacity of approximately 260,000 t/y of lithium concentrates and in late 2010 capacity was increased to 700,000 t/y of ore feed yielding approximately 315,000 t/y of lithium concentrates.

.2 Exploration and Development of Previous Owners or Operators

As noted above, the Greenbushes property is the longest continuously operating mine in WA and features an extensive exploration and operational history. Exploration work was conducted by previous owners and operators through the various commodities focuses as described in Section 5.1, including drilling (rotary, reverse circulation, and diamond core), surface sampling, geological mapping, trenching, and geophysics.

Development work has generally included construction activities related to both open-pit and underground mining, as well as waste dumps, tailings facilities, surface water management infrastructure and more.

6 Geological Setting, Mineralization, and Deposit

.1 Regional Geology

As stated by G. A. Partington (1990), the Greenbushes pegmatite in WA is intruded into rocks of the Balingup Metamorphic Belt (BMB), which is part of the Southwest Gneiss Terranes of the Yilgarn Craton. The Greenbushes pegmatite lies within, and is geometrically controlled by, the Donnybrook-Bridgetown Shear Zone. It appears to have been emplaced during the orogeny as is evidenced by the relatively fine grain size of the pegmatites as well as noted internal deformation which may be consistent with syn-deformation emplacement. The pegmatites are Archaean and dated at approximately 2,525 million years (Ma). Pegmatites are hosted by a 15 to 20 km wide, north to north-west trending sequence of sheared gneiss, orthogneiss, amphibolite and migmatite which outcrop along the trace of the lineament. A series of syn-tectonic granitoid intrusives occur within the BMB, elongated along the Donnybrook-Bridgetown Shear Zone. The pegmatites have been further affected by subsequent deformation and/or hydrothermal recrystallization, the last episode dated at around 1,100 Ma. Figure 6-1 shows the regional geology.

Source: Talison Lithium Limited, 2022

Figure 6-1: Regional Geology Map

.2 Local Geology

The Greenbushes pegmatite deposit consists of a primary pegmatite intrusion with numerous smaller, generally parallel pegmatite dikes and pods to the east (Figure 6-2 and Figure 6-3). For the purposes of this report, the term Greenbushes pegmatite deposits relate to the property-scale pegmatites. Central Lode refers to the primary pegmatite area which has been the focus of mining activity while the Kapanga deposit refers to the area of sub-parallel pegmatite located to the east of the Central Lode. The primary Central Lode deposit intrusion and the subsidiary Kapanga deposit dikes and pods are concentrated within shear zones on the boundaries of granofels, ultramafic schists and amphibolites. The pegmatites are crosscut by mafic dolerite dikes that range from 1 to 50 m wide and over 2 km long. The dolerite dikes occur in both swarms and linear trends with two principal orientations, north to south and east to west. The broader pegmatite body is over 3 km long (north by northwest), up to 300 m wide (normal to dip), strikes north to north-west and dips moderately to steeply west to south-west. The syn-tectonic development of the pegmatite has given rise to mylonitic fabrics, particularly along host rock contacts.

The Greenbushes pegmatite is mineralogically segregated into five primary zones. Internally, the Greenbushes pegmatite consists of the Contact Zone, Potassium Feldspar (Potassium) Zone, Albite (Sodium) Zone, Mixed Zone and Spodumene (Lithium) Zone (Figure 6-4). The zones differ from many other rare-metal pegmatites in that they do not appear concentric, but are lenticular in nature, with inter-fingering along strike and down dip. They do not have a quartz core which is typical of other deposits. The mine sequence was later subjected to the transgressive east-west dike and conformable sill dolerite intrusions.

The highest concentrations of primary Li-bearing minerals are found in specific mineralogical zones or assemblages within the pegmatite. The Lithium Zone within the main pegmatite body exhibit variable dips from 80 to 20° towards the west and south-west. Tantalum (tantalite) and tin (cassiterite) mineralization is concentrated in the Sodium Zone which is characterized by albite (Na-plagioclase), tourmaline and mica (muscovite). The Lithium Zone is enriched in the lithium bearing silicate spodumene. The mixed zone contains lower concentrations of tantalum and lithium. The final major zone is the potassium feldspar microcline which is not considered currently economic.

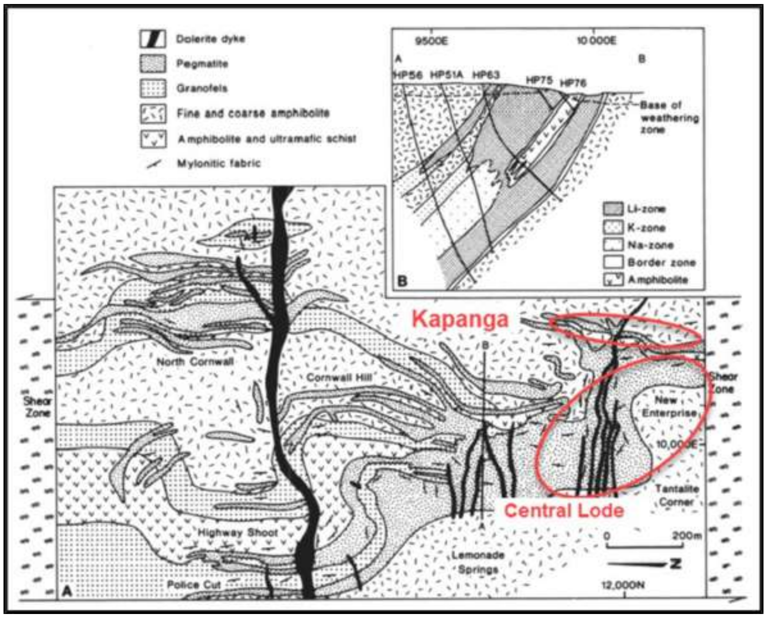
The predominant rock units on the Greenbushes property are a package of Archean amphibolite and metasediments above the basement Bridgetown Gneiss (Figure 6-4). Locally, this is present as the hanging wall Amphibolite and Footwall Granofels. Numerous Archean granitoid intrusions are present, all of which are cut by the Donnybrook-Bridgetown Shear zone represented onsite as the roughly N – S trending shear-zone gneiss. Pegmatite intrusions which host Li mineralization have intruded this package of Archean rocks. Post-mineralization dolerite dikes intrude older units, dated at approximately 1.1 Ga. Lastly, recent cover material of lateritic conglomerates, older alluvium, and recent alluvium are present as shallow cover. A simplified stratigraphic column is presented in Figure 6-4. Weathering and erosion of the pegmatites has produced adjacent alluvial deposits in ancient drainage systems. These are generally enriched in cassiterite. All rocks have been extensively lateritized during Tertiary peneplain formation; the laterite profile locally reaches depths in excess of 40 m below the original surface.

The Central Lode lithium deposit occurs within a large (250 m wide) lithium enriched pegmatite. Spodumene in the Lithium ore zone can make up more than 50% of the rock with the remainder being largely quartz. Toward the northern end of C3 pit (Figure 6-3), a highly felspathic (K-feldspar) zone separates the high-grade lithium zone from the hanging wall amphibolite and the dolerite sill. Tantalum/tin and lithium ore body mineralization are conformable with the trends of the pegmatites both along strike and down dip.

Between C3 and C1 is the mining area referred to as C2. The pegmatite in this area dips approximately 40° west and has an intermediate composition with moderate lithium oxide Li_2O values and moderate tantalum pentoxide (Ta_2O_5) values. This is in contrast to C1 and C3 which have large distinct zones of separate Li_2O and Ta_2O_5 high-grade.

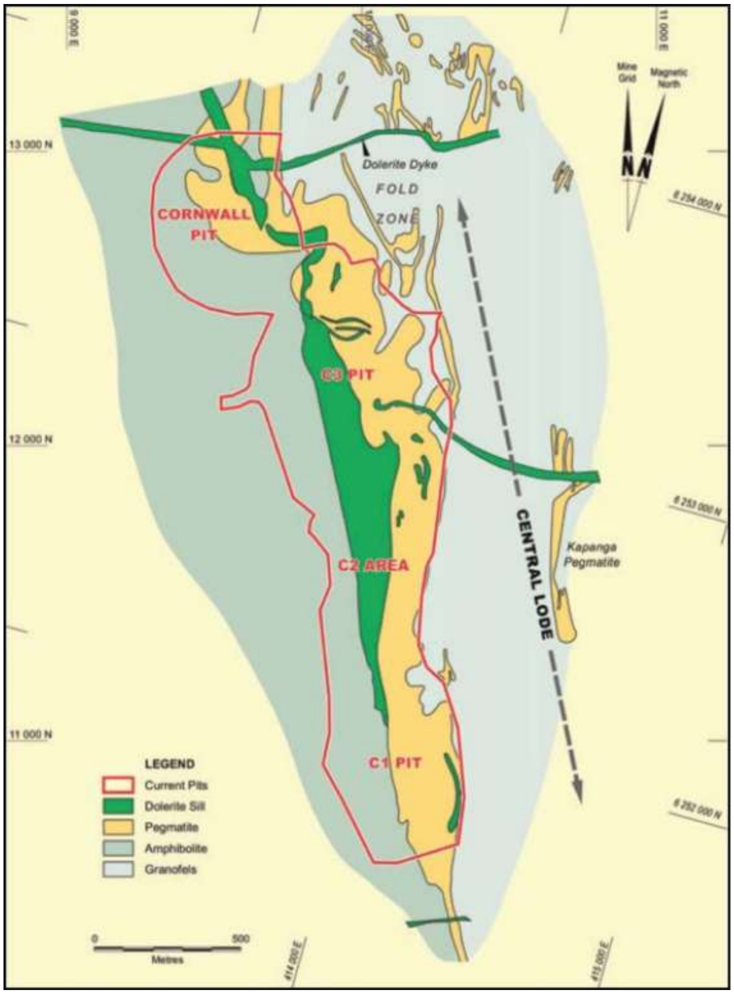
At the southern end of the Central Lode pits is the C1 pit area. It contains the next largest concentration of high-grade spodumene lithium mineralization after C3. The eastern footwall contact in the south of the C1 area dips 35° west steepening toward the north and with depth. The internal grade domains in C1 parallel the eastern footwall contact. The immediate footwall is enriched in tantalum with typical accessory minerals tourmaline and apatite visible. Weathering has locally resulted in argillic alteration of pegmatites near-surface, although this has only limited effects on current operations with the depth of current mining. Moving north, the dip of the pegmatite shallows and the lithium domain at more than 1% Li_2O is discontinuous.

The Kapanga deposit sits approximately 300 m east as a sub-parallel pegmatite to the Central Lode deposit (Figure 6-2). and represents a thinner zone of spodumene mineralization, near-surface, but with reduced volume compared to the Central Lode. It has been interpreted over a northerly strike length of approximately 1.8 km. The pegmatite intrusives within Kapanga typically dip at 40° to 50° with some steepening to 60° toward the southern end of the deposit. The pegmatite has been interpreted as several sub-parallel stacked lodes of varying thickness and length, as well as numerous smaller pods, with an overall thickens of approximately 150 m. Current drilling has identified depth continuity to approximately 450 m below surface.



Source: Partington, 1990 modified by SRK, 2022

Figure 6-2: Greenbushes Area Generalized Geology Map with Inset Cross Section



Source: BDA, 2022

Figure 6-3: Greenbushes Property Geology Map

6.2.1 Structure

Shear structures in the pegmatites are most strongly developed at margins and in albite rich zones. The orientation of shear fabrics is sub-parallel to the regional Donnybrook–Bridgetown Shear Zone indicating pegmatite intrusion was synchronous with this deformational event. Folding postdates mylonization of the albite zone yet predates or is synchronous with later stages of crystallization. Dilatant zones formed in footwall albite zones during folding and were infiltrated by late-stage Sn-Ta-Niobium (Nb) rich fluids which may be the sites for a second stage of high-grade mineralization. Later stage discordant structures have also been interpreted, the most obvious being the “Footwall Fault”, a sub-vertical structure striking north-south across the deposit. Faulted zones vary in structural intensity from heavily jointed to disintegrated rock greater than 30 m in width.

6.2.2 Mineralogy

Internally, the Greenbushes pegmatite displays up to five distinct mineralogically-defined zones (Figure 6-4); the Contact Zone, K-Feldspar (Potassium) Zone, Albite (Sodium) Zone, Mixed Zone and Spodumene (Lithium) Zone. Zones generally relate to multiple phases of intrusion and crystallization of the pegmatites.

The bulk of the lithium is contained within the Spodumene Zone. In the Central Lode deposit, this is typically located within the central part of the pegmatite. For the Kapanga deposit, the elevated spodumene concentrations in the individual lodes are generally located near the footwall contact, and to a lesser extent, near the hangingwall contact, with the core regions being largely barren. Differences between the spodumene concentration in the individual lodes are also evident, with the higher concentrations generally in the upper part of the sequence.

The mineralogical zones occur as a series of thick layers commonly with a lithium zone on the hanging wall or footwall, K-feldspar towards the hanging wall and a number of central albite zones. High-grade tantalum mineralization (more than 420 grams per tonne (g/t)) is generally confined to the Albite zone within the deposit. The Spodumene and K-Feldspar Zones typically have tantalum-tin grades of less than 100 ppm.

Table 6-1 summarizes the main minerals associated with the historically economic elements tantalum (Ta), tin (Sn), and lithium (Li) at Greenbushes. Currently, only lithium minerals are exploited and processed at Greenbushes.

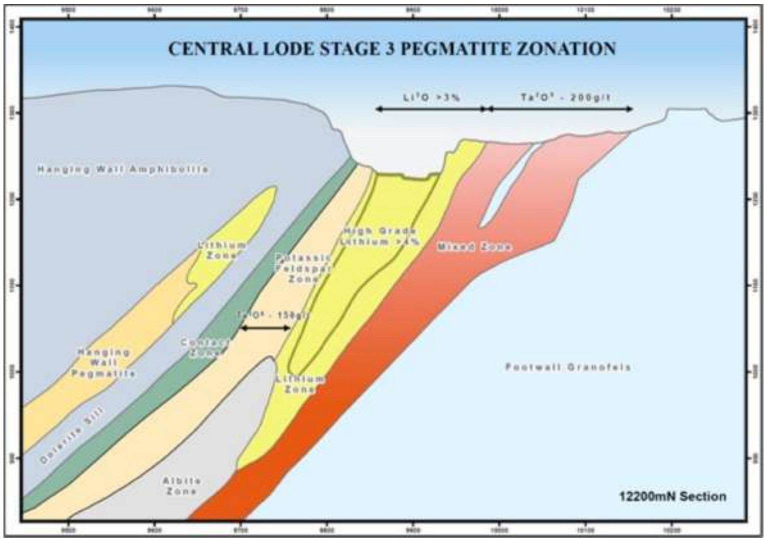
Table 6-1: Major Lithium and Tantalum Ore Minerals

Tantalum	Composition	Lithium	Composition
Columbo Tantalite	$(Fe,Mn)(Nb,Ta)_2O_6$	Spodumene	$LiAlSi_2O_6$
Stibio Tantalite	$(Nb,Ta)SbO_4$	Varieties	
Microlite	$((Na,Ca)_2Ta_2O_6(O,OH,F))$	Spodumene – White	
Ta – Rutile (Struverite)	$(Ti,Ta,Fe^{3+})_3O_6$	Hiddenite – Green	(Fe,Cr)
Wodginite	$(Ta,Nb,Sn,Mn,Fe)_{16}O_{32}$	Kunzite – Pink	(Mn)
Ixiolite	$(Ta,Fe,Sn,Nb,Mn)_4O_8$	Other Lithium Minerals	
Tapiolites	$(Fe,Mn)(Ta,Nb)_2O_6$	Lithiophilite	$Li(Mn^{2+},Fe^{2+})PO_4$
Holite	$Al_6(Ta,Sb,Li)[(Si,As)O_4]_3(BO_3)(O,OH)_3$	Amblygonite	$(Li,Na)Al\ PO_4(F,OH)$
Tin		Holmquisite	$Li(Mg,Fe^{2+})_3Al_2Si_8O_{22}(OH)_2$
Cassiterite	SnO_2	Lepidolite	$K(Li,Al)_3(Si,Al)_4O_{10}(OH)_2$

Source: Talison, 2018

Major minerals hosted in the pegmatites are quartz, spodumene, albite, and K-feldspar. Primary lithium minerals are spodumene, $LiAlSi_2O_6$ (approximately 8% Li_2O) and spodumene varieties kunzite and hiddenite. Minor lithium minerals include lepidolite (mica), amblygonite and lithiophilite (phosphates). Spodumene is hard (6.5 to 7) with an SG of 3.1-3.2. Highest concentrations (50%) of Spodumene occur in the C1 and C3 pits.

When spodumene-bearing pegmatite is weathered and oxidized, the contained lithium ions can become mobilized resulting in zones of depleted lithium concentration, alteration of spodumene to clay products, increased relative silica percentage, and uneconomic lithium grades. Oxidation of the pegmatites has generally occurred in near-surface weathering or along selected structures internal to the pegmatites. Only the near-surface weathering is considered to materially affect the pegmatite from a process mineralogy standpoint.

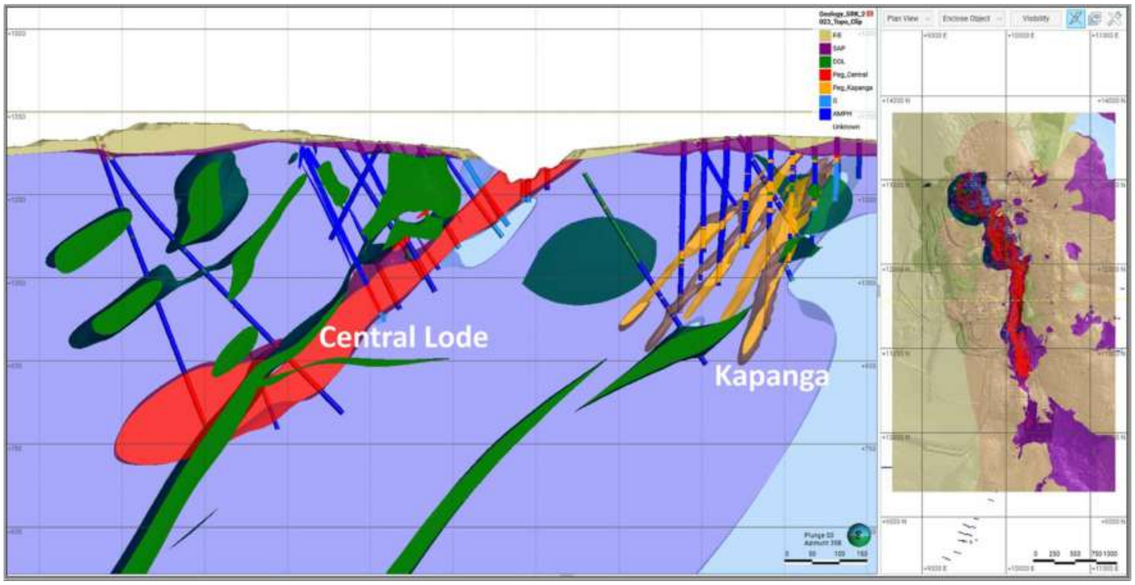


Source: Modified from BDA, 2012
Section looking north.

Figure 6-4: Cross Section Showing Generalized Stratigraphy and Greenbushes Pegmatite Mineral Zoning

.3 Stratigraphic Column and Local Geology Cross-Section

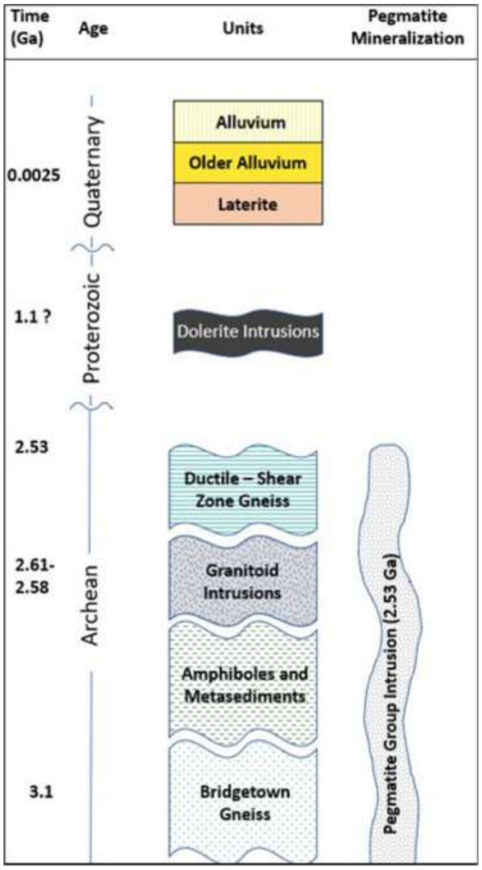
Figure 6-5 shows a generalized cross-section through the Central Lode and Kapanga zones. The section (looking north) shows orientation and relationship of the Li bearing pegmatites and cross cutting dolerite dikes, with the dolerite dikes cross-cutting the mineralization.



Source: SRK, 2023

Figure 6-5: Cross-Section from East to West across the Central and Kapanga Zones

Figure 6-6 illustrates a typical stratigraphic column through Greenbushes Central Lode and Kapanga zones.



Source: SRK, 2022

Figure 6-6: Simplified Stratigraphic Column

7 Exploration

.1 Exploration Work (Other Than Drilling)

The primary method of exploration on the property has been drilling for the past 40 years. While other means of exploration such as geological mapping, surface geochemical sampling, and limited geophysics have been considered or applied over the years, weathering and associated leaching of the near-surface pegmatites results in economic lithium mineralization not commonly being recognized via surface investigations (BDA, 2012).

It is SRK's opinion that the current practices of active mining, exploration drilling, and in-pit mapping provide the most relevant and robust data supporting Mineral Resource estimation. In-pit mapping of the pegmatite and waste rocks is the most critical of the non-drilling exploration methods applied to this model and Mineral Resource estimation, as detailed in Section 11 of this report.

The area around the current Greenbushes Lithium Operations has been mapped and sampled over several decades of modern exploration work. While other nearby exploration targets have been identified and developed over the years, they are not included in the Mineral Resources disclosed herein and are not relevant to this report.

7.1.1 Significant Results and Interpretation

SRK notes that the Greenbushes property is not at an early stage of exploration, and that results and interpretation from exploration data is generally supported in more detail by extensive drilling and by active mining exposure of the orebody in multiple pits within the Central Lode deposit. The Kapanga deposit, to the east of the Central Lode has no historical or active mining but contains significant drilling in support of resources. Drilling at Kapanga occurred more recently with initial drilling in 1991 and the majority of drill evaluation occurring since 2012.

.2 Exploration Drilling

Drilling on the Greenbushes property has been ongoing for over forty years with the majority of historical drilling focused on the Central Lode deposit. The drilling data presented in this section represent data used in the geological and resource models. SRK recognizes that drilling has been performed since model updates in 2023 for Central Lode and Kapanga and recommends recent drilling be incorporated and interpreted into the geological and mineralization models on a routine basis.

7.2.1 Drilling Surveys

Resource drillholes contained in the Greenbushes database date back to 1979. More recent (post-2000) down hole surveys used Eastman Single Shot cameras, while the later reverse circulation (RC) programs (since hole RC214) utilized either a gyroscopic or a reflex electronic tool. Eastman down-hole surveys were recorded at 25 m down hole and thereafter every 30 m to a minimum of 10 m from the final depth. The geologist checks the driller's dip and azimuth written recordings by viewing all single shot photographic discs prior to data entry into the database.

Prior to 2000, surveys were based on a variety of industry standard methods that cannot be verified but, in SRK's opinion, can be relied upon. Checks of surveys within the database, by comparing overlapping data between older and post 2000 drillholes, support the opinion that the surveying is reliable. Some of the RC holes drilled before 2002 were apparently not down-hole surveyed and were instead given linear design parameters based on collar orientations in the database. Also, some of the older vertical diamond holes were not down-hole surveyed. In SRK's opinion, this is not a material issue given the relatively shallow drilling depths and tendency of vertical holes to not significantly drift.

The location of recent surface drillhole collars is surveyed by the mine surveyors using a differential global positioning system (dGPS) accurate to less than 1 m. Historical collars were surveyed using industry standard equipment available at the time and are considered acceptable for resource calculations in SRK's opinion. Environmental rehabilitation programs to relocate historical collars using their coordinates and a handheld GPS have been successful and acts as a validation of historical collar surveys.

7.2.2 Sampling Methods and Sample Quality

The Greenbushes pegmatite is sampled by a combination of RC and diamond drilling programs. The drill patterns, collar spacing, and hole diameter are guided by geological and geostatistical understanding for reliability of geological continuity, interpretation, and for confidence of estimation in Mineral Resource block models.

Drill core samples provide intact geological contact relationships, mineralogical associations and structural conditions, while RC drill sampling provides mixed samples from which mineral proportions are estimated by visual examination.

A sample interval of 1 m is used as the maximum default length in RC and diamond drilling. Analysis of the deposit characteristics has been used to determine the appropriate sample interval in drillholes.

Distinguishing rock types in drill samples is considered robust given the dark internal and country waste rock and the lighter colored pegmatites. Where unaffected by shearing, the geological contacts are abrupt, often regular, and intact. Although contact relationships are masked in RC chips, the pegmatite/waste contact positions are inferred within the sample length. Both diamond drill and RC drillholes are distributed throughout the lithium deposits (Talison, 2020).

7.2.3 Diamond Drilling Sampling

In SRK's opinion, diamond drillholes (DDH) are considered to be authoritative and representative of subsurface materials. Diamond core is collected in trays marked with hole identification and down hole depths at the end of each core run. Pegmatite zones are selected while logging and intervals are marked up for cutting and sampling. All pegmatite intersections are sampled for assay and waste sampling generally extends several meters on either side of a pegmatite intersection. Internal waste zones separating pegmatite intersections are routinely sampled, although in a small proportion of holes drilled prior to 2000, some waste zones separating pegmatite lenses have not been assayed.

Core recovery is generally above 95%. A line of symmetry is drawn on the core and the core is cut by diamond saw. Historically BQ and NQ core has been half core sampled with more recent HQ core quarter cut and sampled. The typical core sampling interval for assay is 1 m, but shorter intervals are sampled to honor geological boundaries and mineralogical variations.

It is SRK's opinion that diamond core recovery and sampling is unbiased and suitable for the purposes of Mineral Resource estimation.

7.2.4 RC Drilling Sampling

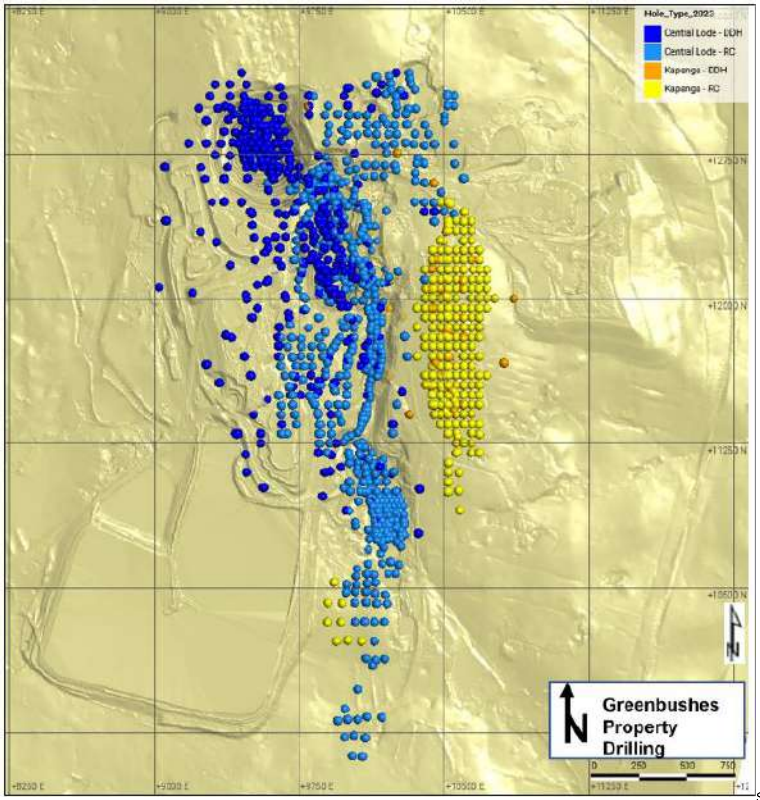
RC samples are collected by face sampling hammer for every meter drilled over the full length of the hole via a cyclone attached to the rig and split at the rig by the drilling contractor using either a riffle splitter, rotating cone splitter, or stationary cone splitter. A sample of approximately 3 to 4 kg is submitted to the laboratory. In some older RC holes, the regular sampling length was 2 m. Field duplicates are collected every 20 m and submitted to the laboratory for quality assurance and quality control (QA/QC) purposes. RC drillhole bit size is normally approximately 4.5 inches or 5.25 inches. The drilling conducted since the last resource update were all drilled using a 5.25 inch bit size.

All pegmatite intersections are submitted for assay. The sections sampled will normally extend several meters into the waste rock hosting the pegmatite. As with diamond drilling, internal waste zones separating pegmatite intersections are also sampled, although in some old holes some of this internal waste sampling is incomplete. Pegmatite intersections are visually distinguishable from waste zones in drill chips during drilling.

Drill cutting reject piles are reviewed by site geologists when geological logging and intervals with poor recoveries are recorded. The drill samples are almost invariably dry, and recoveries are consistently high (Talison, 2020).

7.2.5 Drilling Type and Extent

The drilling on the Greenbushes property is comprised of RC and DDH which extends across the property given the long history of site development and evaluation (Figure 7-1). The holes are drilled in a variety of orientations, primarily vertically or perpendicular to the pegmatite intrusive dikes with a total of approximately 369,174 m of resource drilling across the property. Holes are spread relatively uniformly throughout the Central Lode and Kapanga deposits, and mineralization is generally defined by exploration drilling at 25 to 50 m drill spacings for exploration purposes. More detailed grade control drilling is conducted in the Central Lode deposit in near-term production planning areas, as are detailed blastholes during production. There are no blastholes in Kapanga due to no active mining activities.



Source: SRK, 2023

Figure 7-1: Greenbushes Property Drilling Type and Extents

7.2.6 Central Lode Deposit Drilling

The Central Lode dataset contains a total of 1,844 drillholes, equating to over 310 km of drilling which includes surface and underground (UG) drillholes. A tabulation of the drill quantities by type is presented in Table 7-1. The current drilling database used for resources includes historical RC drilling back to 1977 with drilling though to 2023. Drilling campaigns have been conducted by over 25 different contracting companies over the long history of evaluation.

Table 7-1: Drilling in the Central Lode Deposit.

Hole Type	Holes	Meters
Diamond Core (DDH)	661	140,693
Reverse Circulation (RC)	560	77,565
RC/DDH	619	91,682
Trench	1	186
Underground (UG)	205	31,800
Not specified	3	310
Total	1,844	310,436

Source: SRK, 2023

7.2.7 Kapanga Deposit Drilling

The Kapanga deposit modeling and resources utilized 273 drillholes, representing over 58 km. The majority of the holes were drilled in the past five years due to the more recent discovery of Kapanga. The modeled drilling database contains 46 DDH and 223 RC holes and one DDH/RC hole (Table 7-2). Drilling at Kapanga was performed on a regular grid pattern with nominal spacing of 40 m along west to east sections and 50 m between section lines. Approximately 80% of Kapanga drillholes are vertical, with the remaining 20% angled between 60° and 75° to the east.

Table 7-2: Kapanga Deposit Drilling by Type

Hole Type	Holes	Meters
Diamond Core (DDH)	46	13,389
Reverse Circulation (RC)	223	44,298
RC/DDH	1	247
Not specified	3	804
Total	**273**	**58,738**

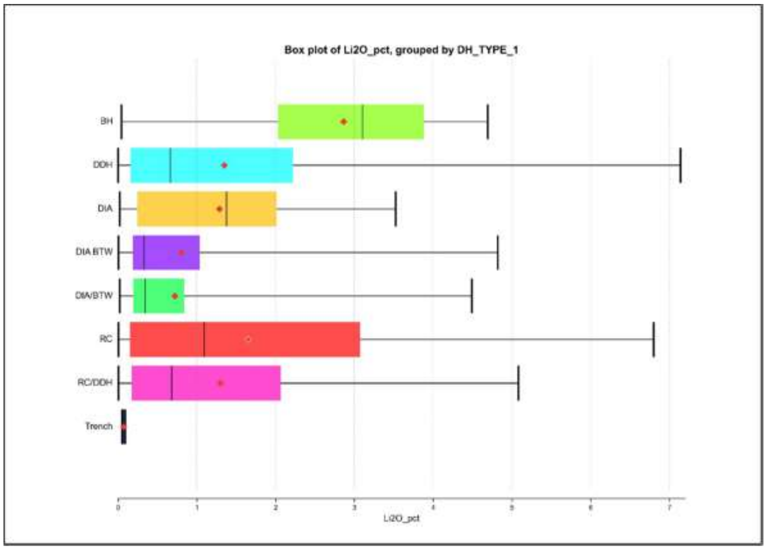
Source: SRK, 2023

7.2.8 Drilling Type and Extents Drilling, Sampling, or Recovery Factors

To evaluate the various types of drilling, SRK compared overall mean Li_2O grades of multiple drilling types on a global and local basis. Global comparisons for drill types are shown in Figure 7-2, and demonstrate that the different types feature different mean Li_2O values. In SRK's opinion, the spatial component of where the specific type of drilling occurred is the source of variance in the means at a global comparison scale. For example, it is natural that the blasthole data or the RC data (which features closely spaced grade control drilling) would be higher-grade on average than the DDH drilling, which is sparser, exploration focused (i.e., determining extents of mineralization and waste dilution), and less likely to be located in the higher-grade portions of the pegmatite.

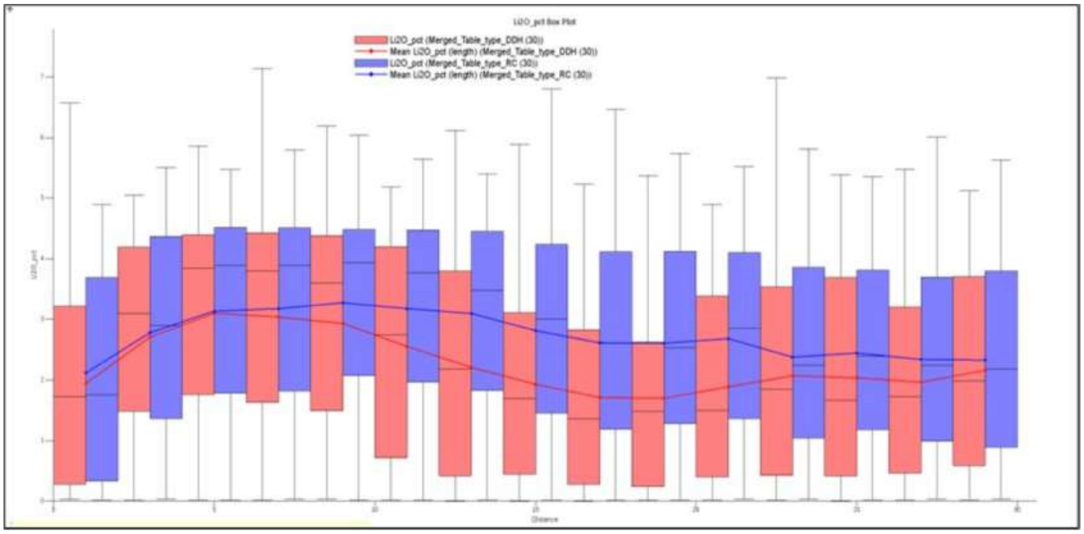
SRK notes that only DDH and RC drilling are considered for the Mineral Resource estimation with exclusion of blasthole data. These data types were compared on a local basis as well.

To do this, RC samples were compared against paired closely spaced DDH samples based on the distance between the two, and SRK noted similar trends in grade distribution between the two data types as shown in Figure 7-3. These comparisons feature excellent comparison of RC and DDH sample grades at close spacings, with differences occurring at distances greater than approximately 10 m. In SRK's opinion, this likely reflects inherent geologic variability or variability of grade within the pegmatites rather than a consistent bias in drilling methodology. SRK also notes that, as distances between samples increase to more global populations, that the inherent spatial bias of the RC grade control drilling (preferentially located within the mineralized zones of the pegmatite) likely influences overall global comparisons to favor the RC drilling with a higher mean Li_2O.



Source: SRK, 2023
BH = Blastholes, DDH = Diamond Drillhole, DIA = Diamond Drillhole, DIA/BTW = Diamond Drilling Thin Wall, RC = Reverse Circulation, RC/DDH = Reverse Circulation with Diamond Drill "Tail"

Figure 7-2: Box and Whisker Plot – Li_2O by Drilling Type



Source: SRK, 2020
Only RC vs. DDH drilling shown.

Figure 7-3: Drilling Type Mean Comparison – By Average Separation Distance

To consider the possible impact of drilling recovery (only noted in DDH drilling) SRK reviewed recovery information for those holes where recovery was logged.

Recovery logs are made of all diamond drill core as a part of the standard logging procedure which includes collection of geological, mineralogical, and structural information. Core recoveries within the fresh pegmatite range from 95% to 100%. SRK noted no bias in Li_2O or relationship with recovery in those samples where both are noted.

Mass measurements are made of RC samples from selected holes to understand potential impacts with recovery in RC drilling but are not quantitative due to the drilling method. Site geologists also inspect the size of the cutting piles, and intervals differing from average mass or moisture content are noted on drill logs. RC sample recovery generally has been assumed to be excellent.

SRK is not aware of any additional material factors to the drilling that would affect the results.

7.2.9 Drilling Results and Interpretation

Geological logging from DDH and RC drilling along with pit mapping is used to construct 3D geological models utilizing implicit and explicit modeling practices. When blasthole data is available in the Central Lode deposit, this close-spaced data is used in aid in guiding geological contacts and general lithological interpretations. No analytical data from blastholes is used for resource estimation purposes.

Analytical data from drill sampling for Li_2O and other elements is interpolated in 3D to develop geochemically distinct domains within the geological model and were driven by structural or interpreted grade continuity models.

7.3 Hydrogeology

Multiple hydrogeological characterization studies have been carried out at the site by various consultants. The latest groundwater characterization and modeling study to support the expansion project has been completed, with a focus on pit dewatering, closure pit lake, and environmental impacts (GHD,2019a and 2020a). Additionally, PSM completed a feasibility-level open pit design for the Central Lode LoM plan (PSM 2020 and 2023). The following sections present key aspects of mining hydrogeology derived from these recent studies, based on observations from ongoing open pit operation and records from underground mining flow records spanning from 2007 to 2014 period.

7.3.1 Regional Hydrogeology

The mine is situated on a topographic ridge that is linked to a north to north-west trending lineament. Water drainage from the ridgeline takes place westward toward Cowan Brook and eastward toward Woljenup Creek. Both drainage lines follow a north-to-south direction and join together south of the site, eventually flowing into the Blackwood River.

Long-term precipitation data can be accessed from the monitoring station at Greenbushes (9552) operated by the Bureau of Meteorology (BoM). The average annual rainfall for the area is 915 mm (varied between 600 to as high as 1,600 mm) for the period 1907 to 2017. The last 30 years have seen an increasingly dry climate, with the annual averages reducing to 845 mm for the 30-year period between 1988 to 2017. The last ten years' average (771 mm) is approximately 15% less than the long-term average.

On a regional scale, the behavior of groundwater is primarily influenced by two major hydrogeological units:

- Archean basement: The fresh basement rocks of the region, a package of Archean amphibolite and metasediments above the basement Bridgetown Gneiss. These units are generally considered to have low permeability with the exclusion of fracturing developed secondary permeability.
- Weathered Zone: The upper basement rocks typically develop lateritic weathering profiles 20 m to 50 m thick, comprising clays, which yield little groundwater flow and have low or negligible permeability (saprolitic profile).

7.3.2 Local Hydrogeology

The hydrogeologic data collected indicates that the Mineral Resource is overlain by a relatively low permeability groundwater system consisting of lateritic caprocks and well-developed saprolitic clays, which yield very little water. During drilling, significant groundwater flows have not been noted within the clayey lateritic weathered profile. The permeability of the clay is inferred as very low. Beneath these weathering products, exists a sharp to gradual transition into the fractured bedrock. Within this transition zone, the variably weathered bedrock and remnant fractures may form zones with enhanced permeability. The potentiometric surface of the basement aquifer is generally above the clay zone, indicating the presence of confined conditions. This is supported by drilling data where the clays are found to be dry and water strikes in the basement zone result in groundwater levels rising following bore completion.

Local aquifers are hosted within the surficial alluvial sediments (where present), at the interface between the saprolitic profile and the underlying basement rocks, and within the deep fracture basement rocks. In general, the alluvial aquifers received most of the recharge from precipitation, with limited vertical migration through the lower clay-rich sediments, to the bedrock contact zone and deeper zones.

Deeper within the bedrock, localized faults and fractures may result in enhanced permeabilities. Based on the testing completed, hydraulic conductivity (K) for the weathered bedrock zone ranges from 0.01 m/d to 1 m/d, while the bedrock (pegmatite/greenstone) has a K of 3.0×10^{-4} m/d to 6.0×10^{-3} m/d (GHD, 2019a), although it should be noted that these values are based on bulk averages within a fracture bedrock groundwater system.

The groundwater flow direction within the Archaean rocks is envisioned radially outwards from the mine site, reflecting the topographic high of the mine location. Groundwater levels within the open pit area are sufficiently low to generate direct groundwater flows towards the pits. Given the inferred low permeability, groundwater will migrate slowly within the weathered and fractured rock toward the lower-lying topographical areas, where a component of groundwater will discharge as baseflow into creek lines. Groundwater flow within the weathered clay material is expected to be negligible and localized.

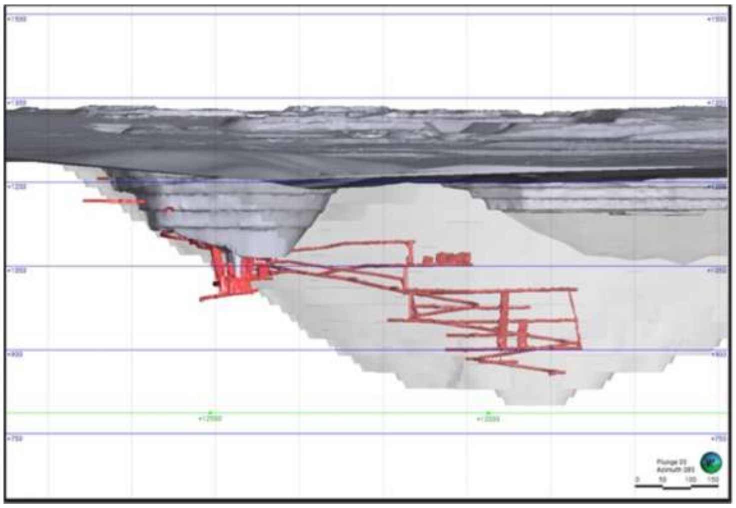
7.3.3 Utilization of Groundwater Resources

Groundwater is not considered a strategic resource due to the Archaean terrain's low permeability and the absence of substantial groundwater storage. The majority of Western Australia's Archaean terrain is not designated as a 'Proclaimed Groundwater Area. In areas that are not proclaimed, there is no requirement to license groundwater abstraction; therefore, groundwater users are not formally registered. While the taking of water from any watercourse, wetland, or underground water source without right or licence is prohibited under the Rights in Water and Irrigation Act 1914, a number of exemptions exist under which mandatory licencing is not required. Nonetheless, DWER maintains records of bore data, including those used for abstraction (DWER, Water Information Reporting, 2018). After examining the Water Information Reporting (WIR) data, it appears that there are roughly seven mainly shallow bores situated within a 5-km radius of the Mine (GHD,2019a).

7.3.4 Open Pit Dewatering and Related Impacts

A 3D numerical groundwater model was constructed and calibrated with the observed water levels near the mine area (GHD,2020). Based on the simulation of the expansion pit (mining until 2033), the dewatering rates were calculated in the range of 8.3 to 15.6 L/s with an average of 11 L/s. The extent of the cone of drawdown (CoD) was estimated to cover an area of approximately 1,000 ha, the majority of which is or will be covered by landforms. The areas not covered by landforms (currently vegetated) will experience a drawdown of up to 5 m at the end of the expansion period. While most of the area of the cone of depression is overlain by mining landforms, groundwater level change towards the end of mining was predicted along the Southwestern Highway to the east and north of the mining site.

SRK notes that the dewatering rates from the previous underground mine workings were available (shown on Figure 7-4) and could provide essential input to the overall modeling efforts.

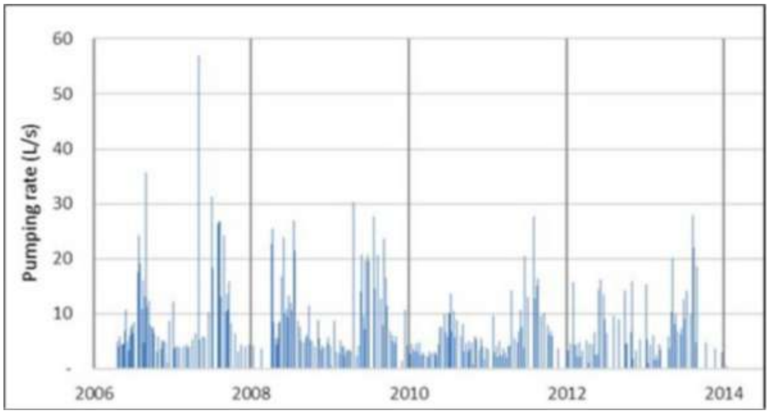


Source: SRK, 2023

Figure 7-4: Existing Pits (dark grey) and Underground Workings (red) with 2020 LoM Open Pit Design (light grey) Assumed to be used in GHD,2020 Modeling Study

Available modeling reports indicate a lack of attempt for transient calibration to this data set. The representation of groundwater calibration only at steady state mode is worthy of further discussion. Considering the observed relatively higher flow rates from the underground mine, which exhibit a steady peak at 10 L/s with a maximum of 58 L/s, and its response to seasonality (Figure 7-5), inflow estimates from the numerical model for future pit appear to be underestimated since it doesn't count depletion of groundwater storage and seasonality of the recharge.

Therefore, it is suggested that the next round of modeling should focus on further improvement in transient calibration and identification of the source of inflow to underground workings. Additionally, the updated study should re-evaluate the impact of the cone of drawdown. While the largest extent of the drawdown is reported to be reached at the end of the mining period (GHD, 2020), this may not be entirely accurate for the low permeability groundwater system, where the delayed impact of the open pit excavation may exhibit later and larger CoD years after the end of mining.



Source: GHD2019b Underground pumping rates (Sons of Gwalia dataset)

Figure 7-5: Measured Flows in Underground Mine

7.3.5 Pit Lake Hydrogeology

Closure phase pit lake water balance modeling has been done by a combination of USGS MODFLOW LAK3 code and GoldSim modeling. Various climate change scenarios were evaluated and demonstrated that under all the scenarios, the water levels in the pits eventually reached equilibrium within the 1000-year simulation period. The pit lake(s) are predicted to remain a groundwater sink. The existing scenario (no future climate change) is predicted to approach 250 to 260 m AHD after 900 years with runoff from contributing catchments or 210 m AHD if the runoff from contributing catchments bypasses the mining pits. Moderate climate change to 2100 is the only climate change scenario in which the three individual pit lakes, Cornwall, C1 and C3 coalesce into a single pit lake at 210-220 m AHD. All other climate change scenarios (extremely dry, medium dry, and drying beyond 2100) predict groundwater recovery that would be too small to form a single pit lake.

SRK found that the approach adopted for predictive pit lake scenarios is reasonable and in accordance with typical industry methods. To reduce the uncertainty in future predictions, it is recommended to incorporate the updated groundwater inflow rate estimates enforced with further transient calibration. Nevertheless, SRK does not foresee a substantial alteration from the current conclusion, which asserts the presence of a terminal sink.

7.3.6 Pore Pressure Evaluation

The presence of excess pore pressure in large open pits, particularly within low-permeability/high-precipitation groundwater systems, poses a significant challenge to slope stability. According to stability analyses (PSM, 2020), there is an assumption that the units located 10 m behind the pit walls will experience complete depressurization. This assumption underwent a revision in 2023 (PSM, 2023), and pore pressure represented in stability models has been adjusted to a more conservative version. In general, acceptable safety factors were achieved with higher pore pressure inputs.

PSM outlines the uncertainty related to the pore pressures, and SRK concurs with these assessments:

- Pore pressure response to mining and potential dewatering
- Hydraulic conductivity between the weathered upper units and underlying basement units
- Presence of vertical flow paths into deeper rock masses
- Pore pressure associated with fault structures at depth

Considering the limited data to represent the deeper hydrogeological system, the following studies are recommended:

- Piggybacking of deep-targeted exploration wells for hydrogeological characterization to increase the numbers of packer-isolated hydraulic testing and VWP installations
- Recalibration of the model based on these new data sets
- Evaluation of transient recharge and its implementation of pressure at upper-weathered units
- Enhancing the geotechnical modeling uncertainty analyses to evaluate ramifications of potential wet conditions and determining pore pressure sensitive sections

7.3.7 Waste Management and Seepage Impacts

Hydrogeological investigation for Greenbushes Lithium Mine Expansion, completed by GHD in 2018 (GHD, 2018) includes:

- Seepage impacts from the existing and proposed TSF facilities to the groundwater and surface water systems
- Seepage impacts from the existing Floyds WRL, and the proposed extension of the WRL to the groundwater and surface water systems
- The dewatering impacts and water quality of the in-pit waters

It was concluded that these impacts should be suitably managed considering the low permeability nature of the weathered zone and implemented engineering structures (i.e., ponds, drainage channels).

7.4 Geotechnical Data, Testing and Analysis

A geotechnical study for the combined pit for the Greenbushes operations was recently updated by PSM Consult (2023). In SRK's opinion, the geotechnical data collected has sufficient coverage around the existing and ultimate pits to demonstrate knowledge of pit sector characterization and strength properties of the rock mass.

7.4.1 Data Collection

The characterization data comprised geotechnical borehole logging, televiewer interpretation, oriented core logging, geotechnical mapping, photogrammetry, piezometer, and laboratory testing data from historical and recent site investigation programs. The data collected from the 2008-2013, 2018/2019 and 2022 / 2023 investigations represent a substantial increase in the available geotechnical data for Greenbushes.

7.4.2 Geology and Structure

The Greenbushes Pegmatite Group is situated within the regional-scale Donnybrook-Bridgetown Shear Zone. On a mine-scale, the geology consists of amphibolites and granofels which host the pegmatite intrusions, and late mafic dolerite dikes and sills which intrude the entire sequence. A weathering profile extends to about 30 m below the surface (up to 60 m in places).

Major geologic structures are at or nearby major lithologic contacts and faults/shears that are typically steeply to moderately dipping to the west. Two primary fault zones will impact slope stability. The Northern Dolerite Sill Fault Corridor is exposed in the current Cornwall and C3 pits. The Pegmatite Shear Zone (PSZ) consists of soil to low strength rock material located behind the northern portion of the west wall. The orientation of the PSZ dips favorably into the wall, has a thickness of 20 to 50 m and the spatial extent appears to be limited by the lack of exposure in the Cornwall Pit and boreholes south of 12,000N.

7.4.3 Structural Domains

Ten (10) structural domains were identified from televiewer photogrammetry and pit wall mapping data. The west wall has steeply dipping structures with variability from north to south and within the Dolerite lithologies. The Pegmatite is separated into two domains with the main set steeply to moderately dipping to the west. This data has been used to guide development of recommended bench face angles and inter-ramp slope angles.

Discontinuity shear strengths were assessed from direct shear tests and using typical joint characteristics from logging. The shear strength ranged from 34° to 9° friction with assumed zero cohesion. The exception is the sheared pegmatite zone with a strength of 20° friction. The estimated strengths also considered lithology, defect shape and roughness characteristics.

7.4.4 Rock Mass Strength

The rock mass was separated into 14 units based on weathering, lithology, and strength characteristics. Below the near-surface upper weathered zone the rock masses are high strength with UCS values from 50 to 190 MPa, except for the sheared pegmatite zone which is very weak rock. Strengths were assessed using GSI values, except for the upper weathered zone where triaxial test results were used.

7.4.5 Data Gaps

Uncertainties in the geotechnical model include the following:

- Variability in the upper weathered zone and location of the contact between the Granofels and Amphibolite behind the east wall
- The character and orientation of modeled faults beyond pit walls and the extent of the sheared pegmatite zone
- The pore pressure response to mining of the basement geology and the connectivity with the weathered zone

8 Sample Preparation, Analysis and Security

The processes for sample preparation and analysis remain consistent with those previously reported.

.1 Sample Preparation Methods and Quality Control Measures

The 2018 Central Lode Resource Update (Talison, 2018), disclosed information about sample preparation for all drilling across the Greenbushes property, with additions supporting recent drilling used in support of resource modeling at Central Lode and Kapanga deposits. It is SRK understanding that there have been no material changes to these procedures since the previous disclosure.

Drill samples from RC drilling programs are collected and bagged at the rig as drilling progresses. The RC samples are collected in sequential, pre-numbered bags directly at a discharge chute on the sample splitter to which the sample bag is attached. The splitter is either fed via a closed sample collection circuit at the drillhole collar or is fed manually from a sample bagged at the cyclone.

Drill core samples are collected sequentially in pre-numbered sample bags after cutting with a diamond saw. The integrity and continuity of the core string is maintained by reassembling the core in the tray. If any apparent geological discontinuities are noted within or at the end of core runs these are resolved by the logging geologist.

All sample preparation and analytical work for the resource models is undertaken at the operation’s on-site laboratory, which is ISO 9001: 2008 certified and audited in accordance with this system, most recently in June 2016. SRK would consider this to be at the upper end of the audit process and a further review maybe warranted. The Greenbushes laboratory provides quick and secure turn-around of geological samples using well established quality control procedures. The laboratory also services processing plant samples and samples from shipping products.

Upon submission to the laboratory, samples are entered into the laboratory sample tracking system and issued with an analytical work order and report (AWOR) number. Separate procedures have been developed for RC and diamond drill samples.

Preparation, analysis and management of geological samples are covered comprehensively in laboratory procedures. The sample preparation is summarized as follows:

- All samples are dried for 12 hours at a nominal 110ºC.
- Samples are passed through a primary crusher to reduce them to minus 10 millimeters (mm).
- Secondary crushing in a Boyd crusher to -5 mm.
- A rotary splitter is used to separate an approximate 1 kg sub-sample.
- Final grinding in a ring mill to minus 100 µm or two minutes in a tungsten carbide media in a ring mill for a “low iron” preparation procedure.

Historically, two routes have been used for the preparation of geological samples. The first utilizes standard ferrous pulverizer bowls, while the second uses a low iron preparation method with a non-ferrous tungsten bowl. A low iron preparation has been used for all samples in recent drilling programs. All resource drilling sample pulp residues are retained in storage. Coarse sample rejects are normally discarded unless specifically required for further test work. Sample preparation is carried out by trained employees of the company in the Greenbushes site laboratory following set laboratory procedures.

.2 Sample Preparation, Assaying and Analytical Procedures

The 2018 Central Lode Resource Update (Talison, 2018) provided a detailed summary of the sample preparation and analytical procedures. This section covers information about assay preparation for drilling across the Greenbushes property. SRK supplemented additional information in support of the 2020 and 2023 resource models at Central Lode and Kapanga deposits. The has been no material change to these procedures since the previous update.

Given the more recent drilling which has evaluated the Kapanga deposit, all Kapanga drill samples were prepared using the tungsten carbide ring mill at the Greenbushes laboratory, which was introduced in 2011 to reduce the likelihood of Fe contamination from the preparation equipment.

Due to the long history of operations on the Greenbushes property, the meta-data regarding assaying is somewhat incomplete; however, the recording of analytical data has been at the current standard since at least 2006. All assaying of drill samples has been by XRF and Atomic Absorption Spectroscopy (AAS). The majority of samples have been analyzed for 36 elements at the Greenbushes laboratory. Sodium peroxide dissolution and AAS is used for Li_2O determination. The other elements/oxides are analyzed by XRF following fusion with lithium metaborate. The analysis of geological samples for Li_2O by AAS and other elements/oxides by XRF is documented in laboratory procedures.

Over time, the detection limits of some elements assayed at the Greenbushes laboratory have improved, as outlined in Table 8-1, with implications for the accuracy of some of the older assays in the database. This appears only to be significant for the low concentration elements and has no material effect on the resource model estimates. Current detection limits remain as listed for PW2400 (low level) June 2001. Detection limits are stored in the acQuire geological database.

Table 8-1: Greenbushes Laboratory Detection Limit History

Element	Detection Limit (%)		
	PW1400 - 1983	PW2400 – Nov 1995	PW2400 (Low Level) – June 2001
Ta_2O_5	0.005	0.005	0.001
SnO_2	0.005	0.005	0.002
Li_2O	0.010	0.010	0.010
Na_2O	0.005	0.005	0.005
K_2O	0.005	0.005	0.005
Sb_2O_3	0.005	0.005	0.002
TiO_2	0.005	0.005	0.005
As_2O_3	0.005	0.005	0.005
Nb_2O_5	0.005	0.005	0.002 [1]
Fe_2O_3	0.005	0.005	0.005
U_3O_8	0.005	0.005	0.002

[1]The detection limits for June 2001 are current apart from Nb_2O_3, which reduced from 0.005% to 0.002% in 2010
Source: BDA, 2012

In 2002, a proportion of underground drill core samples from the Cornwall Pit were sent to the Ultra Trace Pty Limited Laboratory in Perth, WA, for analysis. XRF was used to analyze for Ta, Sn and other components, and ICP for Li_2O analysis.

Dry in situ bulk density (DIBD) tests were performed on a total of 2,074 samples collected from diamond core holes from the Central Lode deposit. The tests were performed using water immersion techniques and performed onsite. The samples were grouped according to the major lithology type.

No new density information was provided in the database for the 2023 estimates and therefore the previous study remains valid for the current assumptions. A statistical summary of the Central Lode DIBD data is presented in Table 8-2. No DIBD samples were collected or tested for the Kapanga deposit though mean data was used for modeling purposes due to the same major rock types in both deposits.

Table 8-2: Central Lode and Kapanga Dry In Situ Bulk Density

Lithology	Samples	Dry In situ Bulk Density (t/m^3)			
		Average	Std Dev	Minimum	Maximum
Amphibolite	254	3.03	0.13	2.38	3.98
Dolerite	198	2.98	0.15	2.53	3.71
Granofels	91	2.93	0.17	2.60	3.17
Pegmatite	1,528	2.76	0.14	1.59	3.79
Alluvial	0	-	-	-	-
Fill	0	-	-	-	-

Source: SRK, 2022

.3 Quality Assurance and Quality Control (QA/QC) Procedures

The QA/QC systems at Greenbushes have developed over time and therefore vary for the dataset used for the 2023 Mineral Resource models at Central Lode and Kapanga deposits. Duplicate field samples are collected and analyzed for RC drillholes but not diamond core samples. Current RC drilling practice is to submit a field duplicate sample for every 20 samples submitted. These duplicates are collected in the same way as the routinely assayed samples. Results are recorded in the acQuire database software and QA/QC reports generated for each drill program.

SRK has been supplied with updated QA/QC data covering submissions for 2006 to date. Raw data has been supplied covering the submission of duplicate (field) and check (laboratory) assays for Li_2O and Fe_2O_3.The quality of the recent drill program was accepted for Li_2O resource estimation. QA/QC relating to all previous drilling has been completed and data accepted with each successive drill program and resource update.

.4 QA/QC (Analytical) - Processes

QA/QC systems have relied upon the Greenbushes laboratory's internal quality systems, which include replicate (pulp repeat) laboratory analyses and analysis of known standards by X-ray fusion (XRF), both included in each batch of drill samples. Greenbushes also has participated in round-robin reviews of analyses with other independent laboratories as checks on their internal processes. Li_2O in geological drill samples is not analyzed in replicated samples to calibrate the machine; instead, the atomic absorption (AA) machine is recalibrated before every batch of samples.

Known solution standards and blanks are embedded in each batch and the accuracy of the calibration is monitored regularly during the analysis of each batch. The results are also captured in the database. The precision of the AA analysis technique is statistically monitored using plant processing and shipping data. In SRK's opinion, the resulting precision at mining grades is of high quality and confirms the quality of the AA method employed.

In SRK's opinion, RC drill sampling results do not indicate any significant bias between the original and check sample populations as evaluated statistically using Q-Q plots. Scatter plots of original and field duplicates for Li_2O from recent RC holes show less variability than the same plot over all the RC resource holes suggesting a reduction in sample error. A scatter plot for Li_2O replicates from RC and DDH samples shows acceptable repeatability of results (Figure 8-3 and Figure 8-4, respectively). Plots for half absolute relative difference (HARD) show less sampling error in recent RC data compared to the overall RC data (Figure 8-6).

.5 QA/QC

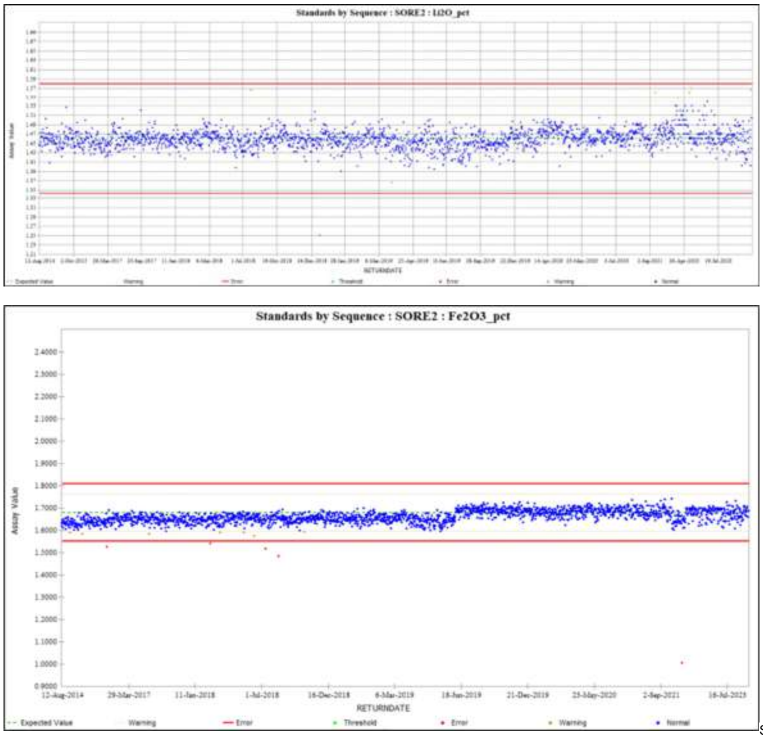
The RC drilling samples were submitted to the site laboratory with the geology department submitting custom certified reference material (CRM) standards SORE1, to SORE6. The CRMs were prepared by ORE Research and Exploration Pty Ltd (ORE) from run of mine material having grades and matrix representative of the deposit. The custom geological standards performed within two standard deviations (2SD) analysis for Li_2O analysis in general shows no evidence of overall bias with only isolated assays reporting outside of the 2SD limits. SRK does note in some of the assays there were some step changes in the assay averages namely around 2019, but this was more prominent in the assays of Fe_2O_3 (%), which were also monitored. The changes still report within acceptable levels and therefore are not considered material, and could be a result of changes within the certified standards. A summary of the overall submissions is shown in Table 8-3.

Table 8-3: Summary of CRM submissions for Li_2O (%) at Greenbushes

CRM	Count	Assigned Li_2O (%)	Mean Li_2O (%)	Bias (Mean)	% Bias
SORE 1	1,892	3.839	3.837	-0.002	-0.05%
SORE 2	2,100	1.459	1.459	0.001	0.04%
SORE 3	508	0.586	0.601	0.015	2.58%
SORE 4	405	0.627	0.631	0.004	0.65%
SORE 5	362	2.136	2.132	-0.004	-0.18%
SORE 6	337	2.227	2.217	-0.011	-0.47%

Source: SRK, 2023

Talison has continuously evaluated and monitored the QA/QC and noted this performance for all relevant sampling, so the analytical accuracy for the database is considered acceptable for Indicated and Inferred resource reporting (Figure 8-1 and Figure 8-2) in SRK's opinion.



Source: Talison, 2023

Figure 8-1: Results for CRM SORE2 – Li_2O % (top). Fe_2O_3 % (bottom)

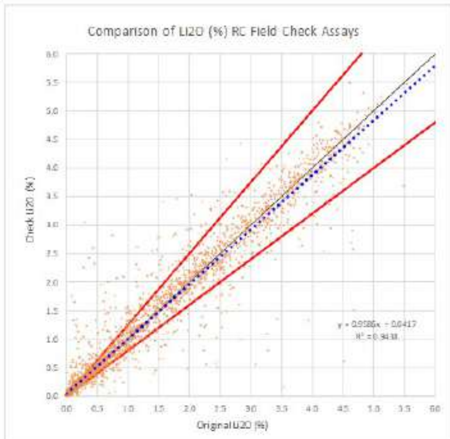
Source: Talison, 2023

Figure 8-2: Results for CRM SORE3 – Li_2O % (top). Fe_2O_3 % (bottom)

Approximately 5% of pegmatite samples submitted to the site laboratory are duplicated in the field. The results are first reviewed using a scatter plot (Figure 8-3 and Figure 8-4) during the drilling program and duplicates with greater than 20% variation investigated. Analysis has been split between RC and DDH sampling to check for consistency and potential differences or bias from using the different drilling methods. As the reliable determination level of the laboratory is 0.05% Li_2O, duplicates with Li_2O assays less than 0.2% Li_2O are generally ignored for monitoring.

A common historical error was reported as mis-ordering of samples through the laboratory process. In recent years, barcode labelling and QR readers have greatly reduced the opportunity for sample mis-ordering in the laboratory. There remain some processes such as when samples are dissolved in solution in reusable glassware that rely on good procedure and keeping things ordered which may result in some of the differences noted in the scatter plots. Sample swaps could potentially offset sample location by 1 m on drillholes and in general are consider not to have a material risk on the estimates, on a review of the returned results a preceding or following sample will show as essentially identical to the duplicate rather than the result reported. Note that the entire 36 element suite is correlated for a sample not just the Li_2O value, but Talison main focus has been on Li_2O and Fe_2O during routine analysis.

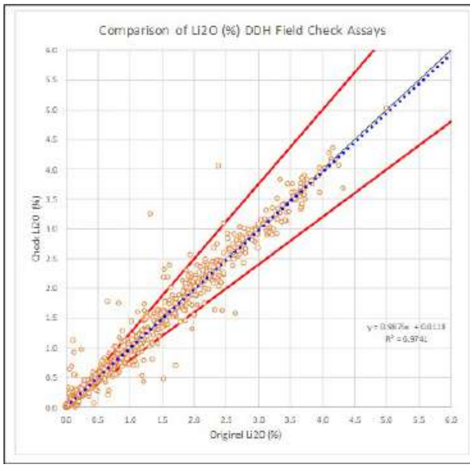
Samples are collected for every meter drilled so field duplicates not resolved by the previous two methods are typically addressed by re-splitting the bagged sample and submitting the second sample (a duplicate) for several samples around the failure. Good correlation of the additional duplicates to their samples confirms the original sample allocation on the hole is correct.



	Original (Li2O %)	Check (Li2O %)	Diff (%)
Mean	1.08	1.07	-0.26%
Standard Error	0.02	0.02	
Median	0.39	0.42	
Mode	0.01	0.03	
Standard Deviation	1.30	1.28	
Sample Variance	1.68	1.63	
Coefficient of Variation	1.20	1.19	
Range	6.00	5.48	
Minimum	0.01	0.01	
Maximum	6.01	5.48	
Count	3,607.00	3,607.00	

Source: SRK, 2023

Figure 8-3: Scatterplot of Recent Field Duplicates RC Samples Li_2O



	Original (Li2O %)	Check (Li2O %)	Diff (%)
Mean	0.84	0.85	0.15%
Standard Error	0.03	0.03	
Median	0.31	0.32	
Mode	0.01	0.01	
Standard Deviation	1.04	1.04	
Sample Variance	1.08	1.08	
Coefficient of Variation	1.23	1.23	
Range	6.12	5.86	
Minimum	0.01	0.01	
Maximum	6.13	5.87	
Count	1,264.00	1,264.00	

Source: SRK, 2023

Figure 8-4: Scatterplot of Recent Field Duplicates Diamond Drillhole (DDH) Li_2O

Where poor correlation remains and there is no confidence in the alignment of results to the hole based on Talison initial review, then Talison will request the whole assay job be re-split from the reject material to get acceptable results. Talison noted this was the case for an assay job on RC484 which was clearly mixed up in the laboratory.

Where sample mix-ups are eliminated as the route cause some failed duplicates remain unresolved which are interpreted to be due to the natural variation within a coarse-grained variable mineralogy at the sample location. These have a strong correlation between many elements in the assay suite but differ on several others. These will often occur in a mixed mafic and pegmatite mineralogy where a sample interval crosses a lithology boundary.

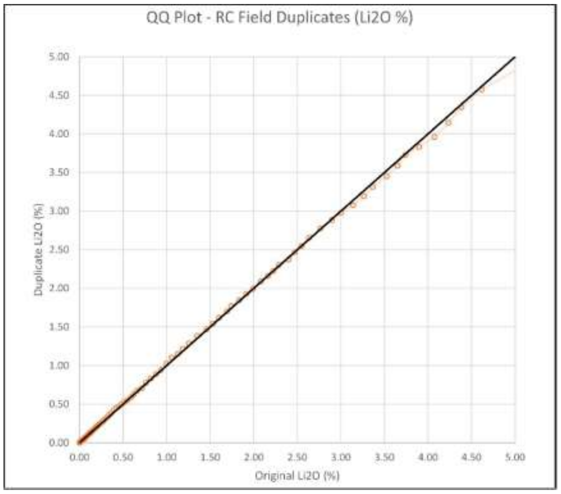
Some remaining failed duplicates were interpreted to be due to poor drilling conditions that affect a sample such as water coinciding with a duplicate position or hydraulic failure of splitter mechanisms, while others may be due to poor field practice. The simple (although time consuming) resolution of many failed duplicates to show the underlying data, in SRK's opinion, was representative and gives enough confidence in the dataset to use for MRE of Li_2O.

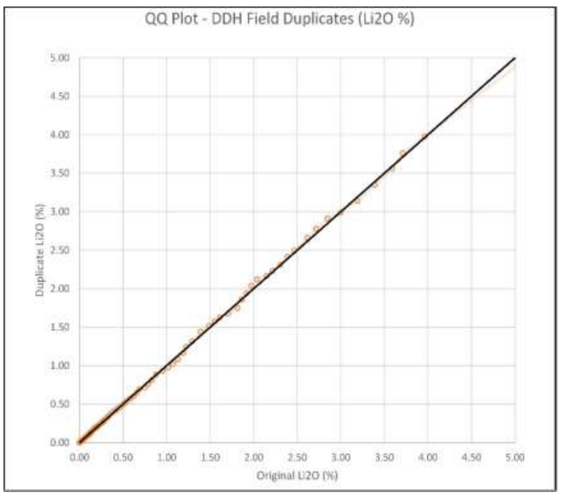
A Q-Q plot (Figure 8-5) which is a comparison of the original and repeat/duplicate sample assays on a quantile basis of the datasets do not show bias between the primary and duplicate sample populations, for both sampling types. Based on these finding SRK concluded that the subsampling routine in the fields and splitter hygiene and operation during the program is therefore interpreted as acceptable.

SRK completed a HARD analysis which is a comparison of the half absolute relative difference in a duplicate dataset on a proportional basis. To complete the analysis the absolute percentage differences are calculated between the datasets, which are then ranked and plotted on a percentage rank basis. The plot display is then compared to a threshold of differences of less than 10% which is considered as acceptable under generally accepted industry best practice for the current level of disclosure (Figure 8-6).

A HARD plot displays 85% of the data with Li_2O >=0.2% has a value of less than 10% for both DDH sampling while only 80% of the RC data is within this range. It is the opinion of the QP, that both datasets are considered acceptable for the current level of disclosure.

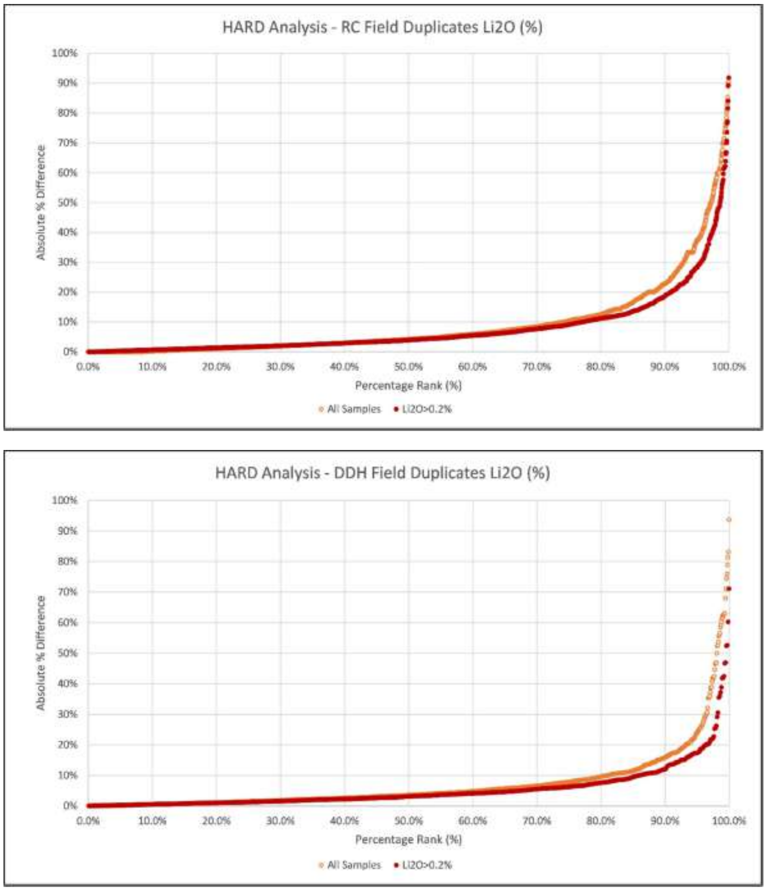
In addition to the Field duplicates the same processes have been followed for the pulp checks on the laboratory check analysis. In general the laboratory pulps return higher correlations than seen in the field duplicates which is expected as it eliminates potential variation/sampling errors for the field sub-sampling routines. It is the QP's opinion that the results from the laboratory check samples do not display any bias and therefore are acceptable for use in the current estimate.





Source: SRK, 2023

Figure 8-5: QQ Plot of Field Duplicates (RC – left, DDH – Right) Post-January 2016 – 2023



Source: SRK, 2023

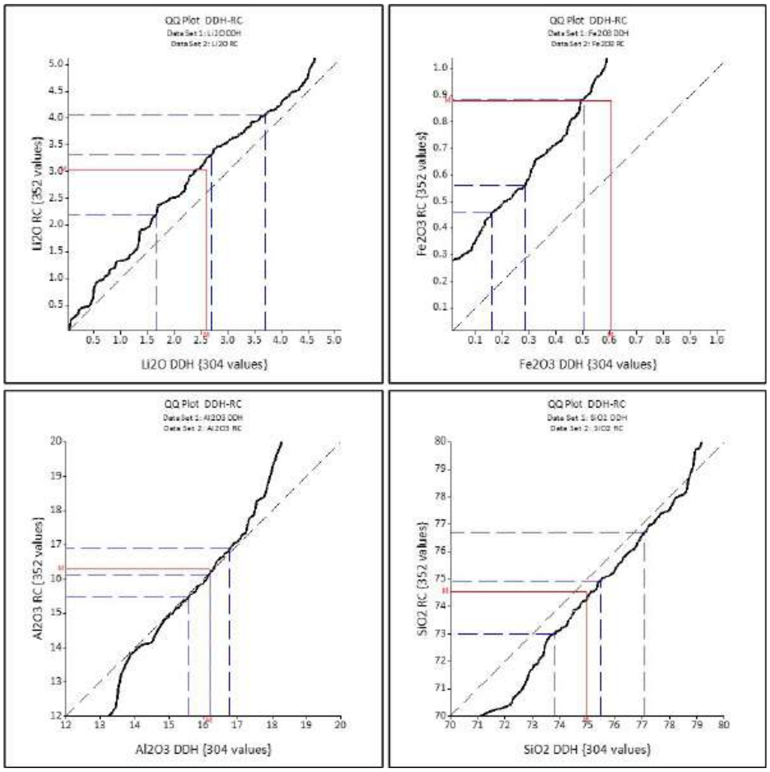
Figure 8-6: HARD Plot of Field Duplicates Post January 2016 – 2023 (RC – top, DDH – bottom)

8.5.1 Twinned Drillholes

Talison reports that twinned hole programs are not routinely conducted with the express purpose of comparing RC and DDH data. However, Talison notes sufficient overlap has occurred with holes from various drilling campaigns to enable a regional comparison to be made and reports the results to be comparable. SRK completed a review of these twinned holes in 2020.

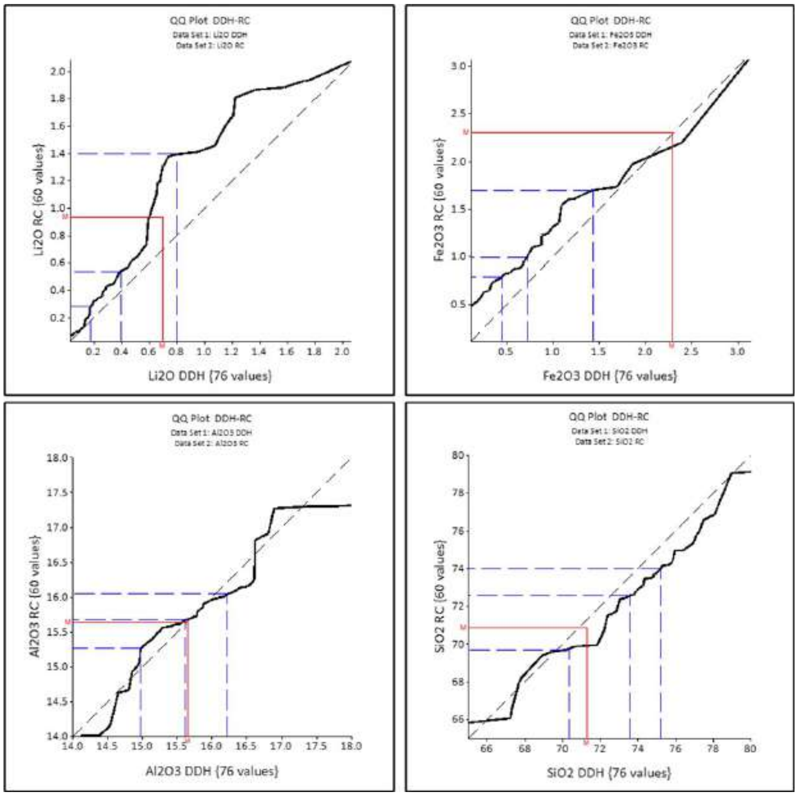
The Kapanga database contain eight sets of DDH and RC holes that had been collared within a few meters of each other. Of these, assay data were available for five of the paired sets of holes. For most paired holes, the collars are within a few meters though at depth, some of the hole pairs were up to 15 m apart and therefore not true twinned holes. It is SRK's opinion that general continuity between these nearby holes is useful for high level comparisons.

In general, the hole pairs displayed consistent grade characteristic with regards to the position and thickness of the pegmatites and the high-grade lithium intercepts. However, some apparent grade biases are evident, with the RC Li_2O grades generally reporting higher than the nearby DDH grades. SiO_2 appears to be biased low in the RC samples with hypothesized preferential loss of the lighter minerals from the cyclone or collar pipe. Q-Q plots comparing the DDH and RC grade distributions for pegmatite composites inside and outside of the Kapanga lithium domain are shown in Figure 8-7 and Figure 8-8 respectively. The RC sample Fe_2O_3 grades are biased high compared to the DDH sample grades.



Source: SRK, 2020

Figure 8-7: DDH v RC Composites QQ PLOTS for Kapanga Pegmatite Lithium Domain



Source: SRK, 2020

Figure 8-8: DDH v. RC Composites QQ Plots for Kapanga Pegmatite Low Grade

.6 Opinion on Adequacy

SRK has previously reviewed the sample preparation, analytical, and QA/QC practices employed by Talison for the Central Lode and Kapanga deposits, and notes the following:

- In SRK's opinion, the current and historical analytical procedures are or were consistent with conventional industry practices at the time that they were conducted. The majority of the resource is supported by modern drilling and QA/QC, and analyses as described above.

- It is SRK understanding that there have been no material changes to the procedures used for QA/QC from previous years and that no major issues are expected.
- The results of the latest sampling 2022 and 2023 are consistent with the performance from previous years.
- SRK has performed detailed verification of historical QA/QC as part of the 2023 Central Lode and Kapanga resource model and found results satisfactory.
- No blank information was provided for review but based on the low-grade assays noted in the samples potential contamination is not considered to be an issues, but would be recommended for addition to the process.
- In SRK's opinion, recent QA/QC practices are satisfactory in design and monitoring and demonstrates that the analytical process is sufficiently accurate for supporting Mineral Resource estimation.
- SRK has considered the historical nature of the drilling, and the limited QA/QC associated with it, in the Mineral Resource classification.

9 Data Verification

.1 Data Verification Procedures

9.1.1 2020 SRK Verification Process

The Central Lode drilling database was verified by SRK as part of the 2020 resource model. Failures were investigated to ensure the error was not due to logic failures in the scripting. SRK was provided a total of 6,918 usable assay certificates the earliest of which date from 2006. More certificates in multiple formats were provided (pdf, excel, csv, paper) which cover the period prior to 2006 of which many are not material to the Central Lode area.

Through personal communications with Talison staff, the Kapanga drilling data was reviewed and verified prior to Talison completing the 2020 Kapanga resource model.

Additionally, SRK personnel have visited the Greenbushes property, inspected various aspects of data and the site laboratory, and interviewed Talison staff central to data acquisition and management.

The following details data verification procedures applied by SRK as part of the 2020 Central Lode resource model construction. No documentation was available regarding data verification on the Kapanga drilling data supporting the 2020 Kapanga resource model.

Verification was completed by compiling analytical information provided in the supplied certificates and cross-reference with the analytical file for the project. Analytical certificates in both Comma Separated Value (CSV) and Excel (XLS) file format were used in verification. Certificates were supplied in other formats including pdf and paper; however, verification was not attempted on those.

Verification on the on the XLS and CSV data was done using the Python scripting language to merge and compare the certificate data against the analytical file (Table 9-1). Tests were done on the string values of Li_2O geochemistry from the certificates, matched by sample ID. Assumptions for these tests in comparing the data sets are as follows:

- In cases where the merged file’s value was below the detection limit, half the lower limit of detection was applied (e.g., <0.01 became 0.005 for comparison purposes)

Merged results from the comparison were imported back to Excel for comparison and analysis. Matched tests were assigned a numeric code of 1, and failures a 0. Through this analysis, SRK compared 45,408 records from the database against the original analytical data and noted a match rate of over 98.5%. Errors were likely related to the challenges in matching samples between data sets (see Section 9.2).

Values were identified for Li_2O comparison from 51.9% of the data used in the Mineral Resource estimation. The complete analytical file includes 87,412 samples. From the analytical certificates provided, SRK was able to identify 45,408 unique samples.

Table 9-1: 2020 Central Lode Data Verification Summary

Number of samples in the assay file for comparison	87,412
Number of samples identified in the lab certificates for comparison	45,408
Total percentage of samples compared from the assay file	**51.9%**
Number of tests compared per sample	1 (Li_2O)
Maximum number of possible matches between identified lab certificate sample and assay file samples when comparing	45,408
Actual number of matches between lab certs and assay database when comparing sample tests	44,761
Percentage of matched tests	98.5%

Source: SRK, 2020

Assay Sheet Data Quality Analytic Procedure

The sample IDs in the assay sheets contained a widely varying set of characters with little consistency. “Fuzzy” matching was attempted to correlate nomenclature across laboratories and generations of data, but mismatches in the naming is likely the source of the majority of the failed comparisons.

Example: Sample ID from certificate: UGX10362.

SRK tested the assay database for:

- UGX10362
- *GX10362
- *X10362
- *10362

If no matches are found, then there is no comparison for this sample.

Duplicate sample IDs in the assay sheets were eliminated from analysis unless all values from duplicate samples were identical.

Within the analytical certificates provided, and due to variability in the naming, formatting, and characters of the sample IDs described in the lab assay sheets, only 45,408 unique sample IDs of the 87,412 sample IDs from the digital drilling database (51.9% of the total) were able to be corresponded to sample IDs in the assay sheets across both verification phases.

Data Comparison

SRK compared Li_2O grades only for the matched assays from assay sheets and the digital database.

Of these 45,408 values in the 2020 Central Lode assay database, there were 647 mismatches between the values recorded in the assay database and the lab assay sheet resulting in an error rate of approximately 1% (1.42%) and a match rate more than 98% (98.58%) in the assay database.

Li_2O values for all corresponding sample IDs were compared and any value which did not match was failed. Only those values which matched were identified as a pass.

Errors were provided to Talison, and failures were primarily attributed to shifts in sample nomenclature which could not be dealt with through the scripted data comparison, or mis-identified duplicates as noted in previous sections.

9.1.2 2022 External Review

According to BDB (2022), Talison commissioned RSC Consulting Services (RSC) to undertake a fatal-flaw level audit of the 2021 JORC Mineral Resources and Ore Reserves focused on the 2020 Central Lode and 2020 Kapanga resource models including a site visit. RSC findings concluded no fatal flaw and technical work supporting the resource models were undertaken to a high technical standard. Three findings were identified as areas of low to moderate risk that represent opportunities for improvement:

1) Potential for RC lithium grade bias noted at Kapanga.
2) Potential sensitivity of the resource model to use a 0.7% Li_2O threshold for mineralization which coincides with the applied mineral resource CoG.
3) Geometrical consistency between composite size and block size in the resource models.

9.1.3 2023 SRK Procedures

SRK has completed an independent review of the QA/QC controls supplied by Talison as part of the current validation process (as discussed in Section 8.5), which found no evidence of potential bias (duplicates) or issues with assay accuracy within the CRM submissions.

SRK has undertaken database validation for erroneous data as part of the 2023 Mineral Resource update. These processes have focused verification of the database provided to SRK by Talison. To complete the review SRK has compared the latest database with the previous database (2022) for consistency, on which no major errors were noted.

SRK has imported all the latest drilling information in Leapfrog Geo and reviewed through the software standard validation checks, which included checks for missing samples, overlapping intervals, from-to errors and more. During the review the following errors have been noted:

- A total of 120 holes with no assay values. These typically related to grade control holes and were therefore not considered to be material to the estimate.
- Four overlapping samples were noted in the assay file which related to a wedge sampling in hole CLDD054
- Minor errors were reported in the Geology input file which were not considered to be material to the estimates and were limited in general to short grade control drilling and therefore not material.

.2 Limitations

SRK has considered the validation process completed in 2020 to be a detailed process which has exceeded the typical checks on laboratory certificates versus database entries. SRK has not been supplied with the hard copies of the certificates to update the procedure for the latest drilling but given the relative proportion of new sampling versus the number of records completed during the 2020 review it is the QP's opinion that with the procedures in place any misallocation of assays from the certification to the database would be minimal and therefore not material to the current estimates.

.3 Opinion on Data Adequacy

In SRK's opinion, sampling, analyses, and management of the digital database provided by Talison is of sufficient quality to support Mineral Resource estimation and disclosure. Low incidents of quality control failure were noted in the comparisons made to original source data, and explanations for failures are reasonable and common amongst mining projects with extensive histories and various generations of logging styles and analytical laboratories.

SRK notes good practices in data acquisition, analyses, management, and modeling by Talison staff. Additionally, SRK's opinion is that Talison technical staff are competent, experienced, and aligned with good industry practices in support of high confidence data supporting Mineral Resources.

10 Mineral Processing and Metallurgical Testing

Greenbushes operates their Chemical Grade Plant-1 (CGP1) to recover spodumene from ore containing about 2.5% Li_2O into lithium concentrates containing about 6% Li_2O. The CGP1 process flowsheet utilizes unit operations that are standard to the industry including: ball mill grinding, HMS (heavy media separation), WHIMS (wet high intensity magnetic separation), coarse mineral flotation and conventional fine mineral flotation. During 2019 Greenbushes completed the construction of their Chemical Grade Plant-2 (CGP2) which was designed to process 2.4 Mt/y of ore at an average grade of 1.7% Li_2O to produce final concentrates containing about 6% Li_2O and meet the specification for Greenbushes' SC6.0 product. The CGP2 flowsheet is very similar to CGP1 but was designed with a number of modifications based on HPGR (high pressure grinding rolls) comminution studies and CGP1 operational experience. The most notable modifications included:

- Replacement of the ball mill grinding circuit with HPGRs
- Plant layout to simplify material flow and pumping duties
- Orientation of the HMS circuit to allow the sink and float products to be conveyed to the floats WHIMS circuit and sinks tantalum circuit
- Locating the coarse flotation circuits above the regrind mill to allow flow steams to gravity feed directly into the mill
- Orientation of the fines flotation cells in a staggered arrangement to allow the recleaner and cleaner flotation tails to flow by gravity into the cleaner and rougher cells, respectively
- Orientation of the concentrate filtration circuit to allow the sinks to be conveyed to the sinks filter
- Provision for sufficient elevation for the deslime and dewatering cyclone clusters to gravity feed to the thickener circuits located at ground level

CGP2 commissioning began during September 2019 and continued through April 2020 and was then shut down during the period from March 2020 to April 2021 due to market demand considerations. CGP2 was then put back into production during May 2021. During 2021 CGP2 recovered only 50.5% of the contained lithium versus a predicted recovery of 73.2%.

In an effort to resolve the performance issues with CGP2, Greenbushes retained MinSol Engineering (MinSol) to undertake a performance assessment of CGP2 and identify areas where improvements in the plant could be made to increase lithium recovery. MinSol issued a report of their finding on October 27, 2022, which presented their findings and a path forward to improve CGP2 performance.

These optimization changes have resulted in increasing average lithium recovery from about 50.5% reported for 2021 to 67.9% reported for the first half of 2023. This represents an almost 18% increase in recovery. However, overall lithium recovery remains about 5% less than the design recovery. MinSol has identified the following process areas that could be further optimized in an effort to further improve overall lithium recovery:

- Blending of ore on the ROM pad to decrease plant feed variability
- Redirecting fines flotation cleaner tailings to allow for additional reagent conditioning
- Improve reagent conditioning efficiency of the fines flotation conditioner
- Improve reagent conditioning in the hydrofloat reagent conditioners.
- Prescreening HPGR feed to reduce slimes generation
- Add a scavenger flotation circuit
- Add a scavenger WHIMS circuit

0.1 Metallurgical Testwork and Analysis

Greenbushes has an on-site metallurgical staff that undertakes routine projects in each of its operating facilities in an effort to improve plant performance. No specific metallurgical test work has been done to support the design and engineering of their future processing facilities, CGP3 and CGP4, as the design for these facilities is largely based on CGP2 plant design as well as operational experience.

0.2 QP Opinion

It has been determined that inclusion of the HPGR in CGP2's comminution circuit has resulted in the generation of a higher proportion of unrecoverable fines than is observed in CGP1. SRK is of the opinion that the incrementally higher lithium recovery included in Greenbushes' CGP2 yield model is not warranted due to the higher proportion of unrecoverable lithium fines than had been anticipated. SRK notes that that CGP1 and CGP2 flowsheets for are similar and both plants process ore from the same mining operation, as such, SRK believes that it is reasonable to expect that if the optimization programs proposed by MinSol are successfully implemented, CGP2 may eventually achieve lithium yields and recoveries defined by Greenbushes' CGP1 yield model.

11 Mineral Resource Estimates

1.1 Key Assumptions, Parameters, and Methods Used

The Mineral Resource statement disclosed in this section has used the same procedures as in previous years, but a combined model covering the Central Lode and Kapanga model has been generated. The process involved database validation, construction of geological and mineralization wireframe domains, data conditioning, statistical and geostatistical analysis, grade interpretations, validation, classification, assessment of reasonable prospects for economic extraction and preparation of a Mineral Resource statement.

The basis for the Mineral Resource estimate reflects the latest drilling and sampling information to June 30, 2023. SRK undertook a review of the previous model and has updated the interpretation to reflect the latest information. Summary changes to the 2023 model include:

- Updated geologic interpretation to reflect the additional 2023 drilling
  - Central Lode: 70 holes, 20,984 meters
  - Kapanga: 22 holes, 8,577 meters
- Construction of a property wide geologic model that includes Central Lode and Kapanga in one model space.
- Refine geologic model to include internal dilution of dolerite dikes
- Review of the estimation parameters used in the 2022 estimates to reflect the latest drilling information and statistical analysis
- Updated mineral resource estimation and classification based on the addition of 2023 drilling

The following subsections summarize the key assumptions from the 2023 resource model which forms the basis of the Mineral Resource statement.

1.2 Geological Model

Digital 3D geological models were constructed for the Central Lode and Kapanga deposits to approximate the geological features relevant to Mineral Resources. SRK has imported the latest drilling information and compared the results with internal Talison models and the previous model developed for the geology and mineralization within the Central Lode and Kapanga. Both the Central Lode and Kapanga areas have been combined and modeled in the same property scale model for the latest update. Previously, the Central Lode and Kapanga were modeled separately and then merged together for reporting purposes in the previous (2022) update. The use of a combined model for both deposits is considered best practice especially during the assessment of reasonable prospects for economic extraction.

All geological information supporting the development of the models was collected by Talison geologists and contractors with data reviews and interpretations performed as a collaborative effort between SRK and Talison staff.

Albemarle's public reporting cadence results in a discrepancy from the ongoing Talison modeling processes which are completed on a biannual basis compared to Albemarle's public reporting cadence which demands a completed resource and reserve statement for EOY.

SRK has generated the latest interpretation in collaboration with Albemarle to incorporate the latest drilling information provided by Talison. The 2023 3D geological model was developed using Leapfrog Geo. In general, model development is primarily based on lithology logging from drilling but incorporates a range of other geological information including:

- Alteration and mineralogical logging
- Geological mapping (historical and modern)
- Interpreted cross sections (historical and modern)
- Surface/downhole structural observations
- Historical drill logging (historical samples are not utilized in resource estimation)
- Interpreted geological contacts (surface and sub-surface 3D)

The 3D digital geological model utilized for calculating the mineral resource estimate was prepared by SRK Consulting (U.S.) Inc. and based on interpretations and inputs from both Talison and Albemarle geologists. The model was prepared using an extensive dataset that included geological logging data and geochemical data acquired from both resource definition and grade control drillhole samples, as well as pit mapping data. The model included the main lithological units, structural features, alteration zones and grade domains. It is based on an internal operational Leapfrog model provided by Talison, updated by SRK Perth with additional drilling, and refined by Albemarle/SRK for public disclosure.

The geological model developed was designed to address the complex nature of the deposit geology. This includes an oxidation model for characterizing oxidized, transition, and fresh material, a lithology model for characterizing geological rock types present, a depletion model to address previously mined out material, and a number of numerical models to identify and segregate domains by geochemical indicators, specifically lithium.

11.2.1 Lithological Model

The lithological model was prepared by interpreting the lithological logging and mapping data into the following grouped major lithological units for modeling purposes:

- Fill
- SAP (Saprolite)
- DOL (Dolerite)
- Peg_Central (Central Lode Pegmatite)
- Peg_Kapanga (Kapanga Pegmatite)
- AMPH (Amphibolite)
- G (Granofels)
- **Fill** (Unconsolidated mining material like waste rock storage facilities. These volumes were constructed by using the difference between the pre-mining surface and June 2023 topographic surface.)
- **Saprolite** (Weathered material below the Fill volume. The saprolite volume was based on the lithology table in the drillhole database. Pegmatite volumes are truncated against the bottom of the saprolite surface.)
- **Dolerite** (The dolerite dikes have two primary orientations: north-to-south and east-to-west. The dikes are discontinuous along strike and down dip and thicknesses range from 1 m to over 50 m.

Dikes were modeled off of detailed pit mapping and drillhole intercepts using intrusive and vein modelling tools in Leapfrog. In the previous model, dikes intercepted in the drilling were not captured unless modeled in short-range drilling or pit mapping; these dikes have an average thickness of 1 m. In the previous Kapanga, these dikes were not modeled and typically averaged 5 m in width.)

- **Pegmatites** (Intrusive pegmatites. The Central Lode and Kapanga pegmatites were modeled using the lithology table and the intrusive modeling tool in Leapfrog Geo. Trends were applied to the interpretation and improve the continuity of migmatite material along strike and down dip.)
- **Granofels** (Set as the host or country rock with pegmatite and amphibolite modeled as intrusives within the broader granofels body.)

No major brittle structures were modeled as a part of this work, as structural data defining brittle faults within the pit is minimal. Talison geologists have noted that offsetting or brittle structural features are not critical to the current geological understanding.

The geological model is shown in plan view and cross section in Figure 11-1 and Figure 11-2.

In SRK's opinion, the level of data and information collected during both the historical and modern exploration efforts is sufficient to support the geological model and Mineral Resources. It is SRK view that the continual monitoring of the dolerite material will aid future estimates especially in the Kapanga region of the model, and therefore integration of pit mapping, short term drilling results and structural review would be recommended for inclusion in future updates.

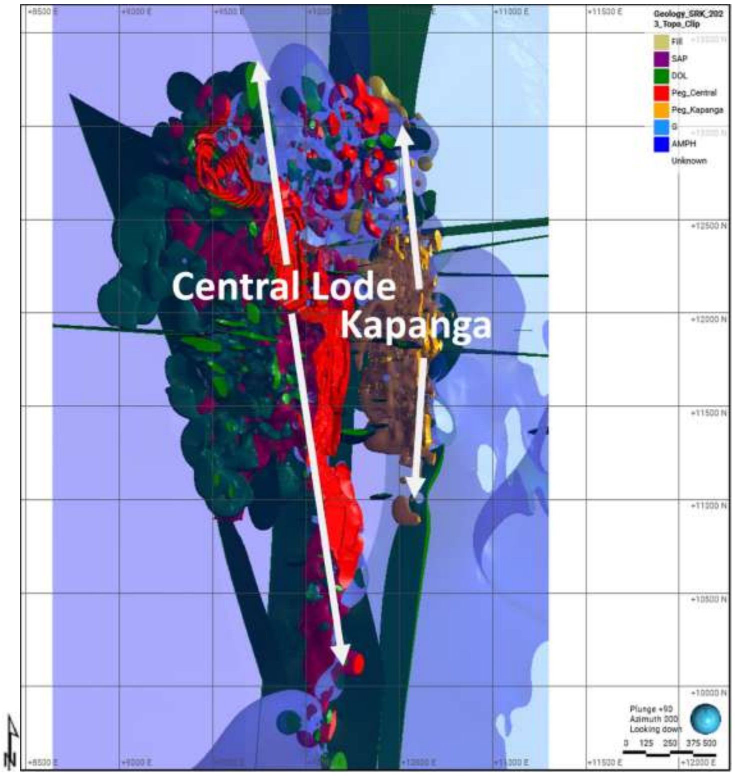
To examine the relative accuracy of the modeling process against the reality of the logging, SRK examined the overall percentages of logged rock types contained within the modeled pegmatites, and vice versa (Table 11-1). Its SRK's opinion the current modeling methods reduce internal dilution of the amphibolite host rock and intrusive dolerite dikes. The Central Lode pegmatite is a continuous massive body with consistent continuity. The pegmatite body has minor internal dilution (3.94%) that is primarily cross-cutting dolerite dikes. Kapanga is not as continuous and massive as Central Lode and consists of a series of sheeted pegmatite intrusives. There is more internal dilution (15.55%) than Central Lode, which reflects the complexity of the geology.

Table 11-1: 2023 Geologic Model vs. Drilling Comparison

Model Values Matchings Drilling Central Pegmatite		
Model Lithology	**Length**	**Percent Length**
Pegmatite Central	125,412	96.06%
Pegmatite Kapanga	9	0.01%
Pegmatite Unassigned	573	0.44%
Amphibolite	1,615	1.24%
Granofels	1,637	1.25%
Dolerites	1,315	1.01%
Model Values Matchings Drilling Kapanga Pegmatite		
Model Lithology	**Length**	**Percent Length**
Pegmatite Central	395	2.89%
Pegmatite Kapanga	11,554	84.45%
Pegmatite Unassigned	309	2.26%
Amphibolite	746	5.45%
Granofels	120	0.87%
Dolerites	557	4.07%
Model Values Matchings Drilling Amphibolite		
Model Lithology	**Length**	**Percent Length**
Pegmatite Central	3,467	3.74%
Pegmatite Kapanga	2,145	2.32%
Pegmatite Unassigned	246	0.27%
Amphibolite	79,655	85.99%
Granofels	1,509	1.63%
Dolerites	5,610	6.06%
Model Values Matchings Drilling Granofels		
Model Lithology	**Length**	**Percent Length**
Pegmatite Central	2,068	6.69%
Pegmatite Kapanga	503	1.63%
Pegmatite Unassigned	17	0.05%
Amphibolite	534	1.73%
Granofels	27,496	88.95%
Dolerites	294	0.95%
Model Values Matchings Drilling Dolerite		
Model Lithology	**Length**	**Percent Length**
P_Central	1,955	5.59%
P_Kapanga	458	1.31%
PEG	6	0.02%
AMPH	1,971	5.63%
GRAN	561	1.60%
DOL	30,045	85.86%

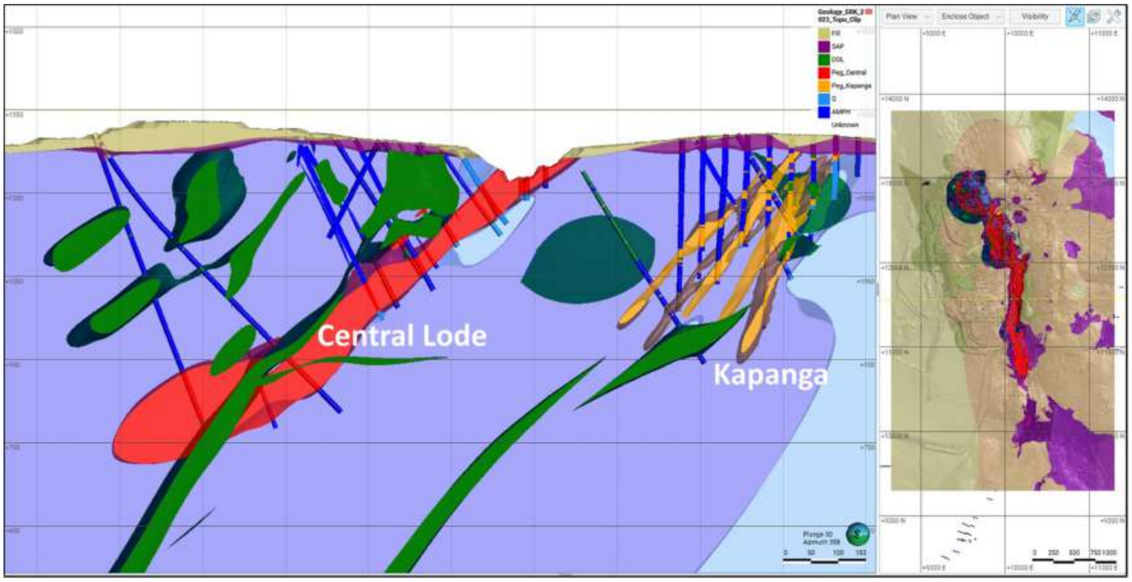
Source: SRK, 2023

In SRK's opinion, the level of data collected during the historical and modern exploration efforts is sufficient to support the geological model and mineral resources. Figure 11-1 and Figure 11-2 show the geological model in plan view and cross-section, respectively.



Source: SRK, 2023
Fill and saprolite material removed.

Figure 11-1: Plan View of 3D Lithology Model showing Primary Trends of Pegmatite Mineralization

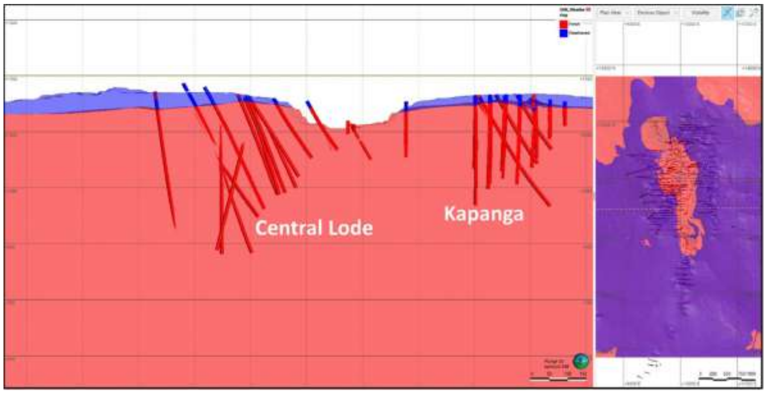


Source: SRK, 2023
Looking North and section width +/- 50 m

Figure 11-2: Cross-Section View of Geological Model

11.2.2 Oxidation Model

The oxidation model (Figure 11-3) was developed by grouping coding within the geologic logging into two categories. The original data provided by Talison has five subjective categories on the degree of relative oxidation: extreme (e), high (h), moderate (m), weak (w), and fresh (f). The general grouping used by SRK, grouped extremely and highly oxidized material as Oxide (e and h) and non-oxidized or Fresh rock (m, w, and f). SRK considered the moderately oxidized or transition material, where logged, as a part of the overall fresh rock zone. A small quantity of codes modified to produce a more geologically consistent model. Though the original assignment of oxidation values was subjective and varied from logger to logger, the broad categories used were suggested by Talison personnel and are considered acceptable for the purposes of identifying the near-surface weathered material.

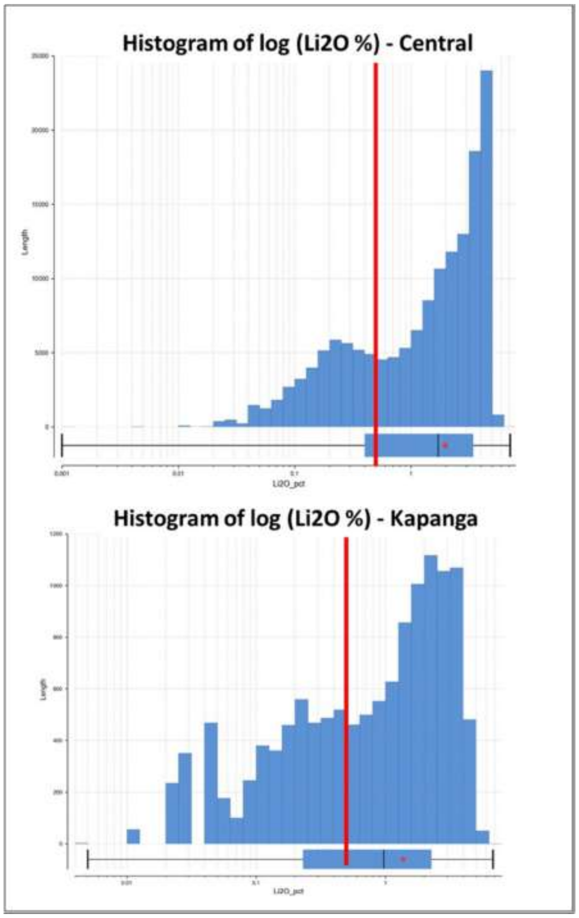


Source: SRK, 2023
Section looking north section width +/- 50m
Logged transition intervals are incorporated into fresh rock for the purposes of simplifying the model.

Figure 11-3: Cross Section View of Oxidation Model

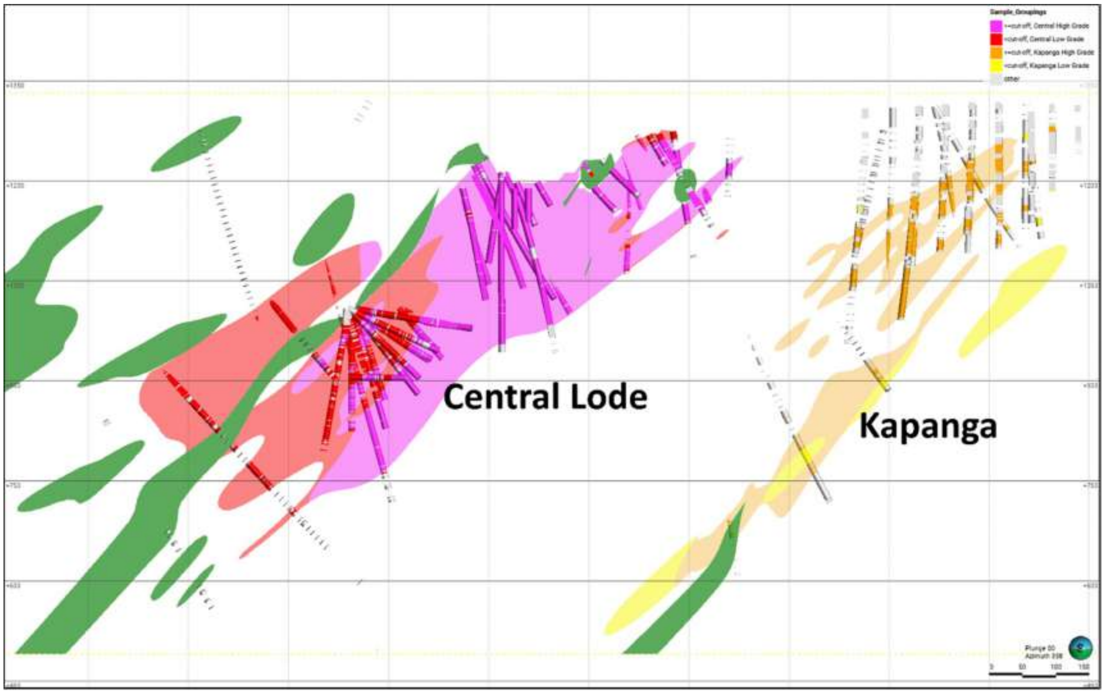
11.2.3 Mineralization Domains

Historically, the pegmatite geological model has been separated into spodumene-dominant pegmatite and pegmatites which may feature less spodumene and elevated tin-tantalum. SRK identified that use of a 0.5% Li_2O threshold tends to define the Central Lode and Kapanga spodumene-rich portion from the spodumene-poor portion. SRK conducted exploratory data analysis (EDA) on the Li_2O assays within the modeled Central Lode and Kapanga pegmatite models and notes that there is a distinct bimodal population in the distribution of Li_2O, as shown on Figure 11-4 (Central Lode) and Figure 11-5 (Kapanga). Visualizing these intervals on section (Figure 11-5) demonstrates a relatively contiguous and spatially discrete volumes of the pegmatite that corresponds to interpretation of higher spodumene pegmatite.



Source: SRK, 2023

Figure 11-4: Li_2O Histogram of Raw Assays Internal to the Central and Kapanga Modeled Pegmatites



Source: SRK, 2023
Green volumes represent dolerite dikes

Figure 11-5: Pegmatite Distribution of Li_2O Based on a 0.5% Li_2O Threshold in the Central Lode and Kapanga Deposits

SRK modeled the Central Lode and Kapanga spodumene-rich portions of the pegmatite using an indicator interpolation approach, bound by the modeled pegmatite itself but considering the overall internal structural trends as defined by each of the pegmatites. The indicator modeling process was conducted using Leapfrog Geo, compositing the samples to a 3 m nominal length.

To optimize the mineralization model, SRK undertook a range of grade indicators and Leapfrog ISO values (threshold that defines regions based on the variables value) to test the sensitivity on the grades and volumes. Different ISO values and threshold grades were compared visually in the context of geological continuity defined by the continuous Li_2O variable and statistically through the relative dilution of intervals below the threshold, exclusion of intervals above the threshold, and comparison to the geological volumes as shown in Table 11-2 and Table 11-3. Similar tables were produced for every scenario and reviewed along with the wireframe itself for reasonability with interpretation. Based on the analysis, SRK has elected to use using a threshold grade of 0.5 % LiO_2, with an ISO value for the indicator of 45% for Central Lode and 35% for Kapanga. The resulting shapes comprises about 56% of the overall pegmatite body for Central Lode and 58% of the pegmatite for Kapanga within these higher-grade domains.

Table 11-2: Statistics for Li_2O Indicator Model – Central Lode

Indicator Statistics	**Li_2O-Central Pegmatite**	
Total Number of Samples	**28,667**	
Cut-off Value	**0.50**	
	≥Cut-off	**<Cut-off**
Number of points	18,504	10,163
Percentage	0.65	0.35
Mean value	2.19	0.24
Minimum value	0.50	0.00
Maximum value	6.56	0.50
Standard deviation	1.19	0.12
Coefficient of variance	0.54	0.51
Variance	1.42	0.01
Output Volume Statistics		
Resolution	10	
Iso-value	0.45	
	Inside	**Outside**
≥ Cut-Off		
Number of samples	17,557	947
Percentage	61%	3%
< Cut-off		
Number of samples	1,226	8,937
Percentage	0.4%	31%
All points	**Li_2O**	
Mean value	2.13	0.29
Minimum value	0.02	0.00
Maximum value	6.56	3.04
Standard deviation	1.24	0.28
Coefficient of variance	0.58	0.94
Variance	1.54	0.08
Volume	132,210,000	102,450,000
Number of parts	2	270
Central Pegmatite Volume	234,600,000	
Pegmatite Volume %	56%	44%

Source: SRK, 2023

Table 11-3: Statistics for Li_2O Indicator Model – Kapanga

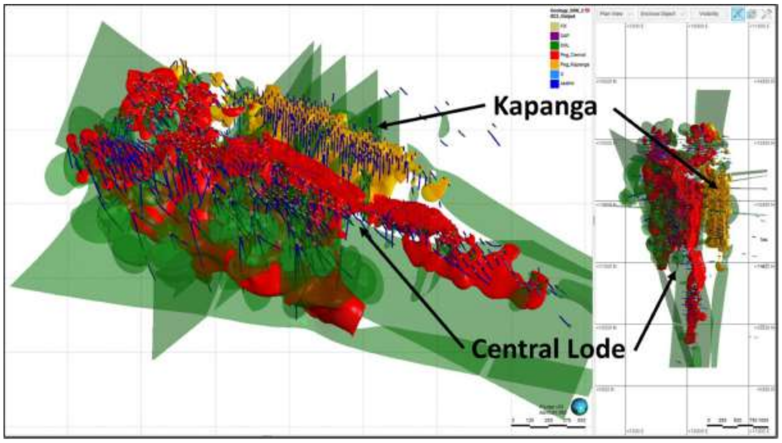
Indicator Statistics	**Li_2O - Kapanga Pegmatite**	
Total Number of Samples		**4,447**
Cut-off Value		**0.50**
	≥ Cut-off	**< Cut-off**
Number of points	2,883	1,564
Percentage	0.65	0.35
Mean value	1.97	0.19
Minimum value	0.50	0.01
Maximum value	6.28	0.50
Standard deviation	1.02	0.14
Coefficient of variance	0.52	0.71
Variance	1.03	0.02
Output Volume Statistics		
Resolution		10
Iso-value		0.35
	Inside	**Outside**
≥ Cut-off		
Number of samples	2,794	89
Percentage	63%	2%
< Cut-off		
Number of samples	494	1,070
Percentage	11%	24%
All Points		
Mean value	1.73	0.24
Minimum value	0.02	0.01
Maximum value	6.28	4.08
Standard deviation	1.12	0.38
Coefficient of variance	0.65	1.59
Variance	1.25	0.14
Volume	28,633,000	20,844,000
Number of parts	13	184
Central Pegmatite Volume	49,476,000	
Pegmatite Volume %	58%	42%

Source: SRK, 2023

These volumes represent a slight increase in the volume from the internal (high-grade) units used in the 2022 model, which in part is attributed to the lower cut-off used in the indicator model (0.5% Li_2O versus 0.7% Li_2O). It is SRK's opinion in conjunction with the new drilling and more geologically controlled modeling of the dikes that the lower-grade cut-off increased the geological continuity of the domain, but in dropping the cut-off, SRK has offset this by using higher probability factors than previously considered, which results in similar volumes.

Lithium does occur external to this shape, but as noted in the statistics for the model, approximately 3% of samples above the threshold is excluded for Central Lode and 2% of the samples above the threshold for Kapanga. Internal to the indicator model, approximately 4% of total samples are included which are below the threshold for Central Lode and approximately 11% for Kapanga. The percentage of samples below the threshold are significantly higher in Kapanga due to the lower ISO value used, 35% for Kapanga and 45% for Central Lode. The lower ISO value was applied by SRK at Kapanga to improve continuity along strike and down-dip. In general, Kapanga does not have the same continuity compared to Central which is attributed to lower drill density and geologic complexity compared to Central.

SRK utilized the ≥0.5% Li_2O indicator volume internal to the pegmatite as the higher-grade domain for estimation, and remaining pegmatite as the lower grade domain for estimation (Figure 11-6).



Source: SRK, 2023

Figure 11-6: Perspective View of 0.5% Li_2O Spodumene Pegmatite

Table 11-4: Statistics for Li_2O Indicator Model – Kapanga

Indicator Statistics	**Li_2O - Kapanga Pegmatite**	
Total Number of Samples		**4,447**
Cut-off Value		**0.50**
	≥ Cut-off	**< Cut-off**
Number of points	2,883	1,564
Percentage	0.65	0.35
Mean value	1.97	0.19
Minimum value	0.50	0.01
Maximum value	6.28	0.50
Standard deviation	1.02	0.14
Coefficient of variance	0.52	0.71
Variance	1.03	0.02
Output Volume Statistics		
Resolution		10
Iso-value		0.35
	Inside	**Outside**
≥ Cut-off		
Number of samples	2,794	89
Percentage	63%	2%
< Cut-off		
Number of samples	494	1,070
Percentage	11%	24%
All Points		
Mean value	1.73	0.24
Minimum value	0.02	0.01
Maximum value	6.28	4.08
Standard deviation	1.12	0.38
Coefficient of variance	0.65	1.59
Variance	1.25	0.14
Volume	28,633,000	20,844,000
Number of parts	13	184
Central Pegmatite Volume	49,476,000	
Pegmatite Volume %	58%	42%

Source: SRK, 2023

Comparison 2022 versus 2023 Geological Model

In the 2023 geological model, SRK made an emphasis on modeling the dolerite dikes to account for potential impact on dilution within the Central Lode and Kapanga Pegmatites, which in the QP's opinion is more geologically representative. Volumetrically, the 2023 dolerite interpretation includes a 15% additional volume of dolerite compared to the 2022 model (reported within the 2023 resource pit). SRK notes that this minor increase is due to the increased number of dolerite dikes modeled at Kapanga and Central Lode.

Based on review of the integrated previous geologic model used by SRK for the 2022 EOY mineral resource disclosure and in the context of new 2023 drilling, it is the QP's opinion that the dolerite intrusive bodies required additional modeling to more accurately represent them at a resource scale (specifically in the Kapanga area).

The 2023 geological update included modeling to reflect the following key changes:

- Small (<5 m) dolerite dikes internal to the Central Lode and Kapanga pegmatites are present in new drilling that were not previously modeled due to geological continuity.

- Previous geological methodology in Leapfrog was adjusted to improve control on the modeling of the contacts for the non-mineralized dolerite dikes by switching to a vein modeling method to compliment the intrusive modeling within the software.

Comparison of the volumes for the two main pegmatite units which for the purposes of comparison have been limited to the 2023 limiting shell indicate an overall reduction in the wireframe volume for the Central Pegmatite in the order of 9% of the volume. The reduction in the volume has been attributed to the impact of dilution from the dolerite dikes, but also minor changes along the contacts which reduced the overall volume in the 2023 model. In comparison, there is limited volumetric changes for the Kapanga model within the limiting pit shell, but SRK notes there were increases in the volumes at depth at Kapanga and that these areas are not currently included within the economic portion for the Project as narrower nature of the mineralization is not an amenable to open pit mining methods due to their depth and potential higher striping ratio. Table 11-5 shows the volumetric differences between the 2022 and 2023 modeled pegmatites and dolerite.

Table 11-5: Summary of Wireframe Volumes for Key Geological Units 2022 to 2023 (Limited to 2023 Pit Shell)

Volume	2022 (M^3)	2023 (M^3)	% Difference
Central Pegmatite	151,780,000	126,140,000	-9%
Kapanga Pegmatite	16,223,000	16,094,000	0%
Dolerite	54,951,000	64,413,000	+15%

Source: SRK, 2023
Volumes are reported within the 2023 resource pit

11.3 Exploratory Data Analysis

SRK conducted detailed EDA on a domain basis. Variables assessed include the economic variables of Li_2O, Fe_2O_3, SnO_2 and Ta_2O_5 and for the purposes of density assignment or materials type characterization include MnO, Na_2O, P_2O_5 and SiO_2. Data were split on the basis of location (Central vs. Kapanga) the resource development exploration drilling (RDEX) and the grade control drilling (Figure 11-7). Raw sample statistics for the elements of interest are summarized in Table 11-6 (Central) and Table 11-7 (Kapanga).

SRK notes the following observations of the pegmatite domains between the two data types:

- The GC drilling is consistently higher in average Li_2O content, due to the nature of it being focused on spodumene-bearing pegmatites.
- Elements are relatively consistently assayed for across the drilling types, with Mn and SiO_2 being the least-assayed-for amongst the elements of interest.
- The GC dataset, due to being isolated and clustered in the production areas, shows significant differences in internal variance of Li_2O (measured by the CV) and other elements.
- Other elements such as Sn or Ta are generally of low concentration in the pegmatite, and do not occur in high enough concentrations to warrant consideration in the mineral resource.

Fe_2O_3 demonstrates relatively low concentration in the pegmatites but is affected significantly by the contributions of limited waste samples from dolerite or amphibolite which are higher in Fe_2O_3. Talison geologists generally do not consider estimated Fe_2O_3 grades in the resource model as definitive characteristics for materials typing or reporting, and instead rely on a calculated Fe variable derived from other elements.

Table 11-6: Descriptive Statistics for Raw Sample Data – RDEX vs. GC within the Central Lode Pegmatite

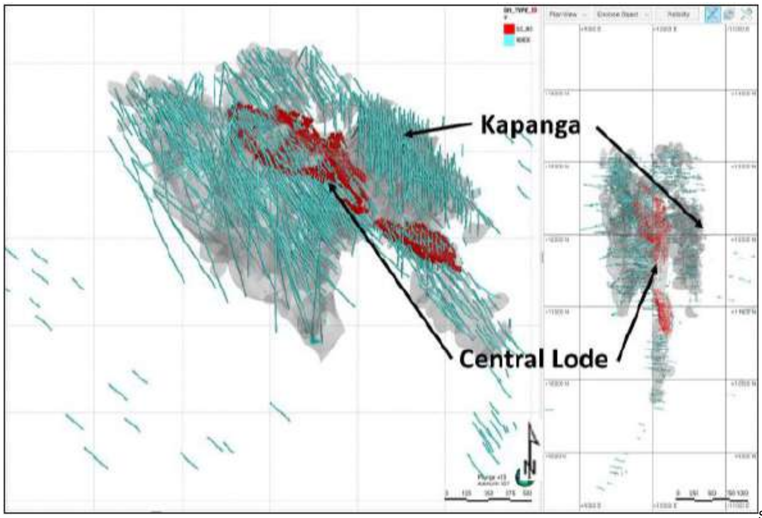
Name	Element	Count	Length (m)	Mean	Standard Deviation	Coefficient of Variation	Variance	Minimum	Lower Quartile	Median	Upper Quartile	Maximum
GC_RC	Total Samples	29344	71,933									
	Fe2O3_pct	27266	66,714	1.62	3.57	2.20	12.72	0.03	0.24	0.40	0.78	57.24
	Li2O_pct	27268	66,719	2.57	1.58	0.61	2.49	0.01	1.12	2.75	4.02	6.43
	MnO_pct	27266	66,714	0.06	0.06	1.07	0.00	0.00	0.03	0.04	0.06	2.03
	Na2O_pct	27266	66,714	1.70	1.31	0.77	1.71	0.03	0.70	1.36	2.34	9.34
	P2O5_pct	27266	66,714	0.19	0.16	0.84	0.03	0.00	0.09	0.16	0.25	6.65
	SiO2_pct	27266	66,714	72.03	6.24	0.09	38.89	26.83	71.32	73.89	75.56	92.60
	SnO2_pct	27266	66,714	0.02	0.03	1.70	0.00	-	0.01	0.01	0.02	1.75
	Ta2O5_pct	27266	66,714	0.01	0.02	2.03	0.00	0.00	0.00	0.01	0.01	3.19
RDEX	Total Samples	83901	100,148									
	Fe2O3_pct	77468	88,363	1.31	2.10	1.61	4.42	0.00	0.48	0.76	1.24	60.71
	Li2O_pct	74201	84,111	1.51	1.41	0.93	1.99	0.00	0.27	1.04	2.48	7.14
	MnO_pct	63201	65,880	0.09	0.13	1.41	0.02	0.00	0.04	0.06	0.10	3.81
	Na2O_pct	77091	87,885	3.23	2.24	0.70	5.04	0.00	1.46	2.73	4.56	20.78
	P2O5_pct	73642	83,038	0.38	0.54	1.43	0.29	0.00	0.15	0.24	0.37	10.56
	SiO2_pct	63198	65,878	72.08	5.81	0.08	33.73	37.25	69.87	72.93	75.26	99.82
	SnO2_pct	78488	89,317	0.05	0.08	1.69	0.01	-	0.01	0.03	0.05	5.16
	Ta2O5_pct	80894	93,091	0.02	0.02	1.15	0.00	0.00	0.01	0.01	0.02	1.14

Source: SRK, 2023
Statistics are length-weighted and reported inside the Central pegmatite geologic wireframe. Intervals may have been split for the purposes of statistical reporting across model domains.

Table 11-7: Descriptive Statistics for Raw Sample Data – RDEX vs. GC within the Kapanga Pegmatite

Name	Element	Count	Length (m)	Mean	Standard Deviation	Coefficient of Variation	Variance	Minimum	Lower Quartile	Median	Upper Quartile	Maximum
RDEX	Total Samples	13620	13,693						Q			
	Fe2O3_pct	13201	12,651	2.27	3.59	1.58	12.89	0.01	0.58	0.87	1.61	28.00
	Li2O_pct	13205	12,649	1.37	1.29	0.94	1.67	0.01	0.23	0.97	2.27	6.80
	MnO_pct	13141	12,557	0.07	0.07	1.01	0.01	0.00	0.02	0.04	0.10	1.85
	Na2O_pct	13201	12,651	3.32	1.91	0.58	3.64	0.00	1.87	2.96	4.49	10.30
	P2O5_pct	13201	12,651	0.14	0.12	0.89	0.02	0.00	0.08	0.11	0.16	4.80
	SiO2_pct	13141	12,557	71.78	7.04	0.10	49.53	34.18	71.27	73.84	75.49	98.63
	SnO2_pct	13222	12,673	0.03	0.04	1.35	0.00	0.00	0.01	0.02	0.03	0.85
	Ta2O5_pct	13228	12,684	0.01	0.01	1.11	0.00	0.00	0.00	0.01	0.01	0.33

Source: SRK, 2023
Statistics are length-weighted and reported inside the Kapanga pegmatite geologic wireframe. Intervals may have been split for the purposes of statistical reporting across model domains.



Source: SRK, 2023

Red holes are RC grade control, Blue are exploration (mixed RC/DDH)

Figure 11-7: Spatial Relationship of RDEX and GC Drilling in the Central Lode and Kapanga Deposits

Based on these observations, SRK elected to only utilize the RDEX dataset for the purposes of estimation for the resource at the Central Lode deposit. The RDEX dataset is more spatially representative than the GC dataset, and use of GC analyses may introduce potential sample biases due to the nature of GC sampling.

Considering only the RDEX data, statistical analyses were reviewed for the data inside the high-grade (>0.5% Li_2O) pegmatite domain, and outside, as shown in Table 11-8 (Central Lode) and Table 11-9 (Kapanga). Other than expected increases in the Li_2O means and relative decreases in Fe_2O_3, SRK notes that there also is more SG data located in the higher-grade domains than the lower-grade volume. Tin and tantalum tend to increase in the low-grade domain, consistent with observations of the lithium-bearing pegmatites being broadly discrete from the tin-tantalum-rich pegmatites. In general, the EDA supports the domaining decision which is geochemically and mineralogically distinct.

Table 11-8: RDEX Drilling Statistics, by Central Lode Pegmatite Resource Domain

Name	Element	Count	Length (m)	Mean	Standard Deviation	Coefficient of Variation	Variance	Minimum	Lower Quartile	Median	Upper Quartile	Maximum
Central High Grade (Li_2O >= 0.5)	Total Samples	47,993	54,671									
	Fe2O3_pct	45,623	50,336	1.12	1.94	1.73	3.75	0.00	0.44	0.68	1.05	32.35
	Li2O_pct	45,808	50,615	2.09	1.32	0.63	1.74	0.00	0.98	1.89	3.13	7.14
	MnO_pct	38,721	39,085	0.07	0.11	1.45	0.01	0.00	0.03	0.05	0.07	3.13
	Na2O_pct	45,592	50,320	2.47	1.66	0.67	2.74	0.00	1.19	2.19	3.45	20.78
	P2O5_pct	44,630	48,975	0.29	0.36	1.26	0.13	0.00	0.13	0.22	0.31	8.78
	SiO2_pct	38,721	39,085	72.82	4.49	0.06	20.13	37.59	71.47	73.50	75.32	99.82
	SnO2_pct	45,432	49,781	0.03	0.04	1.33	0.00	0.00	0.01	0.02	0.03	1.83
	Ta2O5_pct	46,787	51,942	0.01	0.01	1.06	0.00	0.00	0.01	0.01	0.02	1.14
Central Low Grade (Li_2O < 0.5)	Total Samples	28,698	34,180									
	Fe2O3_pct	26,018	29,726	1.73	2.49	1.44	6.19	0.00	0.62	0.99	1.69	60.71
	Li2O_pct	24,714	28,019	0.30	0.33	1.11	0.11	0.00	0.13	0.22	0.34	4.28
	MnO_pct	23,697	25,933	0.13	0.16	1.27	0.03	0.00	0.05	0.08	0.15	3.81
	Na2O_pct	26,081	29,812	4.54	2.43	0.53	5.89	0.00	2.43	4.38	6.58	11.60
	P2O5_pct	25,282	28,683	0.53	0.73	1.37	0.53	0.01	0.20	0.30	0.53	10.56
	SiO2_pct	23,697	25,933	70.97	7.28	0.10	52.98	37.25	67.51	71.30	75.04	97.39
	SnO2_pct	27,226	31,362	0.07	0.09	1.28	0.01	-	0.02	0.05	0.08	3.53
	Ta2O5_pct	27,422	31,644	0.02	0.03	1.04	0.00	0.00	0.01	0.02	0.03	0.58

Source: SRK, 2023
Statistics are length-weighted and reported inside 0.5% Li_2O Central pegmatite shape, and outside. Intervals may have been split for the purposes of statistical reporting across model domains.

Table 11-9: RDEX Drilling Statistics, by Kapanga Pegmatite Resource Domain

Name	Element	Count	Length (m)	Mean	Standard Deviation	Coefficient of Variation	Variance	Minimum	Lower Quartile	Median	Upper Quartile	Maximum
Kapanga High Grade (Li_2O >= 0.5)	Total Samples	10106	9913									
	Fe2O3_pct	9869	9384	1.88	3.22	1.71	10.39	0.01	0.53	0.75	1.26	21.51
	Li2O_pct	9889	9407	1.76	1.26	0.71	1.59	0.01	0.64	1.59	2.65	6.80
	MnO_pct	9869	9384	0.06	0.07	1.06	0.00	0.00	0.02	0.04	0.08	1.85
	Na2O_pct	9869	9384	3.00	1.72	0.57	2.95	0.00	1.73	2.66	3.96	10.30
	P2O5_pct	9869	9384	0.14	0.12	0.86	0.01	0.00	0.08	0.11	0.16	4.80
	SiO2_pct	9869	9384	72.49	6.33	0.09	40.07	34.18	71.98	74.15	75.66	98.63
	SnO2_pct	9889	9407	0.02	0.03	1.33	0.00	0.00	0.01	0.01	0.03	0.85
	Ta2O5_pct	9889	9407	0.01	0.01	1.08	0.00	0.00	0.00	0.01	0.01	0.33
Kapanga Low Grade (Li_2O < 0.5)	Total Samples	3514	3780									
	Fe2O3_pct	3332	3267	3.41	4.28	1.26	18.33	0.13	0.89	1.35	3.46	28.00
	Li2O_pct	3316	3242	0.24	0.43	1.78	0.19	0.01	0.04	0.12	0.26	4.55
	MnO_pct	3272	3173	0.10	0.08	0.85	0.01	0.00	0.03	0.07	0.15	1.01
	Na2O_pct	3332	3267	4.24	2.12	0.50	4.50	0.00	2.62	4.17	5.77	9.71
	P2O5_pct	3332	3267	0.15	0.14	0.95	0.02	0.00	0.09	0.12	0.17	4.53
	SiO2_pct	3272	3173	69.68	8.46	0.12	71.60	37.99	68.00	72.77	74.73	93.80
	SnO2_pct	3333	3266	0.04	0.05	1.28	0.00	0.00	0.01	0.02	0.04	0.85
	Ta2O5_pct	3339	3277	0.01	0.01	1.13	0.00	0.00	0.01	0.01	0.01	0.23

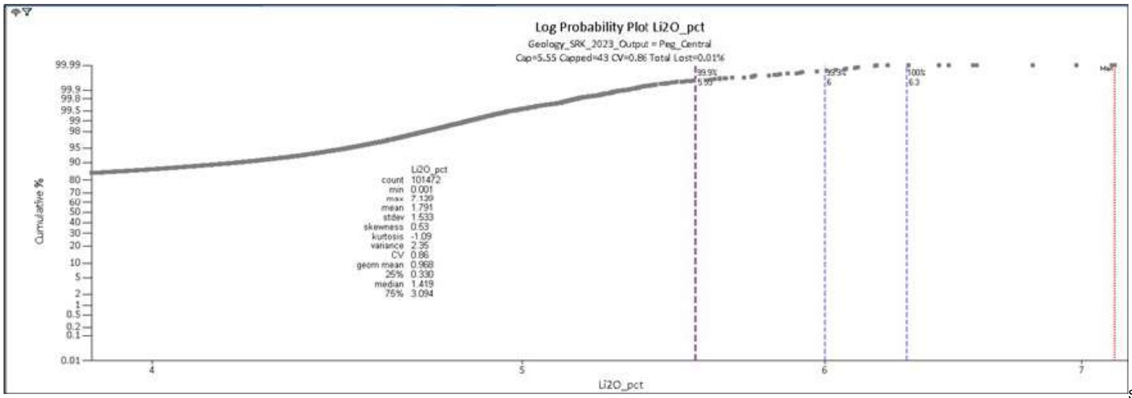
Source: SRK, 2023
Statistics are length-weighted and reported inside 0.5% Li_2O Kapanga pegmatite shape, and outside. Intervals may have been split for the purposes of statistical reporting across model domains.

11.3.1 Outliers Analyses

SRK assessed the drilling data for the presence and potential impact of high yield outlier data in the Central Lode and Kapanga models. Details of these procedures and assumptions by deposit model are outlined below.

Central Lode Outlier Analysis

SRK completed an outlier analysis for Central utilizing log probability plots and a matrix comparison of multiple potential upper caps to consider impacts on the coefficient of variation, mean, and total lost grade due to capping. High grade and low grade mineralization domains, within Central, were not evaluated independently. The log probability plot, as shown on Figure 11-8, show stable and consistently increasing populations of grade above the 90^{th} percentile, with breaks in the distribution occurring around 5.5% to 6.0% Li_2O for the high-grade domain population. To examine the potential impact of these outliers, SRK reviewed the grade populations at higher limits to determine if there were consistent groupings or clusters of higher-grade data which may warrant sub-domaining and noted that this was not the case. Increased Li_2O grades at or above these limits are sparse and scattered throughout the deposit (although generally isolated to the larger higher-grade core of the deposit). SRK reviewed outlier impact tables for each domain as well, reviewing the impacts to the overall variance and mean metrics, and noted material impacts to the Li_2O population at thresholds exceeding 6.0% Li_2O (Table 11-10). SRK selected an upper cap at 6.0% Li_2O for the high-grade population.



Source: SRK, 2023

Figure 11-8: Log Probability Plot – Li_2O% Central Lode High-Grade Domain

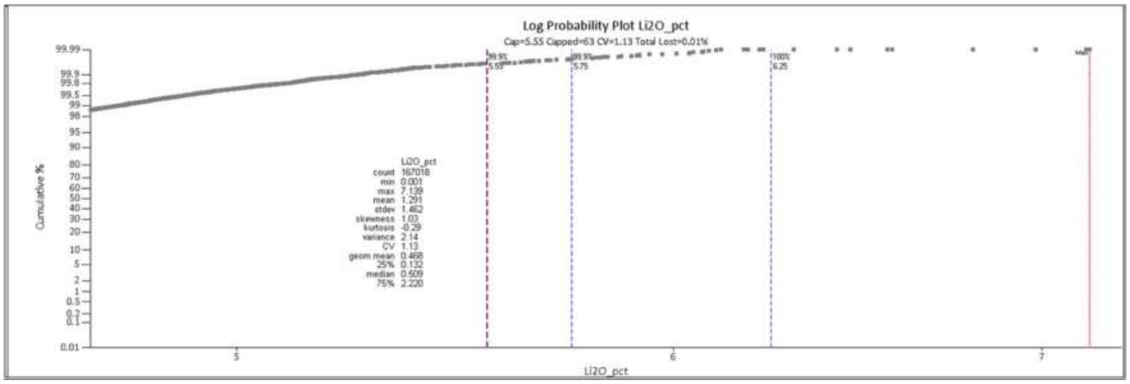
Table 11-10: Outlier Impact Evaluation – Central Lode

Column	Cap	Capped	Percentile	Capped%	Lost		Count	Min	Max	Mean	Total	Variance	CV
					Total%	CV%							
Li2O_pct	6.30	9	100%	0.01%	**0%**	0.01%	101472	0.001	6.3	1.791	181752	2.35	0.86
Li2O_pct	6.00	18	99.90%	0.02%	**0%**	0.01%	101472	0.001	6	1.791	181748	2.35	0.86
Li2O_pct	5.55	43	98%	0.04%	**0.01%**	0.02%	101472	0.001	5.55	1.791	181735	2.35	0.86

Source: SRK, 2023
Yellow highlight indicates selected 2023 capping level for domain.

Kapanga Outlier Analysis

SRK completed an outlier analysis for Kapanga utilizing log probability plots and a matrix comparison of multiple potential caps to consider impacts on the coefficient of variation, mean, and total lost grade due to capping. High grade and low grade mineralization domains, within Kapanga, were not evaluated independently. The log probability plots, as shown on Figure 11-9, show stable and consistently increasing populations of grade above the 90th percentile, with breaks in the distribution occurring around 5.5% to 5.75% Li_2O for the higher-grade population. To examine the potential impact of these outliers on the overall estimation, SRK reviewed the grade populations at higher limits to determine if there were consistent groupings or clusters of higher-grade data which may warrant sub-domaining and noted that this was not the case. Higher-grades at or above these limits are sparse and scattered throughout the deposit (although generally isolated to the larger higher-grade core of the deposit). SRK reviewed outlier impact tables for each domain as well, reviewing the impacts to the overall variance and mean metrics, and noted minimal impact to the Li_2O population statistics in either case (Table 11-11). SRK selected a cap at 5.75% Li_2O for the high-grade domain of the Kapanga deposit.



Source: SRK, 2023

Figure 11-9: Log Probability Plot – Li_2O% Kapanga Domain

Table 11-11: Outlier Impact Evaluation – Central Lode Low-Grade Domain

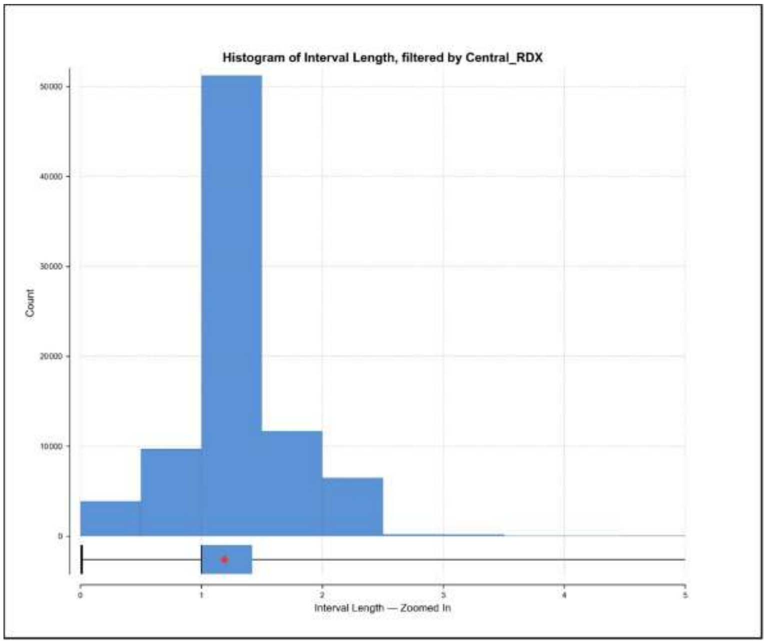
Column	Cap	Capped	Percentile	Capped%	Lost		Count	Min	Max	Mean	Total	Variance	CV
					Total%	CV%							
Li2O_pct							167018	0.001	7.139	1.291	215595	2.14	1.13
Li2O_pct	6.25	10	100%	0.01%	0%	0%	167018	0.001	6.25	1.291	215590	2.14	1.13
Li2O_pct	5.75	41	99.90%	0.02%	0.01%	0.02%	167018	0.001	5.75	1.291	215577	2.14	1.13
Li2O_pct	5.55	63	99.90%	0.04%	0.01%	0.02%	167018	0.001	5.55	1.291	215567	2.14	1.13

Source: SRK, 2023
Yellow highlight indicates selected 2023 capping level for domain.

11.3.2 Compositing

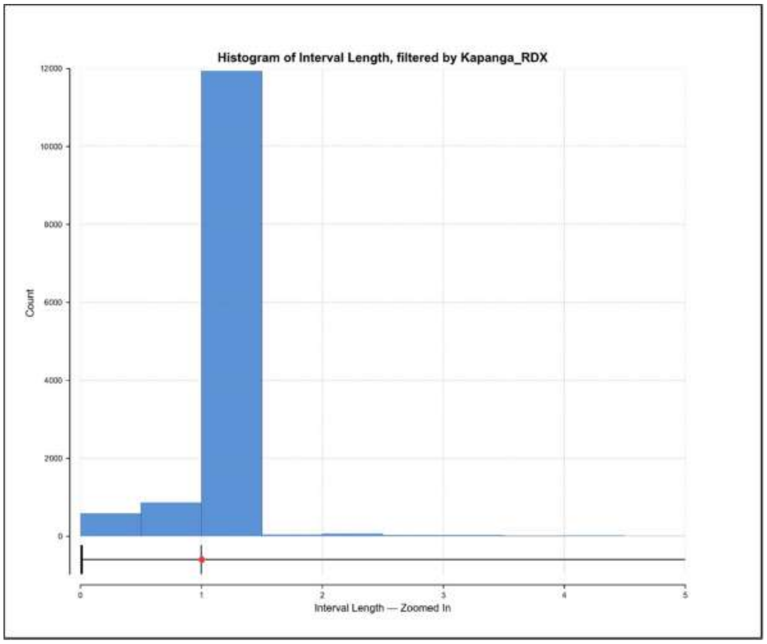
Drilled sample length (RDEX) within the pegmatites was considered for the purposes of understanding the variability of the sample size. Nominally, samples have been collected at 1.5 m intervals for the majority of exploration drilling at Central Lode (61%) and Kapanga (88%). Grade control drilling was not evaluated because it was not used in the mineral resource estimate. A comparatively smaller set of samples were collected at intervals between 2.5 m and 3 m, about 21% for Central Lode and 1% for Kapanga, with the remaining percentages of samples collected at lengths between or below these populations. An immaterial number of samples are collected at lengths longer than 3 m. The histogram distribution of sample lengths within the Central Lode and Kapanga deposits are shown on Figure 11-10 and Figure 11-11, respectively. In addition to the distribution of the sample lengths, SRK reviewed the overall relationship between the Li_2O grades and the sample length and noted no bias which would insinuate nominally higher-grades associated with sample lengths (Figure 11-12 and Figure 11-13).

In order to make the sample support consistent for the purposes of estimation, SRK elected to composite the drilling to a length of 3 m. A comparison of the distribution of Li_2O% in original samples vs. composited data is shown on Figure 11-14. In general, compositing results in a reduction of the overall sample population from 163,188 samples to 59,152 composites, with an incremental decrease in the CV from 1.02 to 0.99.



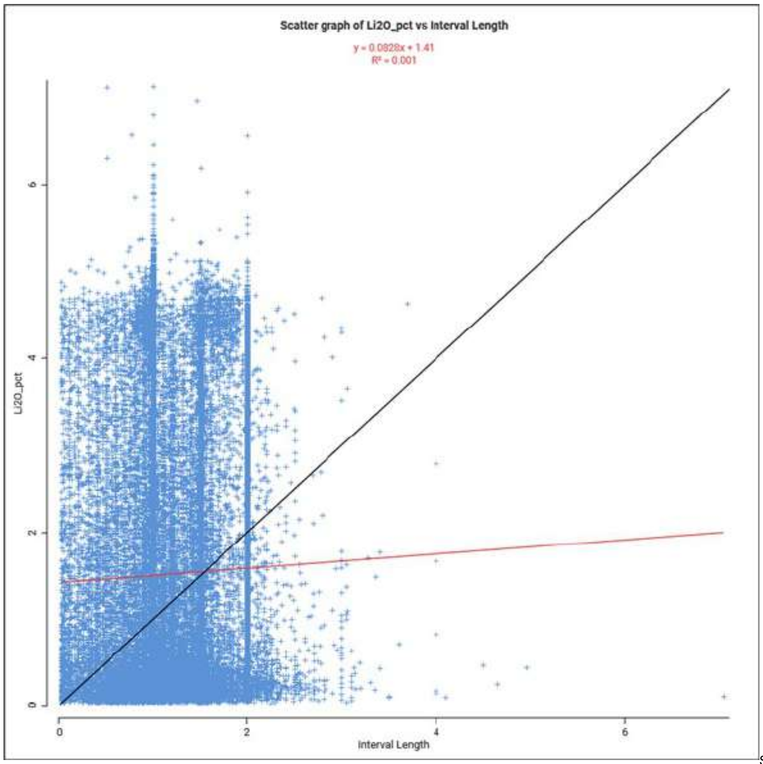
Source: SRK,2023

Figure 11-10: Histogram of Sample Length within Central Lode Pegmatite



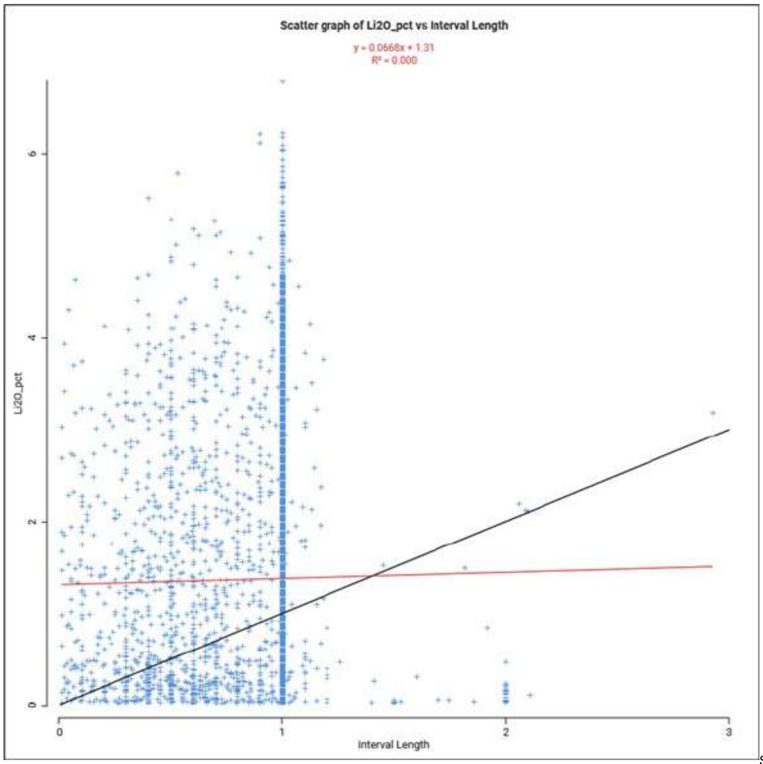
Source: SRK,2023

Figure 11-11: Histogram of Sample Length within Kapanga Pegmatite



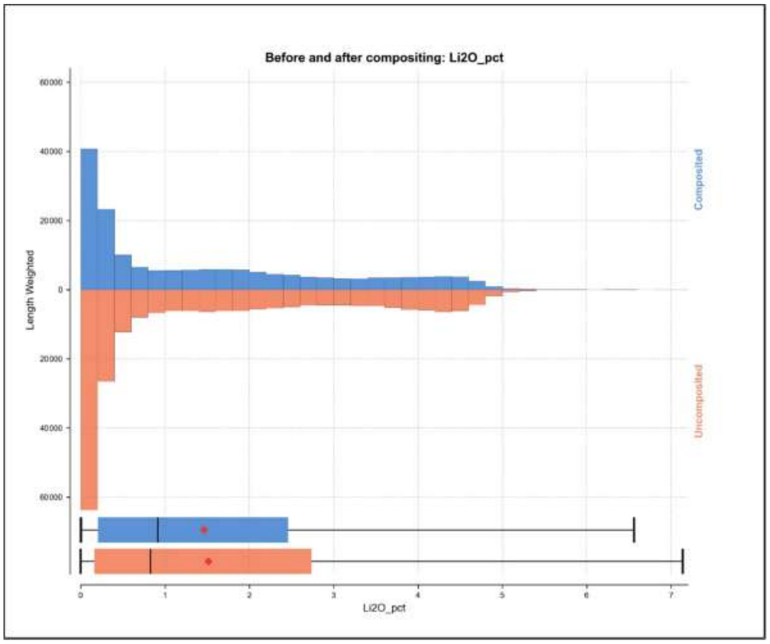
Source: SRK, 2023

Figure 11-12: Scatter Plot Li_2O% and Sample Length – Central Lode



Source: SRK, 2023

Figure 11-13: Scatter Plot Li_2O% and Sample Length – Kapanga



Source: SRK,2023

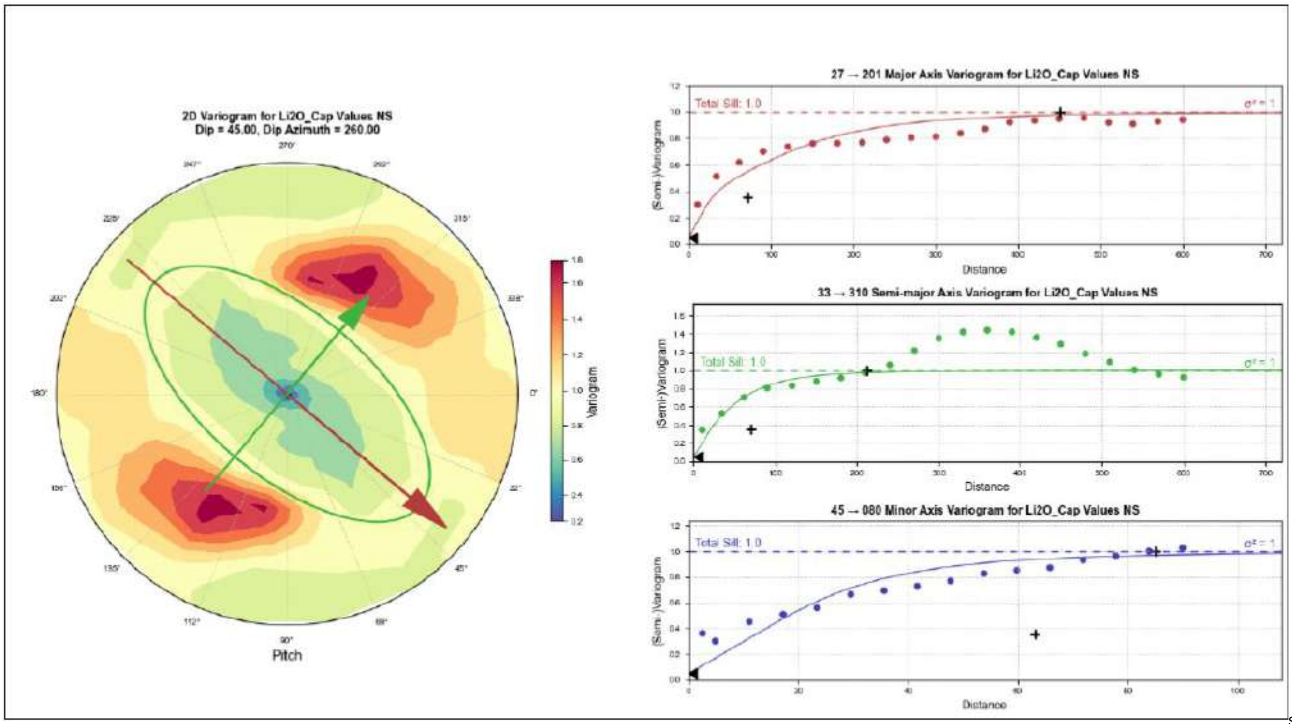
Figure 11-14: Compositing Comparisons – Li_2O% Grades in Central Lode and Kapanga Model

11.3.3 Spatial Continuity Analysis

SRK performed continuity analyses via variography to determine dominant direction and distances of grade relationships for utilization in estimation. A continuity analysis of the composited Li_2O grades within the separate resource domains was conducted on both deposits. Although other elements were estimated and utilized geostatistical estimators, only Li_2O is relevant for the long-term mineral resource reporting and will be described herein. Other elements which are estimated are utilized for internal conceptual materials typing and are not considered for resource reporting. Continuity analysis was calculated through the use of conventional semi-variogram calculations using normal scores transform of the input data and was generated in Leapfrog EDGE. Orientations were determined based on 3D visualization of the trends of mineralization along with variogram maps showing relative orientations of continuity. Variograms were back transformed from the normal scores for use in Leapfrog EDGE for estimation purposes.

Central Lode - Variography

The high-grade domain featured robust variography, with low nugget effects modeled using the down-hole variogram, and stable experimental variograms to ranges of 200 to 450 m in the semi-major and major directions, respectively. Given the relatively tabular nature of the pegmatite intrusion, the minor variogram range is considerably shorter, with a range of about 80 m. This defines an ellipsoid which is generally flattened and oriented along the strike and down dip of the overall pegmatite domain. Individual variograms for the high-grade domain are shown on Figure 11-15 shows individual variograms for the high-grade domain.

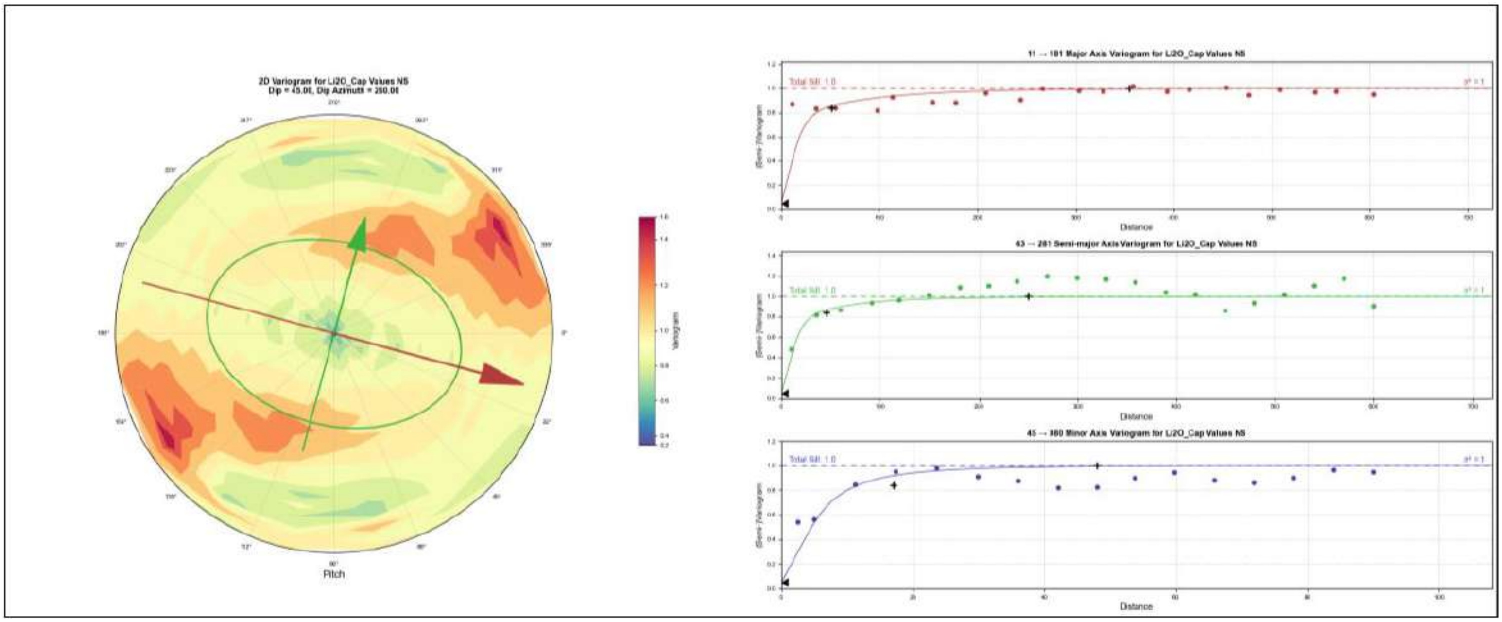


Source: SRK, 2023

Figure 11-15: High-Grade Central Lode Modeled Variograms – Li_2O%

Kapanga - Variography

The high-grade domain featured robust variography, with low nugget effects modeled using the down-hole variogram, and stable experimental variograms to ranges of 250 to 360 m in the semi-major and major directions, respectively. Given the relatively tabular nature of the pegmatite intrusion, the minor variogram range is considerably shorter, with a range of about 80 m; this defines an ellipsoid which is generally flattened and oriented along the strike and down dip of the overall pegmatite domain. Figure 11-16 shows individual variograms for the high-grade domain. Table 11-12 shows a summary of the variogram parameters for the Li_2O% for the Central Lode and Kapanga.



Source: SRK, 2023

Figure 11-16: High-Grade Kapanga Modeled Variograms – Li_2O%

Table 11-12: Li_2O Variogram Models – Central Lode and Kapanga

General					Structure 1										Structure 2									
Variogram Name	Model Space	Variance	Nugget	Normalized Nugget	Sill	Normalized Sill	Structure	Major	Semi-Major	Minor	Dip	Dip Azi.	Pitch	Sill	Normalized Sill	Structure	Major	Semi-Major	Minor	Dip	Dip Azi.	Pitch
Li2O_pct Central HG: Variogram Model	Data	1.68	0.08	0.05	0.36	0.21	Spheroidal	26.13	26.54	23.97	45.00	260.00	28.00	1.24	0.74	Spheroidal	318.30	219.90	111.80	45.00	260.00	28.00
Li2O_pct Central LG: Variogram Model	Data	0.24	0.01	0.05	0.12	0.48	Spherical	42.58	42.97	40.47	45.00	260.00	28.00	0.11	0.46	Spherical	329.30	224.90	57.83	45.00	260.00	28.00
Li2O_pct Kapanga HG: Variogram Model	Data	1.33	0.07	0.05	0.28	0.21	Spheroidal	26.13	26.54	23.97	45.00	260.00	28.00	0.98	0.74	Spheroidal	318.30	219.90	111.80	45.00	260.00	28.00
Li2O_pct Kapanga LG: Variogram Model	Data	0.18	0.01	0.05	0.09	0.48	Spherical	42.58	42.97	40.47	45.00	260.00	28.00	0.08	0.46	Spherical	329.30	224.90	57.83	45.00	260.00	28.00

Source: SRK, 2023

11.4 Mineral Resources Estimates

The geological model and block model used in the mineral resource estimate is based on the new drillhole data, the updated 2023 SRK Greenbushes property model (which combined the Central Lode and Kapanga deposits), updated variography, and refined estimation parameters. The key differences from the prior TRS are due to:

- The revision of the previous geological model with the revised SRK geological and mineralization models as defined in Sections 11.2.1 to 11.2.3.
- Volume and tonnage changes as a result of mining depletion completed to May 31, 2023, calendar year.

SRK notes that the geological model has been updated to reflect all the exploration completed on the Greenbushes property to a cut-off date of June 30, 2023, there was sufficient exploration which in conjunction with a review of the grade control and geological continuity shown in the 2022/23 drilling, resulted in the decision to update the model.

11.4.1 Quantitative Kriging Neighborhood Analysis

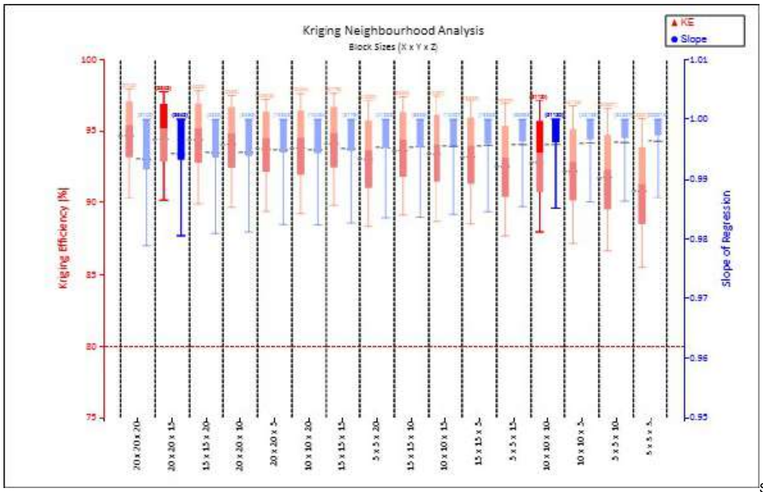
SRK completed an updated quantitative kriging neighborhood analysis (QKNA) review of the estimation parameters for use in the updated 2023 model. While QKNA is not the definitive measure of what parameters must be, it is a useful data point in gauging the potential sensitivity of the estimation to these parameters. In general, QKNA evaluates the impact of varying parameters, but bases the sensitivity on outputs to the kriging efficiency (KE) and slope of regression (SoR) averages for the estimate. KE and SoR are commonly referred to as measures of the relative quality of the estimate and are dependent on the input variogram.

SRK reviewed the results of previous QKNA analysis (completed by both SRK and Talison) and considered modifications were needed to the parameters for the 2023 model. SRK therefore updated the QKNA analysis focusing on the high-grade domain on the Central Lode. SRK evaluated the impacts to the KE and SoR for multiple scenarios evaluating block size, sample selection, and search range as shown in Figure 11-17, Figure 11-18, and Figure 11-19, respectively.

In general, SRK notes that the results of the QKNA suggests the highest average slope of regression occur in block sizes (of those tested) is less than 10 m x 10 m x 10 m, which in SRK's opinion is relatively small compared to the current drill spacing; however, SRK also notes any blocks between 10 to 15 m returned acceptable results in terms of the SoR. For block sizes less than 10 m x 10 m x 10 m the kriging efficiency was deemed to be dropping and therefore a modification from the 15 m x 15 m x 15 m blocks as used in the previous model was selected.

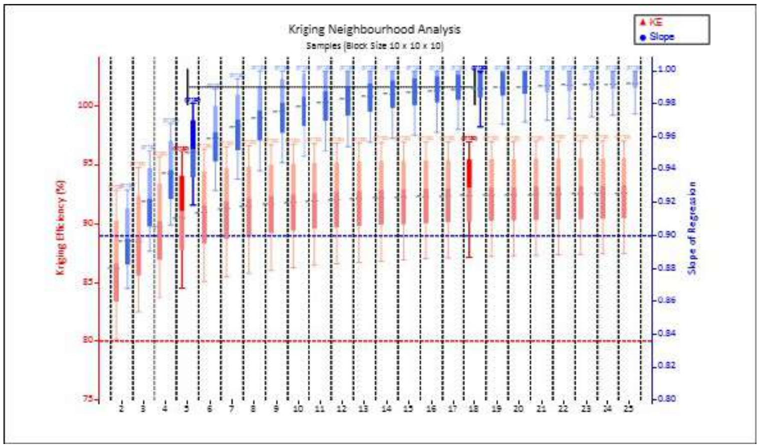
The next stage of the QKNA testwork focused on the minimum and maximum number of samples to be used in the estimate. It is the QP's opinion that sample selection criteria of between 5 and 20 samples provided the most reasonable range of analysis. The minimum of 5 samples represents the first point at which the SoR is above 0.95 on average, while sample selections above 18 provide no real gain in quality. SRK notes that above a maximum of 18 samples the sum of the negative weights could potentially fall below 0 which is considered less than optimal. In practice some of the domains returned negative weights during the estimation process and where this occurred SRK adjusted the maximum number of samples to 15 to reduce the impact. Additional consideration was placed on ensuring samples have been taken from multiple holes during the estimation process which is outside of the QKNA study. To ensure sufficient samples/composites are used to reflect the block size a maximum of three samples per hole have been selected which equals 9 m total composite length vs. 10 m block size. The difference between the composites and block size is not considered material in the QP's opinion and that the estimates will be representative, with block estimates occurring using a minimum of two holes and potentially 16 holes, but on average using between 2 to 8 holes upon review. This distribution of multiple holes and the use of quadrants ensures composites from different directions are being taken to avoid potential bias from data in any given orientation.

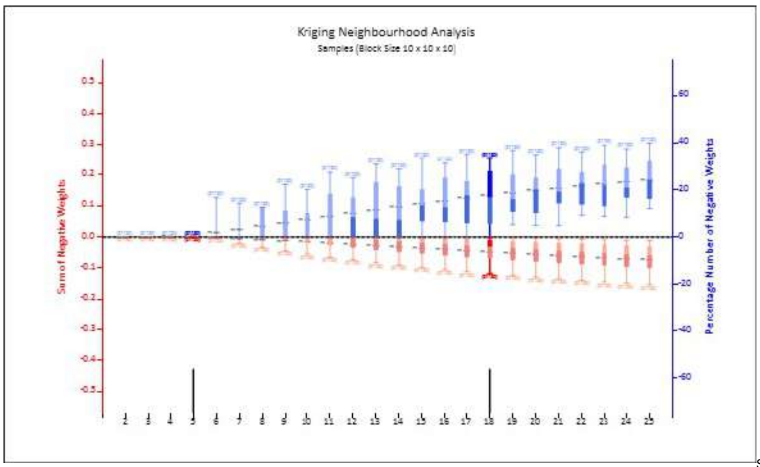
Review of the search ranges indicated effectively a negligible impact to estimation quality based on the search ranges tested. Search ranges considered were done in defined increments in line with the 2022 parameters around a base case. SRK elected to use similar search ranges than the selected ranges from 2022.



Source: SRK,2023

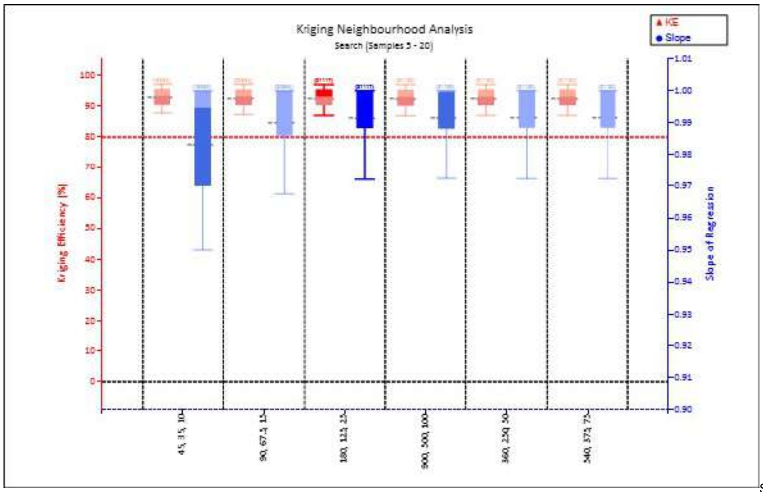
Figure 11-17: QKNA Block Size Sensitivity – Central Lode (High-Grade domain)





Source: SRK,2023

Figure 11-18: QKNA Sample Selection Sensitivity – Central Lode (High-Grade Domain)



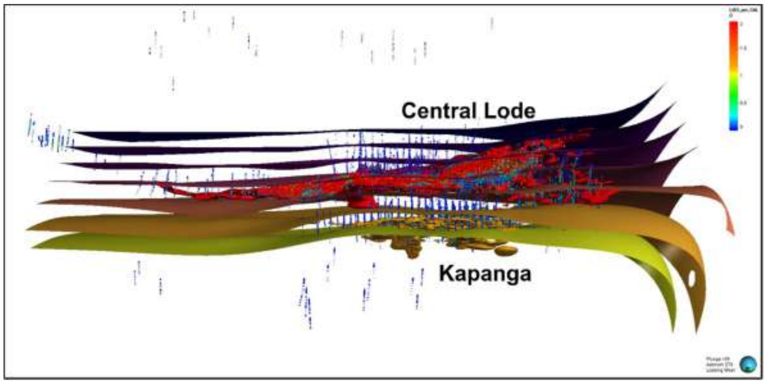
Source: SRK,2023

Figure 11-19: QKNA Search Range Sensitivity

11.4.2 Central Lode Variable Orientation Modeling

Despite the need to calculate and model continuity analysis using variography on the domain scale, which are oriented in a specific direction (strike, dip, and plunge), it has been noted from previous mining at Central Lode and geologic modeling of Central Lode and Kapanga that the pegmatite anastomoses and changes orientation at small scales. It is SRK's opinion that where possible this should be integrated into the current model.

To incorporate this geological variance into the estimation with the aim of producing more representative local estimates, SRK incorporated a number of geological features from the 3D model into a variable orientation model. This effectively calculates an orientation to be used for estimation searches from the input wireframes and variogram models. Wireframes in this case are based on the interpolated structural data for overall pegmatite trends and the variogram models are used to set the plunge of mineralization, as shown in Figure 11-20. Outputs from this process are individual search orientations for each block based on the relative proximity of the block itself to the surfaces. Blocks which are external to the modeled surfaces take on the overall variogram orientation from continuity analysis. The search ellipse is also re-oriented for blocks based on the variable orientation model.



Source: SRK, 2023

Figure 11-20: Structural Planes Utilized for Variable Orientation Modeling

11.4.3 Block Models

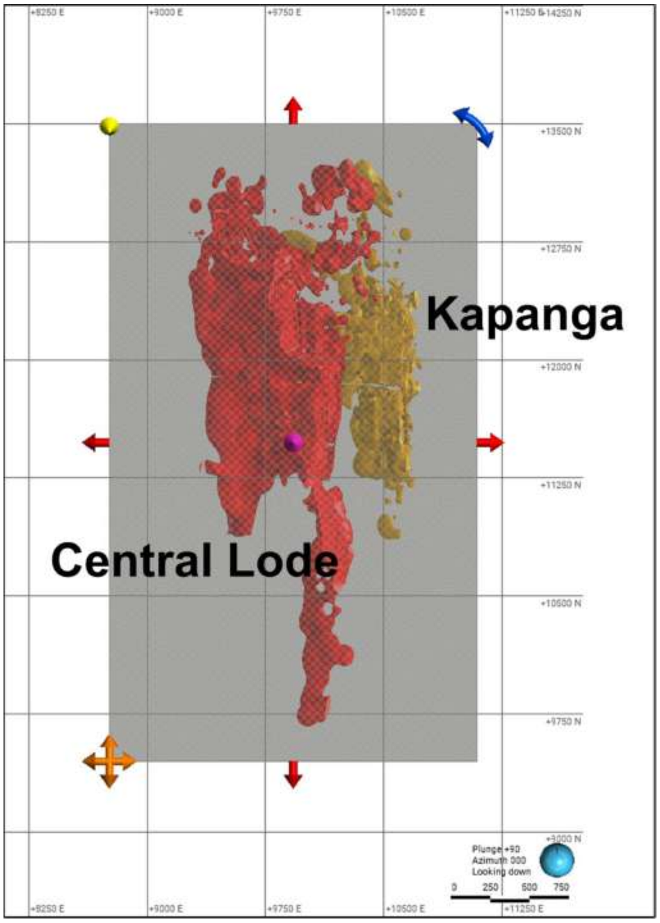
The geological and resource block model was generated in Leapfrog Geo software. The final model combines both deposits and covers the extent of the known mineralization on the Greenbushes property. The model is sub-blocked, with parent blocks at a 10 m x 10 m x 10 m block divided into a minimum sub-block size of 2.5 m^3 along geological or topographic (pit) boundaries. A summary of the final parameters are shown in Table 11-13 and the block model extents are shown in Figure 11-21.

Table 11-13: Kapanga Block Model Parameters

Parameter	Value
Model origin	East: 8,760. North: 9,450. Elevation: 1,360 m.
Model extents	East: 2,330 m. North: 4,050 m. Elevation: 830 m.
Parent cell size	East: 10 m. North: 10 m. Elevation: 10 m.
Sub-celling	East: 2.5 m. North: 2.5 m. Elevation: 2.5 m.
Rotation	None. Orthogonal to the MGA94 UTM – WGS Zone 50 grid.

Source: SRK, 2023

The Greenbushes property-scale model is considered appropriate for use in mine planning and calculation of Mineral Resources. SRK recommends Talison maintains a geologically continuous, property scale model including lithology, oxidation, and mineralization at the Greenbushes property to standardize the procedures, process, and parameters for the Central Lode and Kapanga deposits.



Source: SRK, 2023

Figure 11-21: Block Model Extents in Plan View

11.4.4 Grade Interpolation

Central Lode Block Estimation

Grades were interpolated from the composited Central Lode drilling data for Li_2O using Leapfrog EDGE software. A nested two-pass estimation was utilized to ensure an optimized search neighborhood was applied with a second pass providing lower-confidence grade estimates in areas poorly informed by drilling. Ordinary kriging (OK) was utilized for interpolation of grade Li_2O%, which is considered the only element of economic interest for the purpose of reporting. Other key elements have been estimated for internal use (such as Fe_2O_3 %, which can be used for tracking potential dilution or flag areas for potential lower recoveries during mine planning). These elements are not considered to be economic and are therefore not included in the mineral resource statement.

Estimation parameters are based on overall Li_2O variogram ranges within the high-grade domain, with ranges in the first pass being approximately 50% of the total range (80% of the total variance) and the second pass being the full range of the variogram at 100% variance. Other estimation parameters were selected based on initial assessments from the QKNA results and were refined based on model validation. Summary neighborhood parameters are presented in Table 11-14.

Orientations for searches are variable using the variable orientation modeling parameters as noted in Section 11.4.2. Outliers are addressed using a combination of capping (Section 11.3.1) and limiting the estimation influence through the use of the “clamping” modifier in EDGE. This limits the extent to which an outlier grade is utilized over a smaller range than the actual search (defined as a percentage of the ellipsoid ranges). SRK utilized a 5.5% Li_2O and 3.3% Li_2O threshold for the HG and LG domains, respectively over 5% of the search distance for each pass. SRK also utilized sector limitations (quadrants) for the first pass of estimation to ensure that data was pulled from multiple locations rather than clustered from groups of closely spaced data. To further ensure this, a restriction of a maximum of three samples per hole was utilized. This, combined with the five-sample minimum for the first pass, resulted in the first estimation pass using no fewer than two drillholes. The second estimation pass significantly reduces the overall restrictions by expanding the search, reducing the overall minimum of samples, and eliminating the sector requirements.

Table 11-14: Central Lode Li_2O Estimation Parameters

General			Ellipsoid Ranges (m)			Variable Orientation	Number of Samples		Outlier Restrictions			Sector Search			Drillhole Limit
Interpolant Name	**Domain**	**Numeric Values**	**Maximum**	**Intermediate**	**Minimum**		**Minimum**	**Maximum**	**Method**	**Distance as % of Range**	**Threshold**	**Method**	**Max Samples**	**Max Empty Sectors**	**Max Samples per Hole**
Kr, Li2O_pct HG P1 Central RDX	RESDOMs_SRK_2023: Central_HG	Li2O_Cap	180	150	25	VO_Li_PEG	5	18	Clamp	5.0	5.5	Quadrant	5	1	3
Kr, Li2O_pct HG P2 Central RDX	RESDOMs_SRK_2023: Central_HG	Li2O_Cap	360	250	50	VO_Li_PEG	1	15	Clamp	2.5	5.5	None			3
Kr, Li2O_pct LG P1 Central RDX	RESDOMs_SRK_2023: Central_LG	Li2O_Cap	180	125	25	VO_Li_PEG	5	18	Clamp	5.0	3.0	Quadrant	5	1	3
Kr, Li2O_pct LG P2 Central RDX	RESDOMs_SRK_2023: Central_LG	Li2O_Cap	360	250	50	VO_Li_PEG	1	15	Clamp	2.5	3.0	None			3

Source: SRK, 2023

Kapanga Block Estimation

Grades were interpolated from the composited Kapanga drilling data for Li_2O using Leapfrog EDGE. A nested two-pass estimation was designed to accomplish estimation in a first pass from more sampling, at higher data densities, with more restrictions on estimation methodology in the initial passes. Ordinary kriging (OK) was utilized for interpolation of grade. Estimation parameters are based on overall Li_2O variogram ranges within the high-grade domain, with ranges in the first pass being approximately 60% of the total range (80% of the total variance) and the second pass being the full range of the variogram at 100% variance. Other estimation parameters were selected based on initial assessments from the QKNA results and were refined based on model validation. Summary neighborhood parameters are presented in Table 11-16.

Orientations for searches are variable using the variable orientation modeling parameters as noted in Section 11.4.2. Outliers are addressed through the use of the "clamping" modifier in EDGE. This limits the extent to which an outlier grade is utilized over a smaller range than the actual search (defined as a percentage of the ellipsoid ranges). SRK utilized a 5.5% Li_2O and 3.0% Li_2O threshold over 5% of the search distance for each pass. SRK also utilized sector limitations (quadrants) for the first pass of estimation to ensure that data was pulled from multiple locations rather than clustered from groups of closely spaced data. To further ensure this, a restriction of a maximum of three samples per hole was utilized. This, combined with the five-sample minimum for the first pass, resulted in the first estimation pass using no fewer than two drillholes. The second estimation pass significantly reduces the overall restrictions by expanding the search, reducing the overall minimum of samples, and eliminating the sector requirements.

Bulk Density

The bulk density determination remains unchanged and valid from previous resource block models. It is SRK's opinion that bulk density is appropriate for the calculation and reporting of mineral resource tonnages.

The following provides a summary to support the specific gravity (SG) values used. A total of 2,074 samples collected from pegmatite, amphibolite, granofels, and dolerite rock types. Descriptive statistics for the SG from these rock types is shown in Table 11-15. To assign bulk density into the Central Lode and Kapanga block models, mean SG was coded into the waste rocks based on the data provided. Alluvial and fill material were assigned a nominal density of 1.8 g/cm^3 and 1.5 g/cm^3 based on reasonable average densities for these unconsolidated material types. For the pegmatite, SRK utilized the Talison-derived regression analysis of the Li_2O content to accurately calculate bulk density. This is developed from the pegmatite SG sampling and the extensive production history of the mine. The calculation of density for pegmatite is shown below:

Bulk Density (Pegmatite) = 0.071 * (Li_2O grade in percent) + 2.59

Bulk densities were assigned to the block model based on the values in Table 11-15. SRK considers the assignment of mean densities of the waste rocks reasonable, and the determination of the regression analysis for the Li_2O - SG relationship satisfactory given its reliable use in production tracking and reporting as stated by Talison. All bulk densities are assumed to relate equally to SG for this study, with assumption of negligible moisture content in the hard rock at the time of blasting and mining.

SRK would consider continued tracking of density values and review on an annual basis to be best practice.

Table 11-15: Specific Gravity Data by Rock Type – Bulk Density Assignment

	Model Bulk Density (g/cm^3)	Count	Length	Mean SG	Standard Deviation	Coefficient of Variation	Variance	Minimum	Maximum
Rock Type		2074	1,819.44	2.81	0.17	0.06	0.03	1.59	3.98
A	3.03	254	206.97	3.03	0.13	0.04	0.02	2.38	3.98
D	2.98	198	149.31	2.98	0.15	0.05	0.02	2.53	3.71
G	2.93	91	73.32	2.93	0.17	0.06	0.03	2.60	3.17
P	Variable	1528	1,387.20	2.76	0.14	0.05	0.02	1.59	3.79
Alluvial	1.8	NA							
Fill	1.5	NA							

Source: SRK, 2020

Stockpile inventory is based on the surveyed volume multiplied by stockpile bulk density. Mass calculations are based on crusher weightometer throughput (tonnes), truck count movements, and the distribution of oversize which is allocated an average bulk density of 1.8 g/cm^3. SRK notes all stockpiles are utilized in the Mineral Reserve statement.

Table 11-16: Central Lode Li_2O Estimation Parameters

General			Ellipsoid Ranges (m)			Variable Orientation	Number of Samples		Outlier Restrictions			Sector Search			Drillhole Limit
Interpolant Name	Domain	Numeric Values	Maximum	Intermediate	Minimum		Minimum	Maximum	Method	Distance	Threshold	Method	Max Samples	Max Empty Sectors	Max Samples per Hole
Kr, Li2O_pct HG P1 Kapanga RDX	RESDOMs_SRK_2023: Kapanga_HG	Li2O_Cap	180	150	25	VO_Li_PEG	5	15	Clamp	5.0	5.75	Quadrant	5	1	2
Kr, Li2O_pct HG P2 Kapanga RDX	RESDOMs_SRK_2023: Kapanga_HG	Li2O_Cap	360	250	50	VO_Li_PEG	1	15	Clamp	2.5	5.75	None			2
Kr, Li2O_pct LG P1 Kapanga RDX	RESDOMs_SRK_2023: Kapanga_LG	Li2O_Cap	180	125	25	VO_Li_PEG	5	15	Clamp	5.0	3.00	Quadrant	5	1	2
Kr, Li2O_pct LG P2 Kapanga RDX	RESDOMs_SRK_2023: Kapanga_LG	Li2O_Cap	360	250	50	VO_Li_PEG	1	15	Clamp	2.5	3.00	None			2

Source: SRK, 2023

11.4.5 Block Model Validation

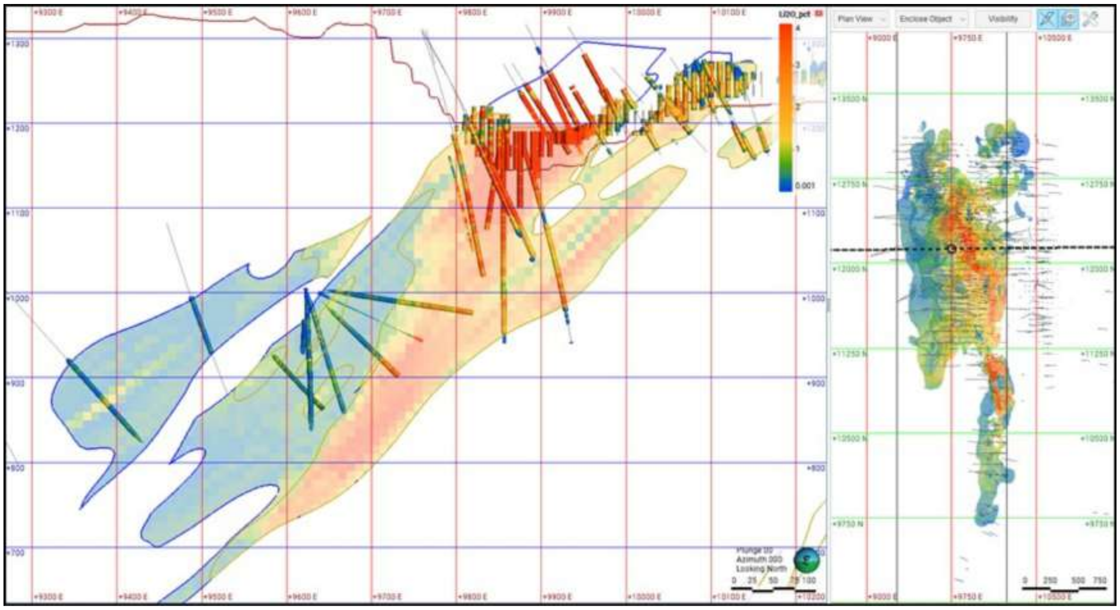
The interpolation of grade was validated in each of the Central Lode and Kapanga areas through a series of checks on the visual and statistical distribution of grades compared to the input composite data. Visual grade distribution on section and level plans was reviewed carefully across the entire estimate in plan and cross-section to ensure that estimated block grades compared well to composite data and that the geological trends were being honored.

Central Lode Block Model Validation

The Central Lode model was validated using a combination of visual, statistical, and comparative analysis to production data (grade control drilling). Examples of the visual validation are shown in Figure 11-22 and Figure 11-23. The visual validation supports the grade distribution with highs and lows reflected from the drilling into the block values. It is the QP's opinion that the orientation of the grade distribution is represented in the block estimates within the main body of the mineralization. It was noted that in areas of wider-spaced sampling, the grade trend appears shallower in terms of dip, but these areas are typically only supported by a single drillhole and therefore are classified as lower confidence (Inferred).

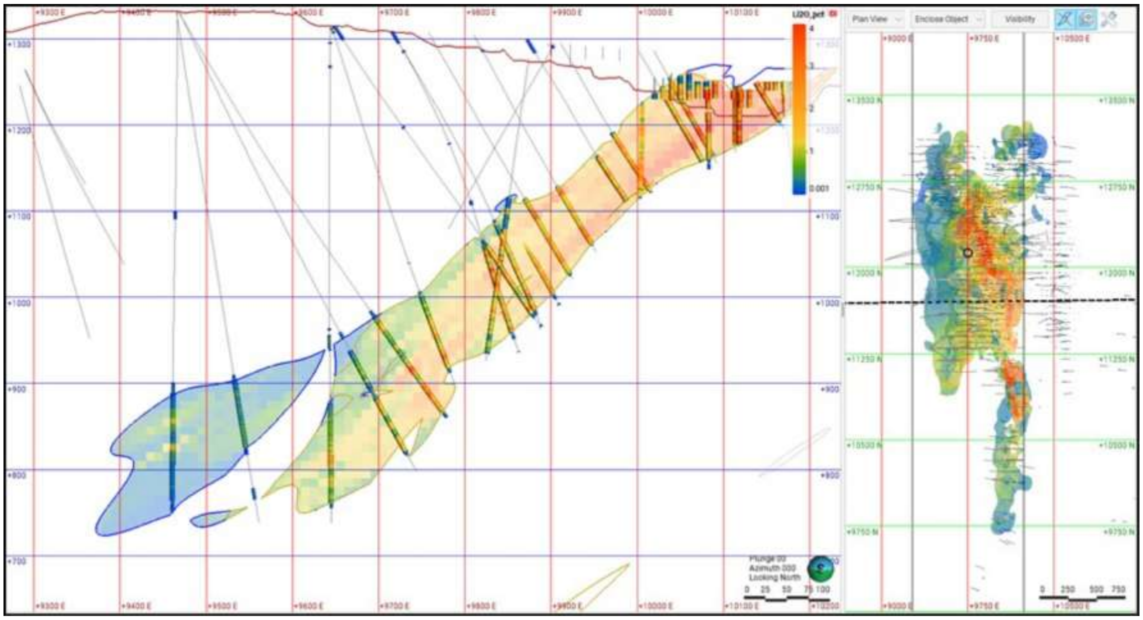
Statistical comparison of the individual domain estimates was completed to compare the estimates to the input composite data, and nearest neighbor (NN) estimates, defined using 10-m composites to reflect the block size, and the same search orientations and ranges as used for the grade estimation. It is the QP's opinion that the results of the validation display satisfactory agreement globally (Table 11-17 and Table 11-18).

To evaluate a localized statistical comparison, SRK produced swath plots. These plots evaluate the means of blocks and composite grades along swaths or slices through the model oriented along the northing, easting, and elevation axes. In general, these plots show excellent local agreement of the composites and block grades along slices, an example is shown in Figure 11-24 (a, b, and c). These plots were created for each axis in each domain.



Source: SRK, 2023

Figure 11-22: Visual Comparison of Li_2O Distribution – Central Lode – Section 12130 N



Source: SRK, 2023

Figure 11-23: Visual Comparison of Li_2O Distribution – Central Lode – Section 11700 N

Table 11-17: Statistical Comparison Li_2O% – Central Lode High-grade Domain

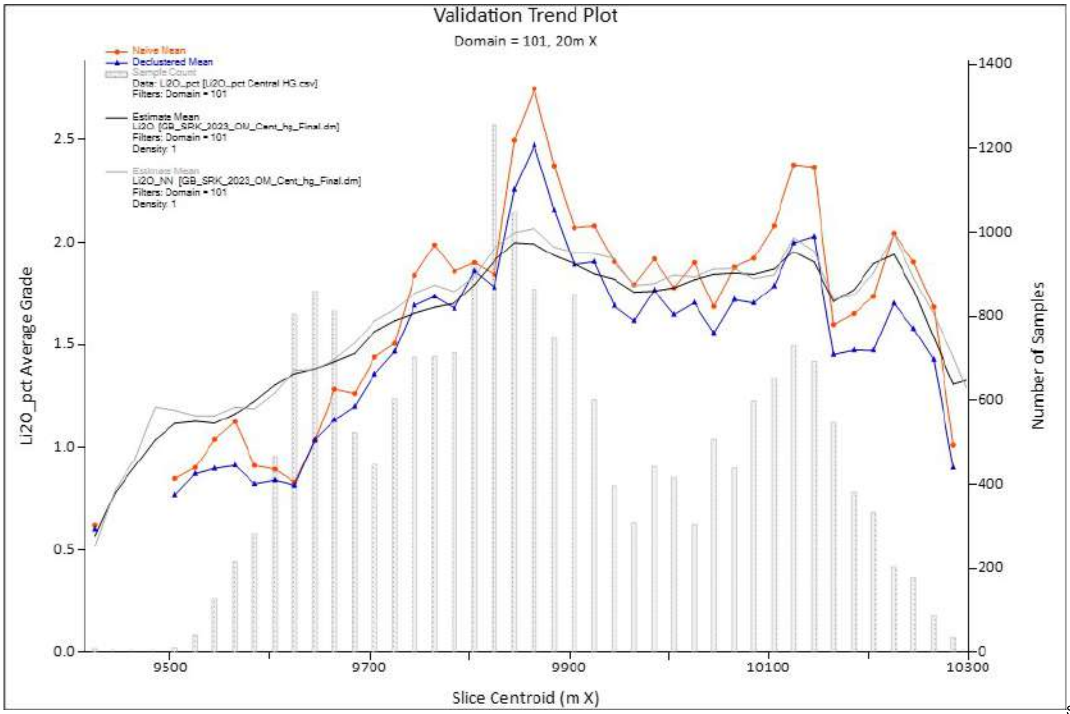
Statistic	Composites Li_2O %	De-clustered Li_2O% (25x25x25)	Estimate Li_2O %	NN Li_2O %	% Diff NN vs. Estimate
Points	20,894	20,894	820,747	820,747	
Mean	1.81	1.64	1.66	1.71	-2.5%
Std Dev	1.30	1.29	0.81	1.01	
CV	0.72	0.78	0.48	0.59	
Maximum	6.00	6.00	4.91	5.08	
75%	2.73	2.49	2.07	2.29	
50%	1.59	1.39	1.50	1.55	
25%	0.66	0.49	1.08	0.92	
Minimum	0.01	0.01	0.03	0.03	

Source: SRK, 2023

Table 11-18: Statistical Comparison Li_2O% – Central Lode Low Grade Domain

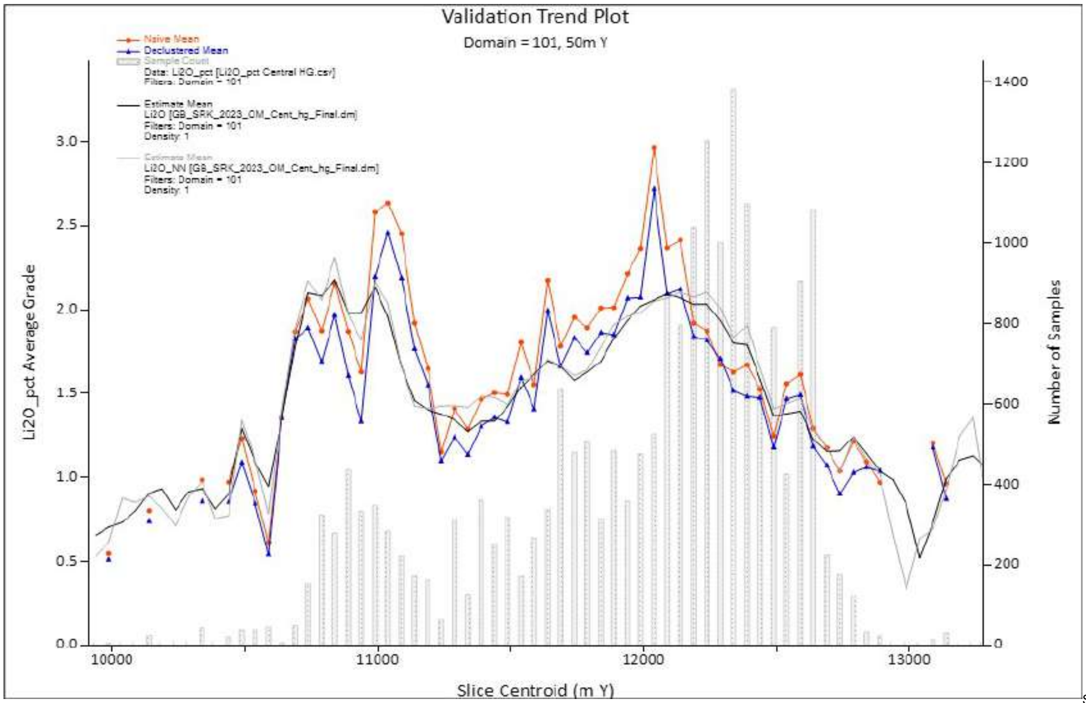
Statistic	Composites Li_2O %	De-clustered Li_2O% (25x25x25)	Estimate Li_2O %	NN Li_2O %	% Diff NN vs. Estimate
Points	12,549	12,549	699,550	699,550	
Mean	0.42	0.45	0.35	0.34	0.5%
Std Dev	0.49	0.56	0.19	0.30	
CV	1.17	1.24	0.56	0.86	
Maximum	4.64	4.64	2.91	4.20	
75%	0.45	0.48	0.42	0.41	
50%	0.26	0.26	0.30	0.27	
25%	0.16	0.15	0.22	0.16	
Minimum	0.01	0.01	0.00	0.02	

Source: SRK, 2023



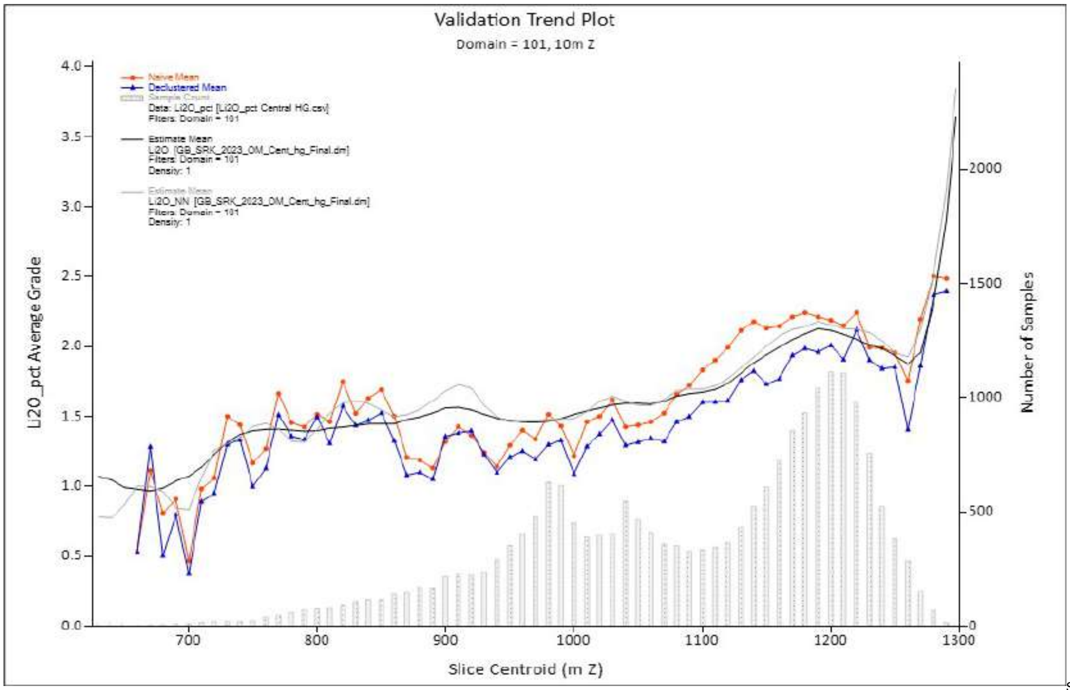
Source: SRK, 2023

Figure 11-24a: Swath Plot – Li_2O% – Central Lode High-Grade Domain



Source: SRK, 2023

Figure 11-24b: Swath Plot – Li_2O% – Central Lode High-Grade Domain



Source: SRK, 2023

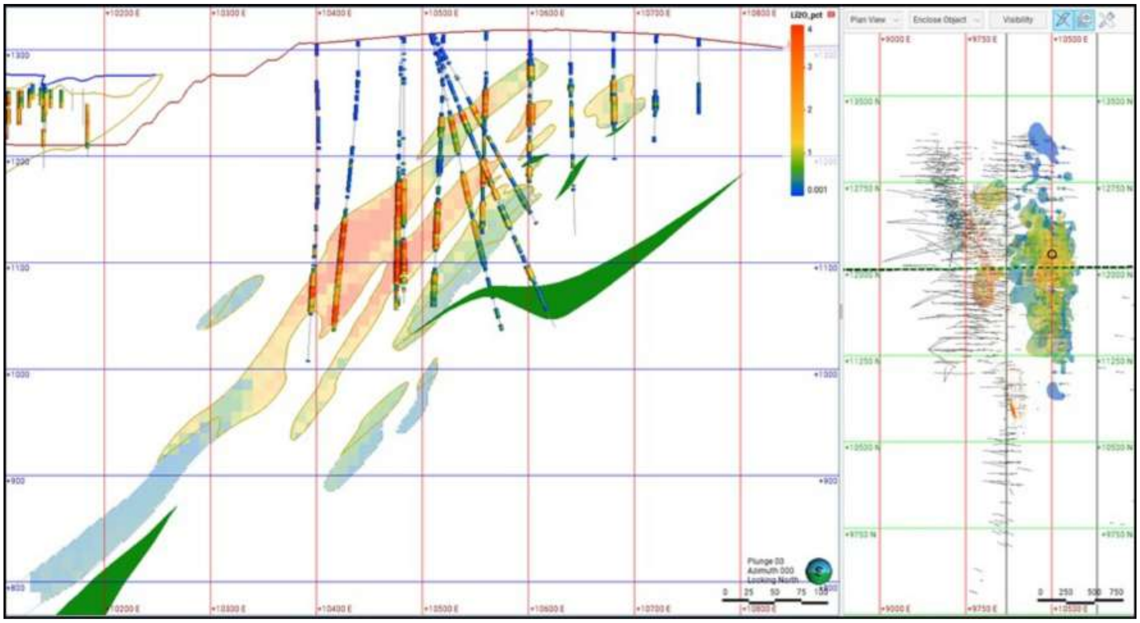
Figure 11-24c: Swath Plot – Li_2O% – Central Lode High-Grade Domain

Kapanga Block Model Validation

The estimated Kapanga block model was validated using the same process as the Central Lode, through a combination of visual and statistical comparisons with composited data and swath analysis. As no development has occurred at this deposit, production data is not available for validation purposes.

Interpolated block grades were visually compared to the drillhole composite grades to ensure that the cell grade estimates appeared consistent with the drillhole data. Satisfactory correlation between the estimated block grades and the composite grades was observed. SRK notes that at Kapanga the drill spacing at depth remains relatively wide and therefore individual composites in areas of low sample volumes tend to have larger influence over the grade estimates. This has been reflected in the confidence in the grade estimates during the classification process by limiting the classification to inferred in areas of low sample volume. Infill drilling during 2023 focused on Kapanga returned lower grades than previously estimated in the 2022 models, especially to the northern end of the deposit.

Overall, it is the QP's opinion that the estimates versus the composites display no significant issues, with the local grade characteristics in the sample data being adequately reproduced in the model. Example section plots showing the sample grades superimposed on the estimated block grades are presented in Figure 11-25.



Source: SRK, 2023

Figure 11-25: Visual Comparison of Li_2O Distribution – Kapanga Deposit – Section 12000 N

As completed on the Central Lode, SRK undertook a statistical comparisons of the raw, de-clustered mean, and NN estimate to the OK estimated block grades. A de-clustered mean is a weighted mean used on spatial data where the raw mean calculated by applying weights using a moving window method to account for areas with anomalously high or low values for a given variable are sampled disproportionately to the average grade sampling for other areas in a given site, there will likely be a biased difference in the true distribution for that variable. This mean has been determined using Snowden Supervisor and optimizing the size of the moving window until a stable mean is found which in the case of Greenbushes was in the order of 25 x 25 x 25 m.

The summary comparison indicates the correlation between the estimated block and sample grades demonstrate wider variance than those noted on the Central Lode. Some differences are expected because the sample data spacings are not uniform in the domains. Overall, SRK considers these differences to be within acceptable levels of tolerance but notes that further drilling will be required to improve the quality and confidence of the estimated grades. The composite and block grade comparison for Li_2O is presented in Table 11-19 for the high-grade and Table 11-20 for the low-grade domain. SRK highlights that the differences noted within the low-grade domain are outside the variance typically expected, but it is not considered to be material to the current estimates based on the relatively low tonnage for the low-grade domain and the comparison to the composite and de-clustered means.

Table 11-19: Statistical Validation - Kapanga Composites to Block Grades – High-Grade

Statistic	Composites Li_2O %	De-clustered Li_2O% (25x25x25)	Estimate Li_2O %	NN Li_2O %	% Diff NN vs. Estimate
Points	4,785	4,785	443,866	443,866	
Mean	1.29	1.08	1.30	1.39	-5.9%
Std Dev	1.15	1.09	0.86	1.09	
CV	0.90	1.02	0.66	0.78	
Maximum	5.94	5.94	4.39	4.30	
75%	2.01	1.73	1.62	2.17	
50%	0.95	0.56	1.08	1.17	
25%	0.28	0.21	0.70	0.41	
Minimum	0.02	0.02	0.09	0.03	

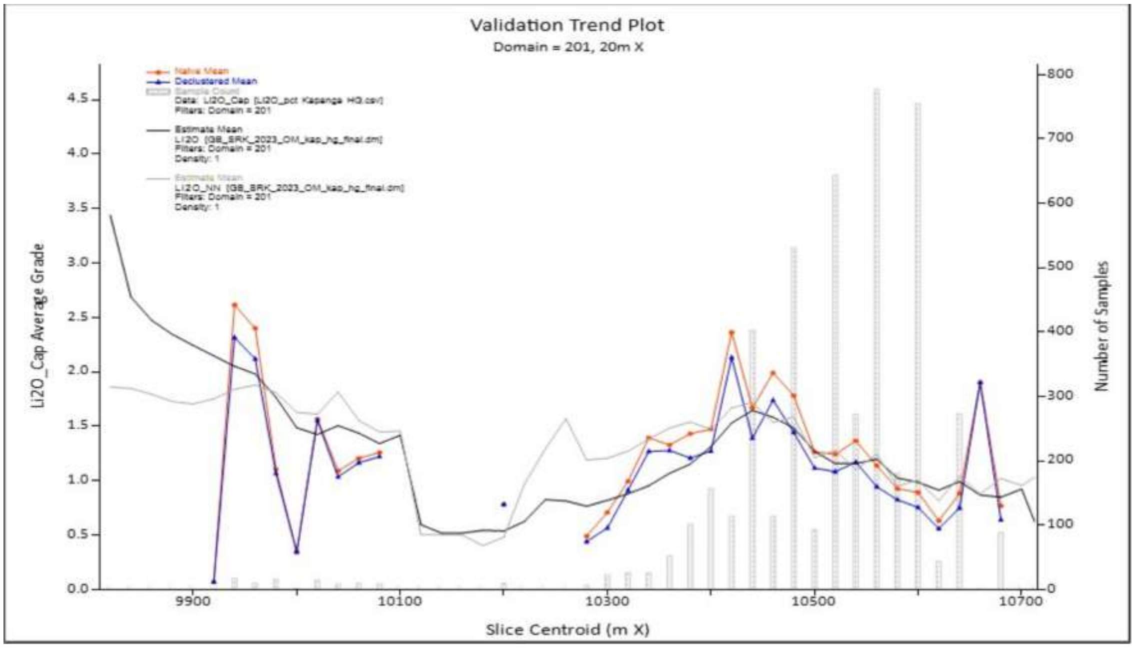
Source: SRK, 2023

Table 11-20: Statistical Validation - Kapanga Composites to Block Grades – Low-Grade

Statistic	Composites Li_2O %	De-clustered Li_2O% (25x25x25)	Estimate Li_2O %	NN Li_2O %	% Diff NN vs. Estimate
Points	1,935	1,935	274,810	274,810	
Mean	0.29	0.30	0.30	0.24	22.1%
Std Dev	0.42	0.43	0.19	0.22	
CV	1.43	1.44	0.63	0.92	
Maximum	4.10	4.10	2.40	2.68	
75%	0.32	0.31	0.37	0.32	
50%	0.16	0.16	0.27	0.17	
25%	0.08	0.09	0.17	0.10	
Minimum	0.01	0.01	0.02	0.01	

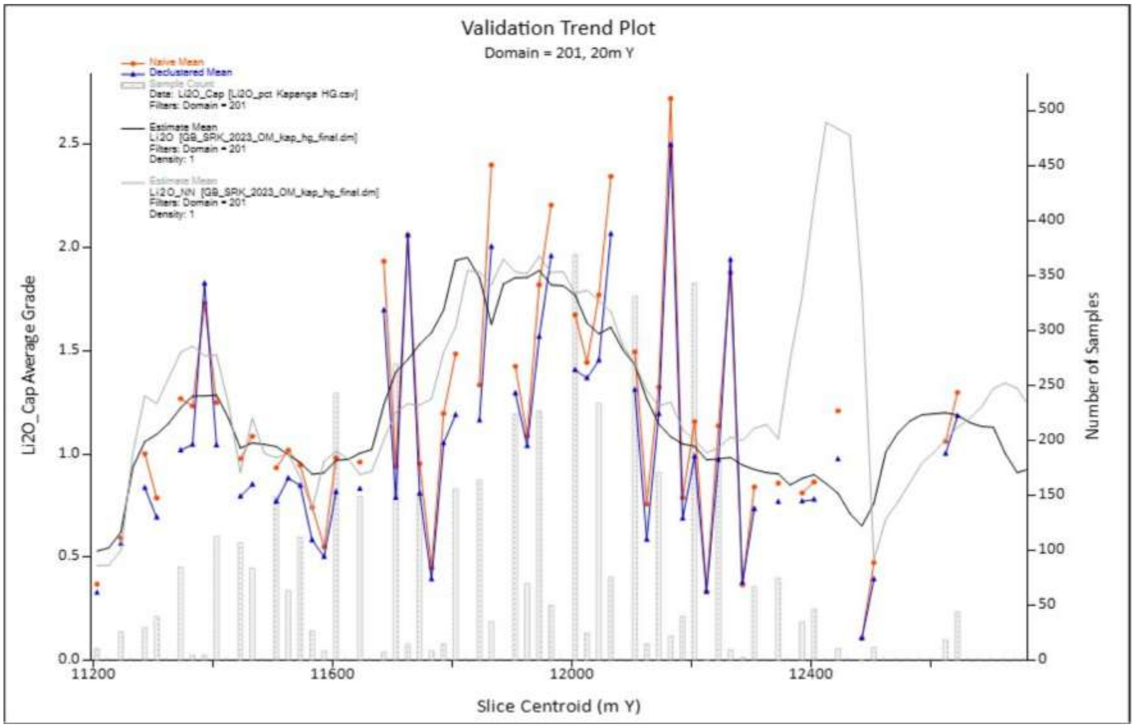
Source: SRK, 2023

Easting, northing, and elevation swath plots were calculated to compare the average grades for the composites (red line), nearest neighbor (grey line) and the OK estimates (black line). In general, satisfactory correlation is observed, with the grade trends evident in the composite data adequately reproduced in the block model. The NN estimates (grey line) are also shown on the Li_2O plots to display areas of apparent biases in the model on the western edges (x-plot), or in the central portion of the deposit (y-plot). These variations typically occur in areas of lower sample volume or in areas within high-variability of grades observed in the composites(red-line). The swath plots for Li_2O for the high- and low-grade domains are presented in Figure 11-26 (a, b, and c) and Figure 11-27 (a, b, and c).



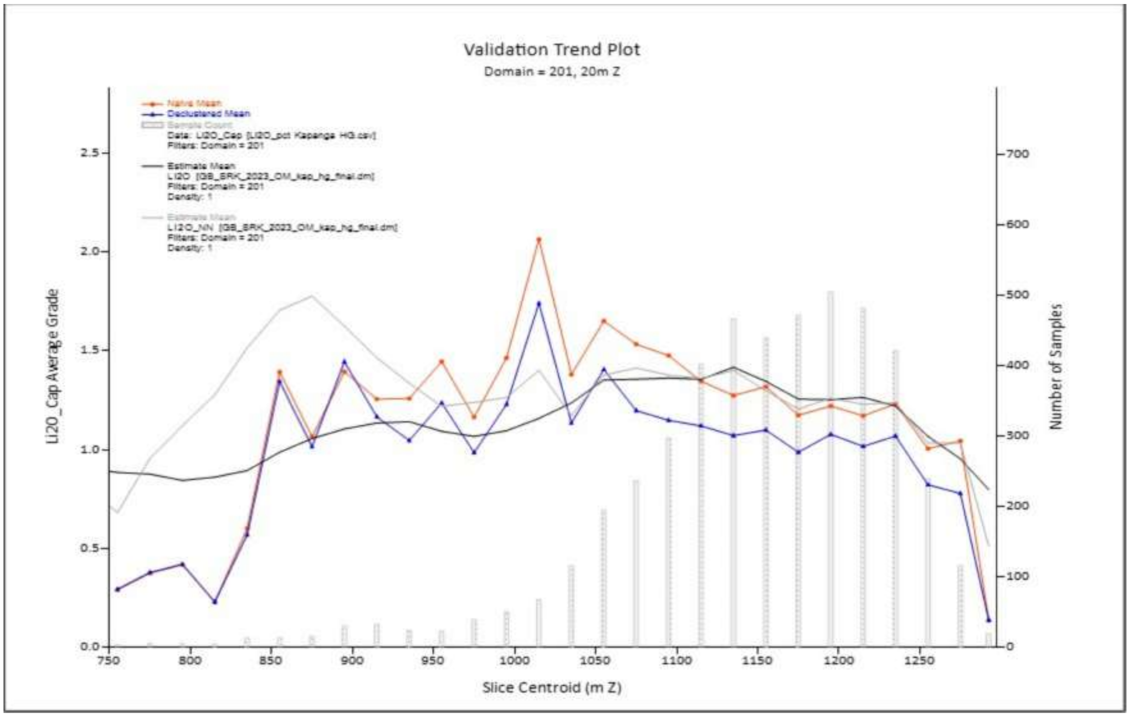
Source: SRK, 2023

Figure 11-26a: Kapanga Swath (Trend) Plots for Li_2O – High-Grade Domain



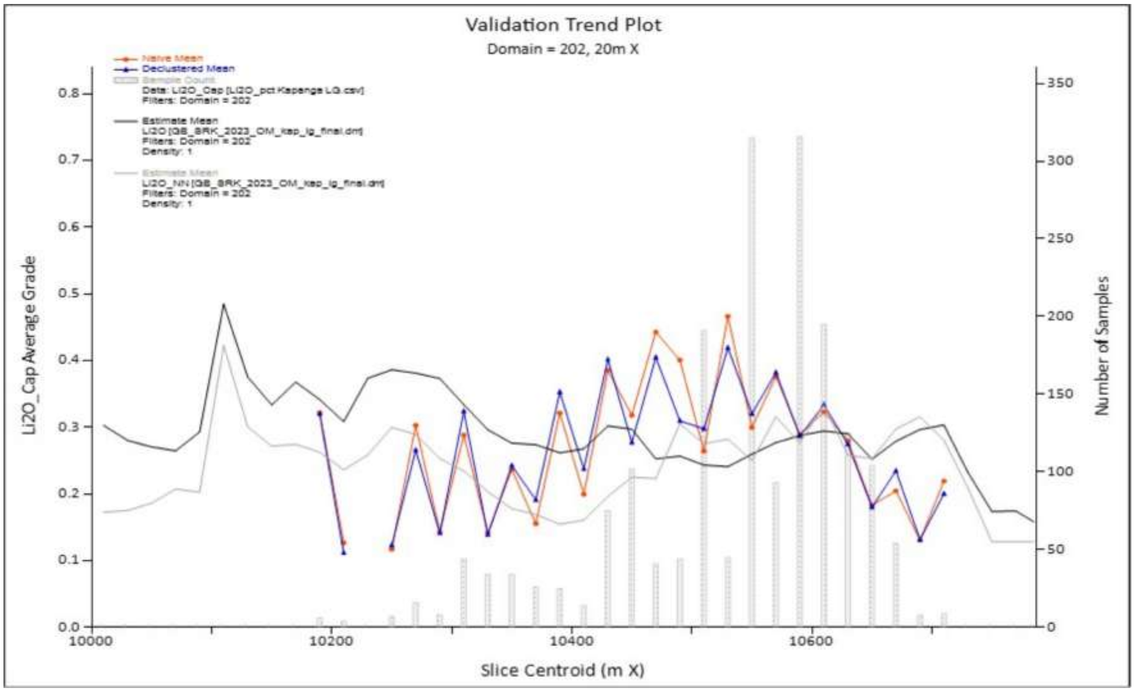
Source: SRK, 2023

Figure 11-26b: Kapanga Swath (Trend) Plots for Li_2O – High-Grade Domain



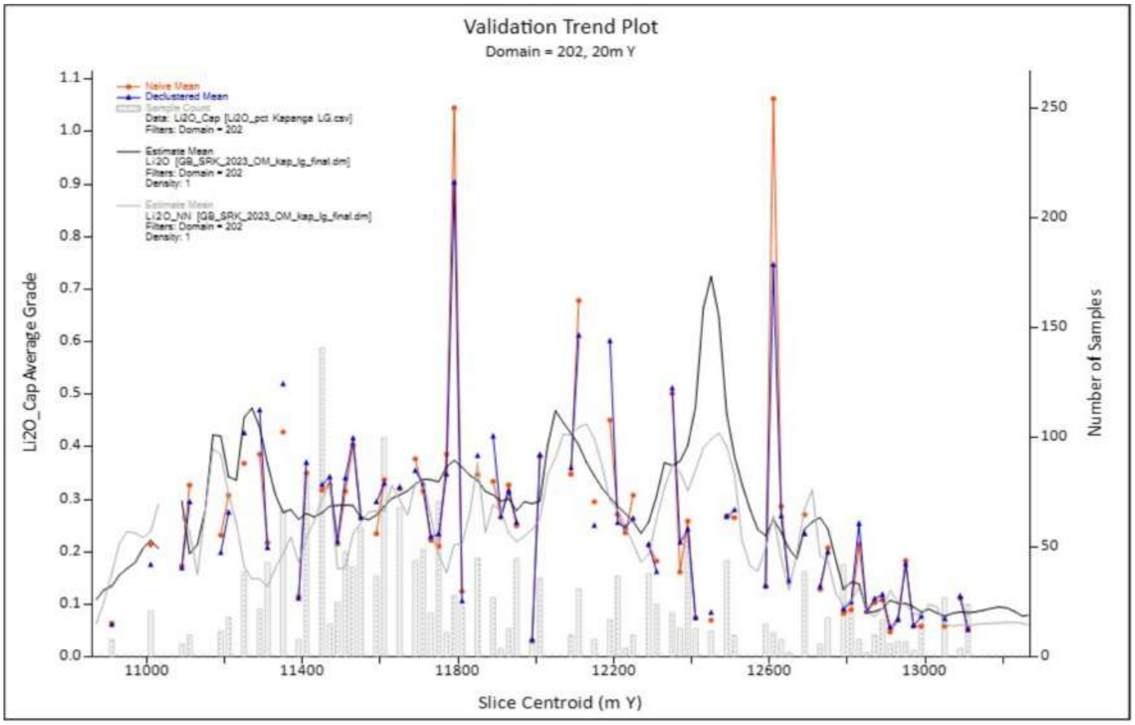
Source: SRK, 2023

Figure 11-26c: Kapanga Swath (Trend) Plots for Li_2O – High-Grade Domain



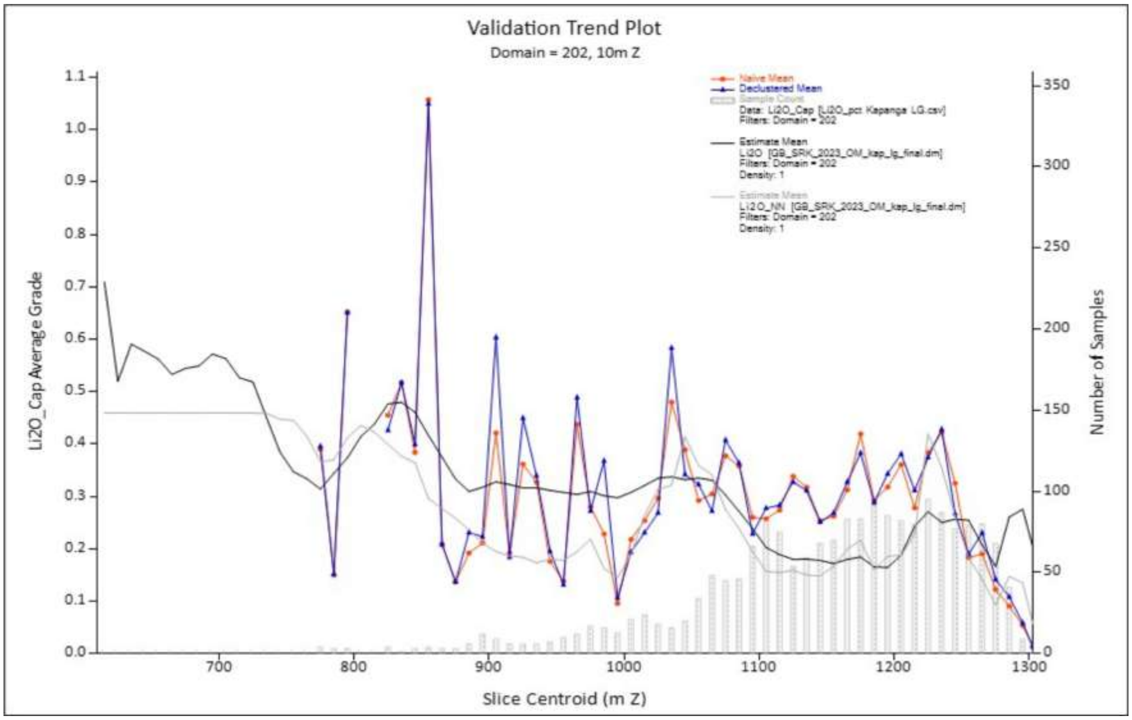
Source: SRK, 2023

Figure 11-27a: Kapanga Swath (Trend) Plots for Fe_2O_3 – Low-Grade Domain



Source: SRK, 2023

Figure 11-27b: Kapanga Swath (Trend) Plots for Fe_2O_3 – Low-Grade Domain



Source: SRK, 2023

Figure 11-27c: Kapanga Swath (Trend) Plots for Fe_2O_3 – Low-Grade Domain

Depletion of Historically Mined Underground Mineral Resources

To define the depleted portion of mineral resources, SRK calculated the volumetric differences mined using the June 30, 2023, topography, as provided by Talison.

As part of the open-pit mining depletion, SRK used surveyed underground voids from the previous tantalum mining operation at depth in the northern C3 area (Figure 11-28) to exclude these volumes in the calculation of Mineral Resource. This was done via a 1 m distance buffer around a combined void wireframe to account for potential inaccuracy in the survey of the wireframes, and due to closure/consistency issues in the survey wireframes themselves. This underground depletion affects density assignment in blocks for both the Mineral Resource and the Mineral Reserve, although overall impacts are minimal.

Additionally, the stockpile inventory of material greater than the 0.7% Li_2O CoG is managed onsite by Talison staff. This material is classified appropriately and included for use in Mineral Resource and Mineral Reserve calculations. For the 2023 mineral resources, all stockpiled material which exceeded 0.7% Li_2O was classified as Indicated and thus fully utilized in Mineral Reserve calculations. As Mineral Resources are reported exclusive of Mineral Reserve, no stockpiled material is stated as mineral resources.

Source: SRK, 2020
Shown are June 30, 2020 mine topography (yellow) and 1 m distance buffer around underground mining/development (red).

Figure 11-28: Underground Void Wireframes

Reconciliation

The reconciliation of production data is utilized by SRK as validation against the volumetric depletion exercise. SRK compares the tonnes and grades estimated in the resource block model to annual production for the time period. Talison produces annual end of year pit surfaces which were used to flag the production periods in the block model and compare against the documented production from those periods. This comparison is generally dependent on the quality of the reconciliation done by site, and can be influenced by materials handling, stockpile movement, and operational challenges which locally may make the comparisons challenging.

11.4.6 Resource Classification and Criteria

SRK modelled the geological complexity and estimated the Mineral Resources at a high level of detail, but the uncertainty associated with geological complexity and its effect on mining and processing of pegmatites is better assessed at the grade-control scale through short-range modeling. Given the uncertainty noted, no Measured Resources are stated on the Greenbushes property, despite the long production history and extensive drilling and mapping. The reason for the lack of Measured resource are as follows:

- The geological and inherent local variability of grade within the pegmatite body is highly variable in localized areas, and difficult to characterize to a Measured degree of certainty for a Mineral Resource.
- There is potential for dolerite dikes and internal waste rock to be incorporated into the pegmatite resulting in mine dilution. These geological features represent small-scale features which are not modeled at the deposit scale and have the potential to contaminate the pegmatite with iron (Fe_2O_3) that may deleteriously affect the recoverability and concentration of final product.

The Mineral Resources at the deposit scale are reported as Indicated and Inferred categories to convey the confidence in the geological continuity and grade consistency in the pegmatite. The largest source of uncertainty in the Central Lode and Kapanga models is the reliability of the local estimates and the accuracy of the lithological interpretation, both of which are influenced by drillhole spacing.

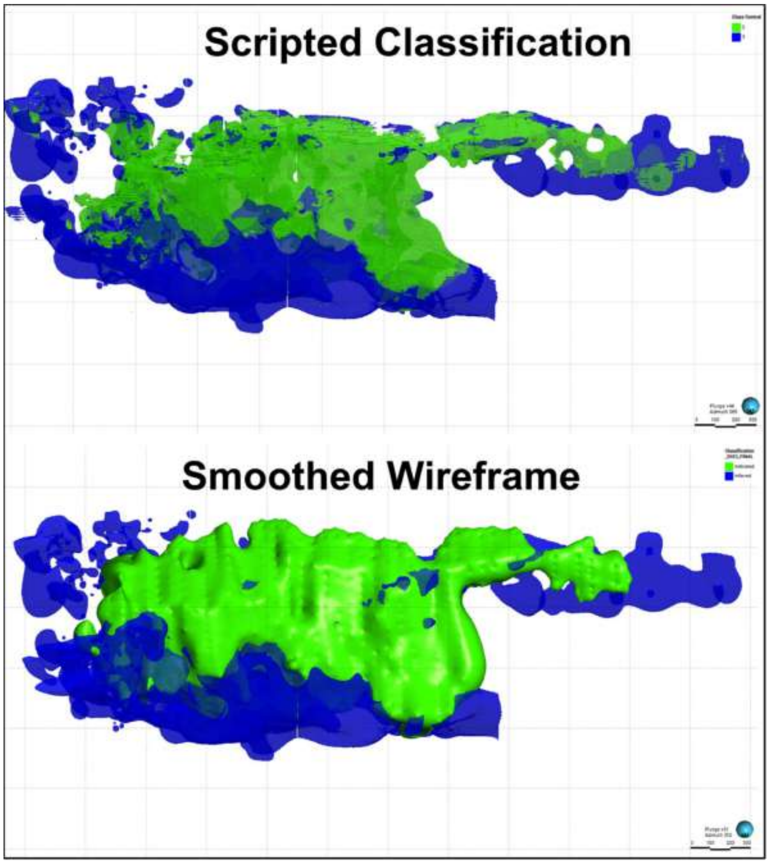
To assess this relative confidence, SRK considered a number of factors in the classification scheme. SRK considered:

- The geological complexity within the pegmatites
- The number of drillholes used in the estimate
- The average distances to the informing composites
- Mining method (open pit)
- The slope of regression (SoR) for Li_2O estimates as a measure of relative accuracy of the estimate as inputs to a script-based classification of the resource
- Final spatial review, manual digitizing of polylines, and modification of final classification

To classify the Central Lode deposit, SRK digitized polylines and generated smoothed classification wireframes which addressed the edge effects and artifacts of scripted classification. The general criteria for defining Indicated blocks in the Central Lode block model script is shown below and remain consistent with the parameters used to define the 2022 model. A graphical example of this process is shown in Figure 11-29 (Central Lode) and Figure 11-30 (Kapanga). All mineralized material estimated within the pegmatite which were not categorized as Indicated were assigned an Inferred category:

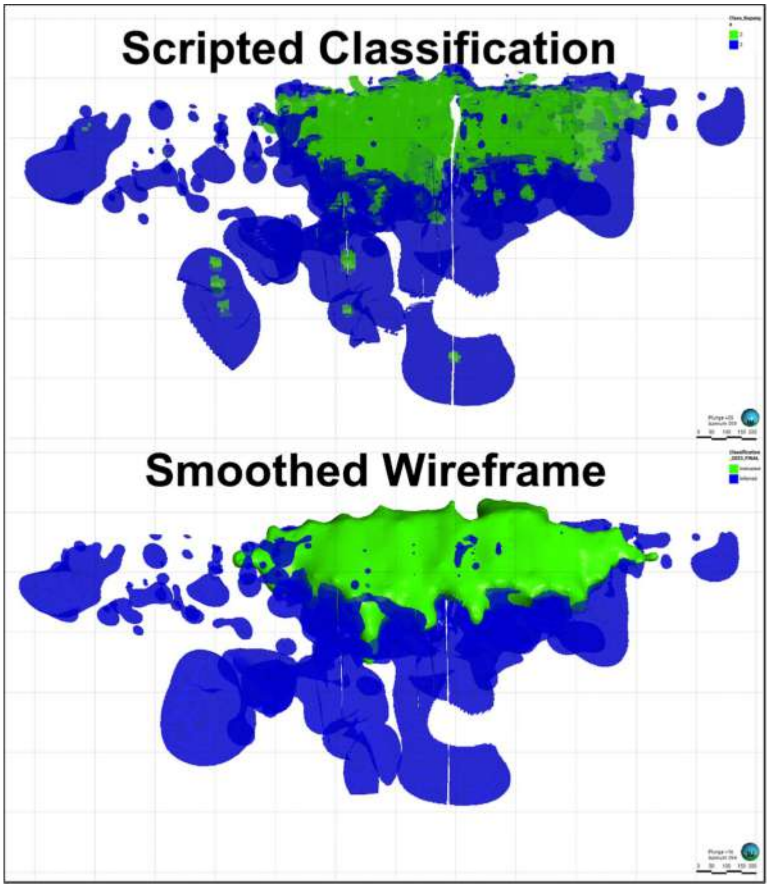
- Indicated Resources – Central Lode Deposit:
  - High-grade Domain:
    - >=Three Drillholes
    - Average Distance of <= 180 m
    - SoR >= 0.5

- Low Grade Domain:
  - >=Three Drillholes
  - Average Distance of <= 40 m
  - SoR >= 0.2



Source: SRK, 2020

Figure 11-29: Central Lode Resource Classification (looking east)



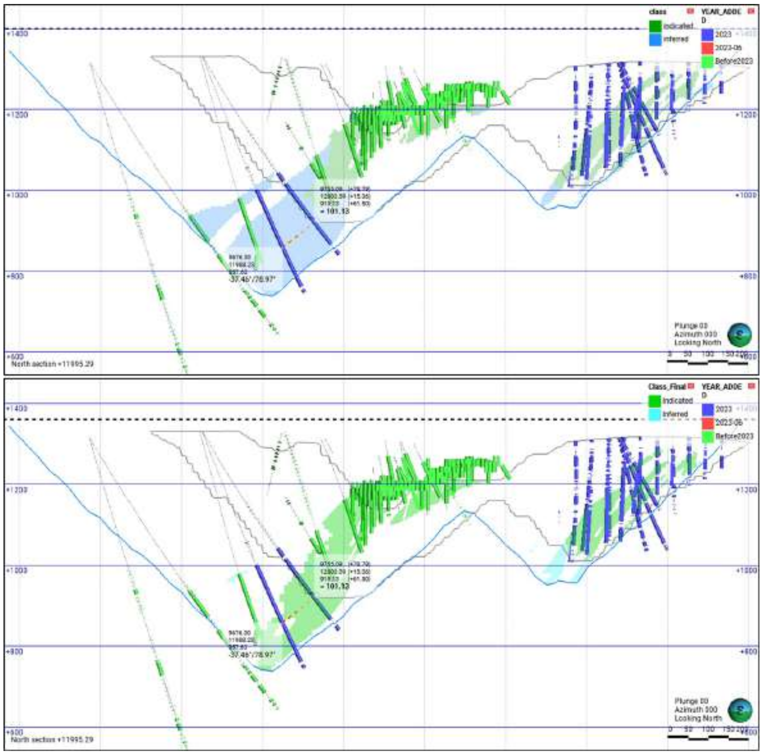
Source: SRK, 2023

Figure 11-30: Kapanga Resource Classification (looking east)

Overall, the basis for the classification remains the same between the 2022 and 2023 resource model for the initial pass using the scripted methodology. The results from the script and the smoothed wireframes represent minor upgrades of Inferred material to Indicated based on the QP's opinion of geological continuity. A review of the volumetrics for the upgrading shows that the refinement of the classification results in approximately ±1% of the tonnage and metal within the

Central Lode deposit being either upgraded or downgraded, while at Kapanga, a total of 6.5% of the scripted Inferred material was upgraded to Indicated based on the geological review, and 2% of the volume was downgraded from Indicated to Inferred.

SRK notes that the revised classification in the 2023 model results in a material upgrade in the proportion of Indicated mineral resources within the limiting pit shell. The two main factors that contribute to the upgraded confidence in the estimates is a direct result of the 2023 infill drilling programs which targets Inferred material at depth within the 2022 limiting mineral resource pit shell. The other factor is the marginal upgraded completed by SRK during the smoothing process, which, as noted above, SRK considers these movements between categories to be reasonable and resulting in the material upgrade year on year noted between the 2022 and 2023 mineral resource estimates. Figure 11-31 shows an example of the impact of the infill drilling at depth on the classification.



Source: SRK, 2023

Figure 11-31: Comparison of Classification in 2022 (top) and 2023 (bottom) versus Available Drilling Data

11.5 Reasonable Prospects for Economic Extraction

SRK has evaluated the mineral resources based on the potential to extract the resources by open pit methods. The parameters used to evaluate reasonable prospects for economic extraction (RPEE) include the volumetric constraint of mineralized materials using the economic resource pit shell and selection of blocks within the pit shell which meet the applied CoG criteria.

11.5.1 Economic Pit Shell

SRK constrained the open pit Mineral Resources to material above the economic open pit resource shell using a CoG of 0.7% Li_2O within an optimized, property-scale economic pit shell produced using Maptek Vulcan software using the internal Lerch-Grossman (LG) algorithm. The optimized pit shell is designed to consider the ability of the resource tonnes to pay for the waste tonnes based on the input economics. The result is a surface or volume which constrains the resources but provides RPEE at the mine gate resource price assumption. RPEE pit optimization inputs are as follows:

- Mine gate resource price assumption = US$1,525/t Li_2O at 6% concentrate pricing.
- Chemical grade plant weight recovery (mass yield) varies as a function of grade. The mass yield (MY) equation used for RPEE pit optimization is MY%=9.362 x Li_2O%^1.319 - 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. Recovery is set to zero when the mass yield equation result for a block is less than zero.
- Pit slope (47° on the west wall and 40° on the east wall)
- 0% mining dilution, 100% mining recovery
- Revenue factor of 0.9
- US$5.62/t mining cost (average life-of-mine cost for ore and waste within the selected resource pit shell), US$31.90/t processing cost, US$11.54/t G&A cost, and US$2.35/t sustaining capital cost. It is noted that some preliminary cost parameters used for pit optimization for RPEE evaluation may differ from the final cost parameters used for the resources CoG calculation in Table 11-21. In the QP's opinion, the differences are not material.

The resource pit is then used as a reporting constraint to exclude all mineralized tonnes from open pit resource reporting which are external to this pit volume. SRK notes that the Mineral Reserves (Section 12) are constrained by a reserve pit. The reserve pit generally sits within the resource pit, although it locally extends beyond the limits of the resource pit due to more stringent design constraints such as ramps and subject to reserve economics. Additionally, and consistent with the approach used for reserves, a restrictive boundary was placed on the resource pit optimization to prevent the optimized resource pit from extending into the tailings storage areas.

In SRK's opinion as the QP for mineral resources, the issue on an economic resource pit shell reasonable and appropriate for constraining the open pit mineral resources.

11.5.2 CoG Estimate for Open Pit Mineral Resources

The CoG determination for open pit Mineral Resources is based on assumptions and actual performance of the Greenbushes operation. SRK has utilized a Mineral Resource CoG of 0.7% for Mineral Resources, which is elevated from a calculated resource economic CoG of 0.576% Li_2O. SRK has decided to utilize the 0.7% Li_2O CoG to align with current site practices.

Concentrate attributes and production cost inputs to the cut-off calculation are presented in Table 11-21. Recovery of a 6% Li_2O concentrate is based on weight recovery calculations from actual operational data.

Table 11-21: Economic CoG Calculation for Open Pit Mineral Resources

Revenue	Units	Value
Cut-Off Grade	Li_2O%	0.576
Mass Yield	t of 6% Li_2O concentrate	0.03027
Price at Mine Gate	US$/t of 6% Li_2O Concentrate	1,525
Total Revenue	**US$/t-RoM**	**46.16**
Costs		
Incremental Ore Mining	US$/t-RoM	2.67
Processing	US$/t-RoM	31.90
G&A	US$/t- RoM	9.24
Sustaining Capital	US$/t-RoM	2.35
Total Cost	**US$/t-RoM**	**46.16**

Source: SRK, 2023

- Chemical grade plant weight recovery (mass yield) varies as a function of grade. The mass yield (MY) equation used for RPEE pit optimization is MY%=9.362 x Li_2O%^1.319 - 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. Recovery % = mass yield% x 6 / Li2O%. Recovery is set to zero when the mass yield equation result for a block is less than zero.
- Incremental ore mining costs include RoM loader, rehandle from long-term stockpiles, grade control assays, and rock breaker. Full mining costs, including drilling, blasting, loading, hauling and overheads are not included in the CoG calculation but were included in the pit optimization. In the QP's opinion this methodology for the cut-off grade calculation is appropriate because the pit limits have been established by economic pit optimization.
- Based on the internal constraints of the current operations, a nominal 0.7% Li_2O CoG was utilized to report Mineral Resources.

11.6 Uncertainty

As a baseline consideration for uncertainty and how it is discussed in this report, SRK notes that Greenbushes is an operating mine with a long history and extensive experience with the exploration, definition, and conversion of Mineral Resources to Mineral Reserves which have been mined profitably.

SRK considered multiple factors of uncertainty in the classification of resources on the Greenbushes property. Most importantly, there are no Measured Resources stated despite the long production history and extensive detailed drilling and mapping. Reasons for this are as follows:

- The geological and inherent local variability of grade within the pegmatite body is highly variable in localized areas, and difficult to characterize to a Measured degree of certainty for a Mineral Resource.
- There is potential for dolerite dikes and internal waste rock to be incorporated into the pegmatite resulting in mining dilution. These geological features represent small-scale features which are not modeled at the deposit scale and have the potential to contaminate the pegmatite with iron (Fe_2O_3) that may deleteriously affect the recoverability and concentration of final product.
- There is a lack of long-term confidence in the definition of mineralization appropriate to produce higher value products such as technical grade concentrates. Greenbushes consistently produces technical grade concentrates, which on average, sell at a higher price than chemical grade concentrate and features a separate recovery facility. However, the detail needed to define and predict this material happens at the blasthole scale and is thus not reported in the long-term through the resource block model.

These factors are relevant to the overall confidence in the distribution of the quality and quantity of pegmatites and does not satisfy the definition of Measured Resources at a long-term scale as reported herein. Greenbushes accounts for this variability operationally through detailed grade control drilling in near-term production areas, logging, and sampling of blastholes for integration into short range planning, selective mining of the deposit, and ore-sorting at the crusher to limit inputs from waste rock.

Indicated Resources are those which are defined at a sufficient level of confidence to assume geological and grade continuity between points of observation. SRK notes that this characterizes the majority of the detailed drilling and sampling at Greenbushes within the potential open pit mineable areas, and that the modeling effort has been designed to incorporate all relevant geological information which supports these assumptions. Confidence assumptions built into the designation of Indicated Mineral Resources are based on geological consistency as noted through cross section and level plan view reviews, 3D observations of the modeling, similarity in drilling characteristics and thicknesses, model validation, and estimation quality metrics.

Uncertainty regarding lack of evidence for geological or grade continuity at the levels of the Indicated Mineral Resources is dealt with by categorizing this material as Inferred. In general, this typically suggests lack of continuity from at least two drillholes, extrapolated mineralization, high internal variance of Li_2O grades (as determined through estimation quality metrics), or other factors. In short, there is sufficient evidence to imply geological or grade continuity for this material, but insufficient to verify this continuity. Inferred Resources do not convert to Mineral Reserves during the reserve estimation process and are treated as waste in mine scheduling and reserve economic calculations.

Economic uncertainty associated with the resources is mitigated to a large degree by the nature of the Greenbushes mine functioning for many years, as well as the reasonable application of both a pit optimization and CoG assumptions for reporting. SRK has provided sensitivity tables and graphs for the Mineral Resources in the next section as grade tonnage curves.

It is the QP's opinion that from a technical perspective aspects likely to influence the prospect of economic extraction to establish economic potential have been addressed with the current classification system and that any areas considered a risk can be resolved with further exploration and analysis.

11.7 Mineral Resource Statement

The Greenbushes Mineral Resource statement is based on the property-scale model comprised of the Central Lode and Kapanga deposit-scale models. This model has been updated to reflect revised pit optimization parameters for the June 30, 2023, effective date. All models have been depleted to the appropriate date. All Mineral Resource statement calculations were performed using Leapfrog Edge software. The Greenbushes Mineral Resources are stated as in situ and exclusive of Mineral Reserves attributable to Albemarle.

The open pit mineral resources have been defined as all material above the resource CoG, below the reserve final pit design, and constrained by the limiting resource pit shell as defined by the reasonable prospect for economic extraction as discussed in Section 11.5. In addition to the material outside the reserve final pit design, all Inferred material within the reserve pit has also been accounted for within the exclusive Mineral Resource.

Table 11-22 shows the SEC defined Mineral Resources, exclusive of reserves. Resources are contained within the resource pit shell and include material above the CoG of 0.7% Li_2O for the open pit. All stockpile material has been classified as Indicated as reported to SRK by Talison. Given the higher level of confidence assigned to these stockpiles, all stockpile materials are reported as Mineral Reserves.

SRK notes that Greenbushes is not a multiple commodity mineral resource statement. The only relevant commodity of interest for Albemarle is Li_2O in the form of spodumene concentrate. Although, other elements have been estimated for the purposes of downstream materials characterization, in the opinion of the QP, none are considered deleterious to the point of exclusion from the Mineral Resources, and none are considered to be a co-product with economic value for the purposes of reporting for Albemarle.

Table 11-22: Greenbushes Summary Mineral Resources Exclusive of Mineral Reserves as of June 30, 2023 Based on US$1,525/t of Concentrate at Mine Gate– SRK Consulting (U.S.), Inc.

Area	Category	100% Tonnes (Mt)	Attributable Tonnes (Mt)	Li_2O (%)	Mass Yield
Open Pit 2023	Indicated	75.8	37.1	1.48	15.7
	Inferred	11.8	5.8	1.19	11.8

Source: SRK, 2023

- Albemarle's attributable portion of Mineral Resources is 49%.
- Mineral Resources are reported exclusive of Mineral Reserves. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability.
- Resources have been reported as in situ (hard rock within an optimized pit shell and above the effective CoG).
- Resources have been categorized subject to the opinion of a QP based on the quality of informing data for the estimate, consistency of geological/grade distribution, and data quality.
- Resources which are contained within the Mineral Reserve pit design may be excluded from reserves due to an Inferred classification.
- All Indicated stockpiled resources have been converted to Mineral Reserves.
- Open Pit Mineral Resources are reported considering a nominal set of assumptions for reporting purposes:
  - Chemical grade plant weight recovery (mass yield) varies as a function of Li_2O% grade. The mass yield (MY) equation used for RPEE pit optimization is MY%=9.362 x $Li_2O\%^{1.319}$ - 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. Recovery is set to zero when the mass yield equation result for a block is less than zero.
  - Derivation of economic CoG for resources is based on the mine gate pricing of US$1,525/t of 6% Li_2O concentrate. The mine gate price is based on US$1,650/t-conc CIF less US$125/t-conc for government royalty and transportation to China.
  - Costs estimated in Australian Dollars were converted to U.S. dollars based on an exchange rate of 1.00AU$:0.68US$.
  - The economic CoG calculation is based on US$2.67/t-ore incremental ore mining cost, US$31.90/t-ore processing cost, US$9.24/t-ore G&A cost, and US$2.35/t-ore sustaining capital cost. Incremental ore mining costs are the costs associated with the RoM loader, stockpile rehandling, grade control assays and rockbreaker
  - The price, cost and mass yield parameters produce a calculated resource economic CoG of 0.576% Li_2O. However, due to the internal constraints of the current operations, an elevated resource CoG of 0.7% Li_2O has been applied. SRK notes actual economic CoG is lower, but it is the QP's opinion to use a 0.7% Li_2O CoG to align with current site practices.
  - An overall 40° (east side) and 47° (west side) pit slope angle, 0% mining dilution, and 100% mining recovery.
  - Resources were reported above the assigned 0.7% Li_2O CoG and are constrained by an optimized 0.90 revenue factor pit shell.
  - No infrastructure movement capital costs have been added to the optimization.
- Mineral Resources tonnage and contained metal have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding.
- SRK Consulting (U.S.) Inc. is responsible for the Mineral Resources with an effective date: June 30, 2023.

11.7.1 Mineral Resource Breakdowns and Sensitivity

This section provides additional transparency and demonstrates resource sensitivity on the Greenbushes property. Given the 2023 inclusion of both the Central Lode and Kapanga deposits and the split into open pit and underground components, Table 11-23 provides the relative breakdown of contributing resources by deposit on the Greenbushes property. As shown, the Central Lode comprises the majority of resource tonnage on the Greenbushes property.

Table 11-23: Deposit Contribution to Mineral Resources

Classification	Deposit	Cut-Off Li_2O (%)	Mass (Mt)	Average Value Li_2O (%)
Indicated	Central Lode	0.7	71.7	1.47
	Kapanga		4.1	1.59
Inferred	Central Lode	0.7	5.7	1.04
	Kapanga		4.6	1.36

Source: SRK, 2023

To evaluate the sensitivity of the Mineral Resources to modification of the CoG, SRK generated a grade-tonnage curve and accompanying table (Table 11-24). The table is presented for mineralized material constrained within the economic resource pit shell with variable CoG applied.

Table 11-24: Grade Tonnage Sensitivities – Pit-Constrained Mineral Resources Exclusive of Reserves, Split by Category

Cut-off Grade Li_2O (%)	Indicated		Inferred	
	Tonnes ≥ Cut-off (Mt)	Average Li_2O Grade ≥ Cut-off (%)	Tonnes ≥ Cut-off (Mt)	Average Li_2O Grade ≥ Cut-off (%)
0.00	111.7	1.13	59.6	0.47
0.10	111.5	1.13	59.0	0.48
0.20	108.1	1.17	52.8	0.51
0.30	99.9	1.24	35.3	0.64
0.40	91.8	1.32	22.1	0.82
0.50	85.7	1.38	15.6	0.98
0.60	80.8	1.43	12.3	1.10
0.70	75.9	1.48	12.3	1.10
0.80	70.5	1.54	8.8	1.26
0.90	64.9	1.60	7.6	1.33
1.00	58.9	1.66	6.5	1.39
1.10	52.5	1.74	5.4	1.46
1.20	45.7	1.83	4.4	1.53
1.30	39.5	1.92	3.4	1.62
1.40	34.2	2.01	2.6	1.70
1.50	29.4	2.09	1.9	1.79

Source: SRK, 2023
Mineral Resources are reported exclusive of Mineral Reserves.

11.7.2 Comparison to Previous Estimates

SRK has undertaken a comparison of the Mineral Resources on a year by year to note key differences. This exercise has been completed on an inclusive basis (split by the 2023 Resource and Reserve pit shell), classification and pegmatite units to account for the key changes initially to understand the impact from changes in the geological model and grade estimation processes.

The final comparison considers the exclusive resources. Table 11-25 provides the breakdown for the 2022 Mineral Resource, and Table 11-26 for the 2023 Mineral Resource, which have been depleted to the June 30, 2023 surface.

The results can be summarized as follows:

- Overall in terms of tonnage within the limiting pit shell there has been a reduction in the Central Lode in the order of 12.7 Mt, which is a result of changes in the geological and mineralization wireframes; this is an approximate reduction of around 5% in tonnage and therefore not considered to be material. The reduction in the tonnage has been offset to a degree by an increase in the grade of approximately 4% in the Central Lode domain.

- The combined tonnage at Kapanga dropped by approximately 4.0 Mt (-10%) based on the new wireframes, which has additionally been impacted by a reduction in grade of approximately 15% due mainly to new drilling within this portion of the deposit.
- Within the 2023 mineral reserve area, there is limited change to the Indicated mineral resource within the Central Lode (+2% Li_2O), but a more significant reduction in the Kapanga Resources (-21%), resulting in a net difference of approximately -2% in the contained Indicated material within the Mineral Reserve design.
- Within the portion of the mineral resources below the 2023 Mineral Reserve shell there has been:
  - An increase in the proportion of Indicated Mineral Resources in the Central Lode, which has increased from 37.0 Mt at 1.48 % Li_2O to 71.5 Mt at 1.47 % Li_2O.
  - This increase offsets changes in the Inferred portion of the deposit, which has reduced from 48.0 Mt at 1.10% Li_2O to 5.7 Mt at 1.04%, which is mainly attributed to upgrading of the Inferred mineral resource to Indicated.
  - A reduction in the proportion of Indicated mineral resources in Kapanga, which has decreased from 6.9.0 Mt at 1.80% Li_2O to 4.1 Mt at 1.59% Li_2O
  - At Kapanga within the Inferred portion of the deposit, there has been a slight increase in the tonnage from 3.6 Mt to 4.6 Mt of material, but there is a reduction in the grades from 1.98% to 1.36%, which is a function of lower grades in the new wireframes.
- The changes in the mineral resources noted in the tables below are mainly attributed to the following key factors:
  - Upgrade of mineral resource from Inferred to Indicated
  - Impact of new drilling on the deposit reducing the tonnage and grades at Kapanga
  - Changes in the geological models which form the basis for the current estimate

Table 11-25: 2022 Mineral Resource Broken Down by Classification and Reserve Shell

Reporting Pit Shell	Classification	Deposit	Mass (Mt)	Average Value Li_2O (%)
2023 Reserve Shell	Indicated	Central Lode	135.5	1.96
		Kapanga	28.0	1.94
		Total	163.4	1.95
	Inferred	Central Lode	16.1	1.20
		Kapanga	0.2	1.44
		Total	16.3	1.20
Outside 2023 Reserve Shell	Indicated	Central Lode	37.0	1.48
		Kapanga	7.0	1.80
		Total	43.9	1.53
	Inferred	Central Lode	48.2	1.10
		Kapanga	3.6	1.98
		Total	51.8	1.16
Combined (Inclusive)	Indicated	Central Lode	172.4	1.85
		Kapanga	34.9	1.91
		Total	207.4	1.86
	Inferred	Central Lode	64.3	1.13
		Kapanga	3.8	1.95
		Total	68.1	1.17

Source: SRK, 2023

Table 11-26: 2023 Mineral Resource Broken Down by Classification and Reserve Shell

Reporting Pit Shell	Classification	Deposit	Mass (Mt)	Average Value Li_2O (%)
2023 Reserve Shell	Indicated	Central Lode	145.0	1.87
		Kapanga	25.7	1.66
		Total	170.7	1.84
	Inferred	Central Lode	1.1	1.24
		Kapanga	0.3	1.33
		Total	1.4	1.26
Below 2023 Reserve Shell	Indicated	Central Lode	71.5	1.47
		Kapanga	4.1	1.59
		Total	75.6	1.48
	Inferred	Central Lode	5.7	1.04
		Kapanga	4.6	1.36
		Total	10.3	1.18
Combined (Inclusive)	Indicated	Central Lode	216.6	1.74
		Kapanga	29.7	1.65
		Total	246.3	1.73
	Inferred	Central Lode	6.8	1.08
		Kapanga	4.9	1.36
		Total	11.8	1.19

Source: SRK, 2023

11.8 QP Opinion

SRK is of the opinion that all identified factors to the RPEE of the June 30, 2023, mineral resources have been considered as a part of this study. Notwithstanding, SRK notes that the influence of the pit shell on the reported Mineral Resources is significant, as additional mineralized material exists external to the shell. Additionally, a restrictive boundary was placed on the resource pit optimization to prevent the optimized pit from extending into the tailings storage areas. It is SRK's opinion that there is potential to develop additional resources in the future with realization of increased confidence in mineralized material through further technical evaluation work (including investigation of potential infrastructure relocation), higher commodities pricing, and lower costs.

SRK is not aware of any other significant factors (environmental, social, or governance) or risk not included in this disclosure that may affect access, title, or the right or ability to perform work on the property.

12 Mineral Reserve Estimates

The conversion of Mineral Resources to Mineral Reserves has been completed in accordance with SEC regulations CFR 17, Part 229 (S-K 1300). Mineral Reserves were estimated based on a spodumene concentrate sales price of US$1,500/t of concentrate CIF China (or US$1,383/t of concentrate at the mine gate). The Mineral Reserves are based on PFS level study as defined in §229.1300 *et seq*.

The Mineral Reserve calculations for the Greenbushes Central Lode and Kapanga lithium deposits have been carried out by a Qualified Person as defined in §229.1300 et seq. SRK is responsible for the Mineral Reserves reported herein.

Greenbushes is an operating mine that uses conventional open pit methods to extract Mineral Reserves containing economic quantities of Li_2O to produce both chemical and technical grade spodumene concentrates.

The following reserve is based on the assumption that CGP4 will be placed into production per the current Greenbushes LoM plan. It is noted by the QP that CGP4 is currently considered at a study-level and is subject to approval and permitting, but it is the QP's view that it is using the same technology as CGP3 which has been approved and therefore the QP does not see any technical risk for inclusion in the reserve. Should CGP4 not be approved, this will change the results of the reserve as presented below as the mine plan would need to be adjusted to account for production limits through CGP1, CGP2, and CGP3. This would likely extend the LoM but would present different project economics.

2.1 Key Assumptions, Parameters, and Methods Used

The key mine design assumptions, parameters and methods are summarized as follows.

12.1.1 Resource Model and Selective Mining Unit

The in situ Mineral Resources used to define the Mineral Reserves are based on the SRK block model as described in Section 11 of this report. The block model is depleted to June 30, 2023. The SRK block model was used with reblocking process modification, as the subblock size in the model is smaller than the selective mining unit (SMU) size that was adopted for mine planning purposes.

12.1.2 Pit Optimization

The Mineral Reserves are reported within an ultimate pit design that was guided by pit optimization (Lerch-Grossman algorithm). The pit optimization considered only Indicated Mineral Resources as there are no in situ Measured Resources in the SRK block model. Inferred resource blocks were assigned a Li_2O% grade of zero prior to pit optimization and were treated as waste.

The overall pit slopes used for pit optimization are based on operational level geotechnical studies and range from 27° to 50°. This includes a 5° allowance for ramps and geotechnical catch benches.

Pit optimization parameters are shown in Table 12-1.

Table 12-1: Pit Optimization Parameters

Parameter	Unit	Value
Mining Cost	US$/t-mined	Variable based on depth and material type (Average is US$5.70/t mined)
Processing Cost	US$/t ore	31.90
G&A Cost	US$/t ore	11.54
Sustaining Capital Cost	US$/t ore	2.35
Mass Yield	%	Variable based on Li_2O% grade (Average MY is 20.9%)
Gross Sales Price (CIF China)	US$/t of 6% Li_2O Conc	1,500
Shipping, Transportation and 5% Royalty	US$/t of 6% Li_2O Conc	117
Net Sales Price (mine gate)	US$/t of 6% Li_2O Conc	1,383
Discount Rate	%	8.0

Source: SRK, 2023
The mass yield (MY) equation for pit optimization is MY%=9.362 x Li_2O%^1.319 - 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. Recovery is set to zero when the equation result for a block is less than zero.
The Microsoft® Excel® mass yield equation used for pit optimization is "=IF(Li_2O%>5.8,Li_2O%/6*97%,IF((9.362*Li_2O%^1.319-1.5)/100<0,0,(9.362* Li_2O%^1.319-1.5)/100))"

The mine planning process begins with pit optimization using preliminary estimates of costs, recoveries, and other input parameters. At the conclusion of the pit optimization, an economic pit shell is selected to guide the design of the final reserves pit. In this case, the revenue factor (RF) 0.40 pit shell was selected, which corresponds to a mine gate price of US$553/t of 6% Li_2O. The mining schedule for the final reserves pit is then generated. Detailed mining costs (both operating expenditures and capital expenditures) are then calculated from the reserves mining schedule. Provided that the detailed mining costs are not materially different from the preliminary mining costs used for pit optimization, the pit optimization results are typically considered to be valid.

In this instance, the average preliminary mining cost used for pit optimization was US$5.70/t mined (this is the average corresponding to the RF 0.40 pit shell). The preliminary mining cost was estimated based on established mining, drilling and blasting contractor rates, along with estimates for mining overheads. We note that the mining cost applied to each block in the block model is variable depending on the depth of the block (i.e., deep blocks have longer haul pathways than shallow blocks and therefore the haulage cost for deep blocks is higher). Also, the mining costs vary depending on whether the material is ore, soft rock waste (which doesn't require blasting), or hard rock waste (which does require blasting).

The average mining cost used in the Technical Economic Model (TEM) is AU$8.16/t. This cost was calculated from the final mining schedule and is shown in Table 18-5. Based on the modeled exchange rate (Table 19-2), this equates to US$5.55/t-mined (Table 19-5). In SRK's opinion, the average preliminary mining cost of US$5.70/t-mined used for pit optimization is sufficiently close to the average final mining cost used in the TEM of US$5.55/t-mined. SRK notes that the preliminary average mining cost will never exactly match the final average mining cost used in the TEM because the mining planning process is iterative (i.e., changing the input parameters changes the pit shells, which changes the final pit design, which changes the schedule, which changes the detailed cost estimate). Also, the quantities (and ratios) of ore and waste in the final designed reserves pit are different from the quantities in the optimized pit shell because the final pit design includes ramps and other practical mine design features.

A LoM sustaining capital allowance of US$2.35 per tonne of ore was used for the purposes of pit optimization and cut-off grade calculation. Because pit optimization is performed as a first step in the mine planning process, SRK typically relies on the most recent information that is available at the time when the pit optimization process commences. In this instance, SRK used the estimate of LoM annual sustaining capital costs for Greenbushes that was included in the 2023 budget provided by the Company. The budgetary estimate of average annual sustaining capital costs for Greenbushes was AU$29.6 M/y, or AU$3.45 per tonne of ore. This cost was then converted to US$2.35 per tonne of ore based on an assumed exchange rate of 0.68 US$:AU$. SRK reviewed the budgetary projection of the sustaining capital costs for Greenbushes and determined that it was reasonable to rely thereon for the purposes of pit optimization and cut-off grade calculation.

Subsequent to pit optimization, design and scheduling, a detailed estimate of LoM sustaining capital costs was prepared as discussed in Section 18 of this report. The detailed estimate based on the final reserves was used in the TEM in Section 19.

It is noted that the other preliminary cost parameters used for pit optimization (processing cost, site G&A cost) may differ slightly from the final estimated costs used in the technical economic model (TEM) discussed in Sections 18 and 19 of this report. The differences are due to the TEM being based on final reserves whereas preliminary cost parameters are based on preliminary quantities. It is also noted that an 8% discount rate was used for pit optimization, whereas a 10% discount rate was used for the TEM. In the QP's opinion, the differences in costs and the discount rate are not material and would not have resulted in a different optimized pit being selected to guide the design of the reserves pit.

The summary pit optimization results are shown in Table 12-2. The RF 0.40 pit shell was selected to guide the design of the ultimate reserves pit. This pit shell is highlighted as "Pit 5" in Table 12-2. The RF 0.40 pit corresponds to a mine gate price of US$553/t of 6% Li_2O concentrate (i.e., 40% of the mine gate reserves price of US$1,383/t of 6% Li_2O concentrate).

The reason that a relatively low revenue factor pit shell was selected to guide the design of the ultimate reserves pit is because of infrastructure and land ownership constraints that currently exist at the Greenbushes operation. If such constraints are removed at some point in the future, the Company will have the option selecting a higher revenue factor optimized pit shell, which would result in a larger ultimate reserves pit. In the QP's opinion, the selection of a relatively low revenue factor pit shell (RF 0.40) is conservative and helps to de-risk the mine design because it results in a lower strip ratio than would otherwise be required for a higher revenue factor pit.

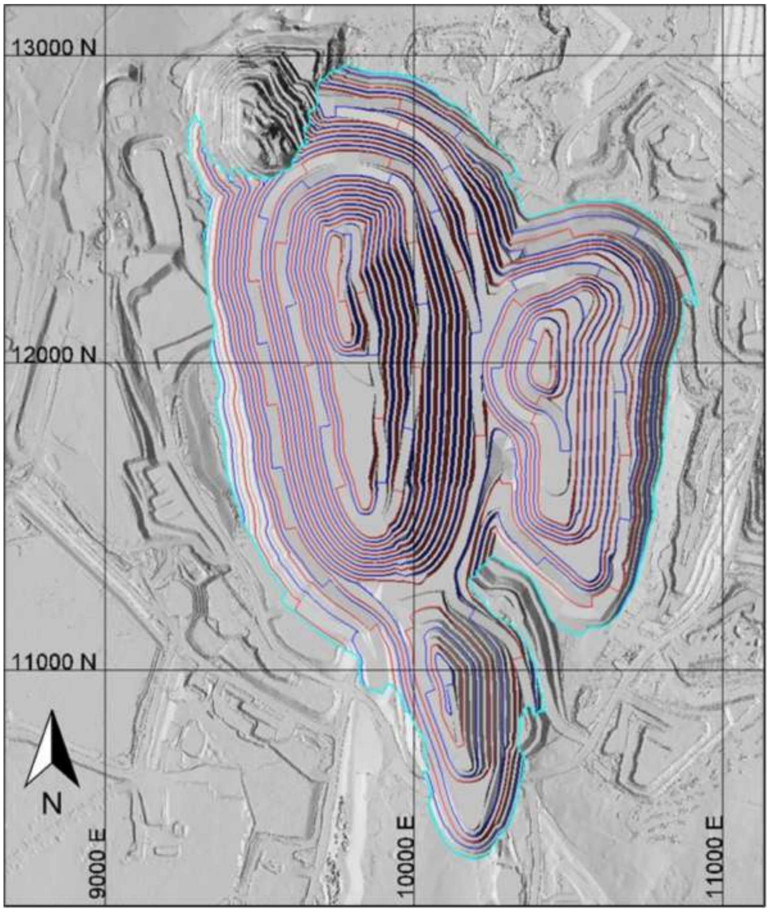
Table 12-2: Summary Pit Optimization Results

Pit Shell	Revenue Factor	Mine Gate Selling Price (US$/t-conc)	Strip Ratio (w:o)	Total Ore + Waste (Mt)	Ore (Mt)	Waste (Mt)	6% Li_2O Concentrate (Mt)	Mass Yield (%)	Diluted Grade (Li_2O%)
1	0.20	277	1.34	91.8	39.3	52.5	11.5	29.30	2.33
2	0.25	346	1.67	171.7	64.3	107.5	16.5	25.63	2.10
3	0.30	415	2.69	380.4	103.1	277.4	23.8	23.10	1.94
4	0.35	484	3.45	643.4	144.6	498.8	31.4	21.72	1.85
5	0.40	553	3.81	809.5	168.3	641.2	35.3	20.95	1.80
6	0.45	622	4.01	923.8	184.4	739.4	37.7	20.42	1.76
7	0.50	692	4.14	988.9	192.2	796.6	38.8	20.17	1.75
8	0.55	761	4.32	1,071.2	201.2	870.0	40.0	19.88	1.73
9	0.60	830	4.45	1,128.1	207.1	921.1	40.7	19.67	1.71
10	0.65	899	4.76	1,244.6	216.2	1,028.4	42.0	19.42	1.70
11	0.70	968	6.03	1,736.1	246.8	1,489.3	46.4	18.78	1.65
12	0.75	1,037	6.39	1,899.0	257.1	1,641.9	47.8	18.58	1.64
13	0.80	1,106	6.53	1,981.1	263.2	1,717.9	48.5	18.42	1.63
14	0.85	1,176	6.62	2,020.0	265.1	1,754.9	48.7	18.39	1.63
15	0.90	1,245	6.71	2,066.1	268.0	1,798.1	49.1	18.31	1.62
16	0.95	1,314	6.75	2,086.0	269.3	1,816.7	49.2	18.27	1.62
17	1.00	1,383	6.81	2,112.8	270.6	1,842.2	49.4	18.24	1.62
18	1.05	1,452	6.88	2,144.3	272.1	1,872.3	49.5	18.21	1.61
19	1.10	1,521	6.98	2,180.3	273.2	1,907.1	49.7	18.19	1.61
20	1.15	1,590	7.02	2,194.9	273.8	1,921.1	49.8	18.18	1.61
21	1.20	1,660	7.05	2,206.7	274.2	1,932.6	49.8	18.17	1.61
22	1.25	1,729	7.06	2,210.1	274.3	1,935.8	49.8	18.17	1.61
23	1.30	1,798	7.11	2,231.8	275.1	1,956.6	49.9	18.15	1.61

Source: SRK 2023
Optimized Pit 5 (the revenue factor 0.40 pit) was selected to guide the design of the final reserves pit.

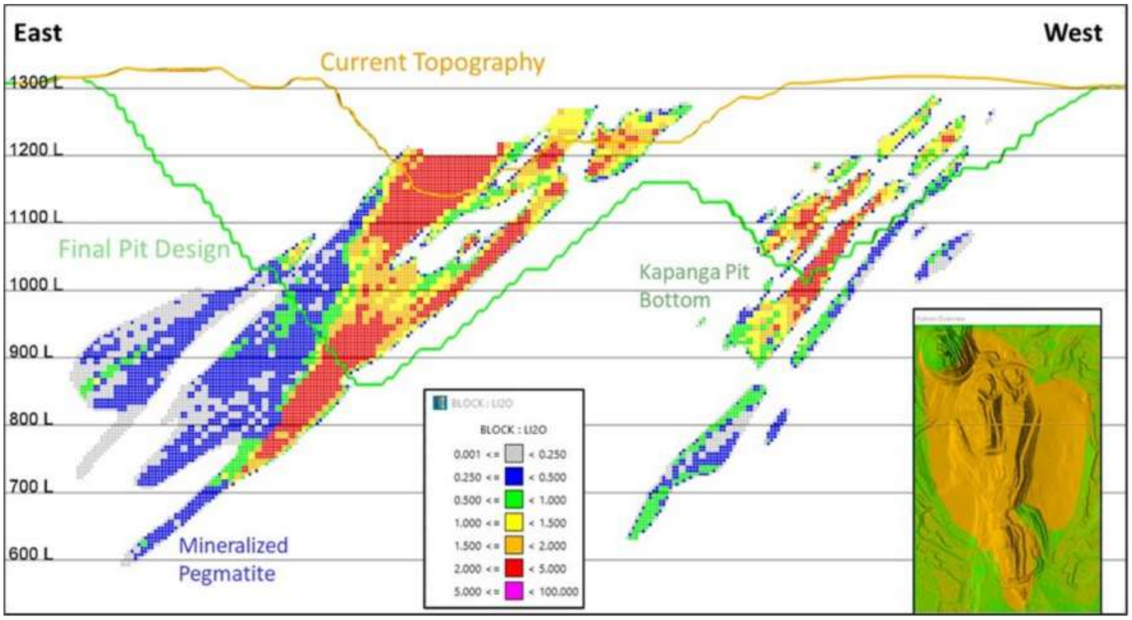
12.1.3 Ultimate Pit and Phase Design

A 3D mine design based on optimized Pit 5 (RF 0.40) was completed using Vulcan software and is the basis for the in situ Mineral Reserves. The reserves pit has been designed with 10 m benches, variable bench widths, variable face angles and overall wall angles of between 27° and 50°. Local berm angles vary with local ground conditions and in some areas a double bench is applied (20 m bench height with zero catch bench). Ramp width is 20 m for single-way and 32 m for two-way traffic. The ramp gradient is 1:10. The ultimate pit floor is designed at 860 mRL, with a maximum wall height of approximately 480 m. The pit has been designed with a dual ramp system with exits on both the east and west walls. Figure 12-1 is a plan view of the final pit design that was used for Mineral Reserves, and Figure 12-2 is a section view through the middle part of the final design pit.



Source: SRK, 2023

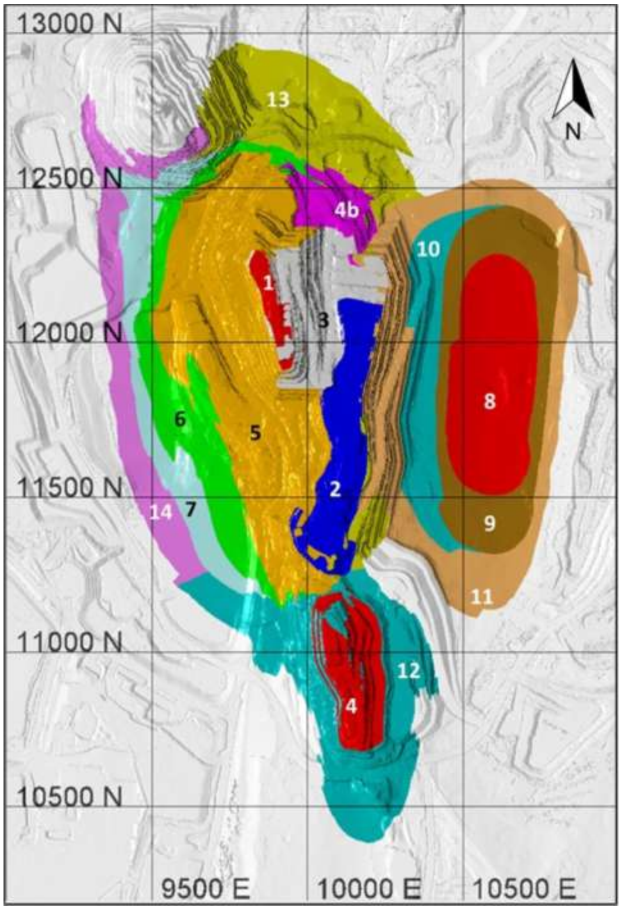
Figure 12-1: Plan View of the Ultimate Pit Design



Source: SRK, 2023

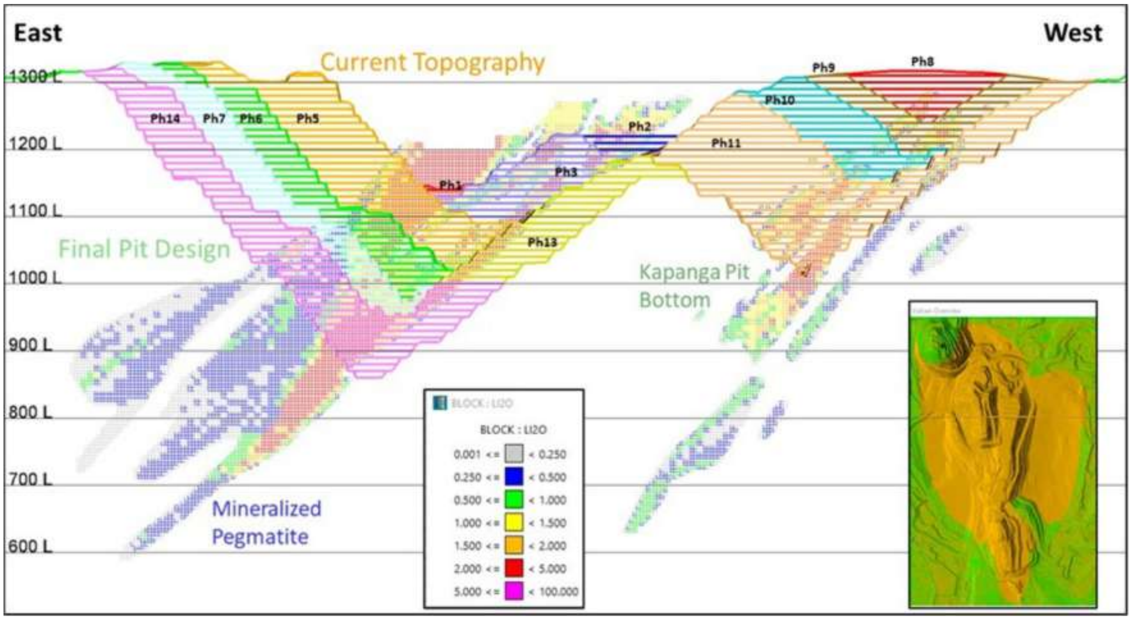
Figure 12-2: Section View of Ultimate Pit Design (12,100N) – Central Lode and Kapanga

Phase design resulted in a total of fourteen phases being designed, with the ultimate reserves pit representing the fourteenth and final phase. Figure 12-3 shows the location of the fourteen pit phases in plan view. Figure 12-4 is a sectional view though the northern part of the ultimate pit showing multiple nested phases. Figure 12-5 is a plan view of the ultimate pit and the final waste rock dumps.



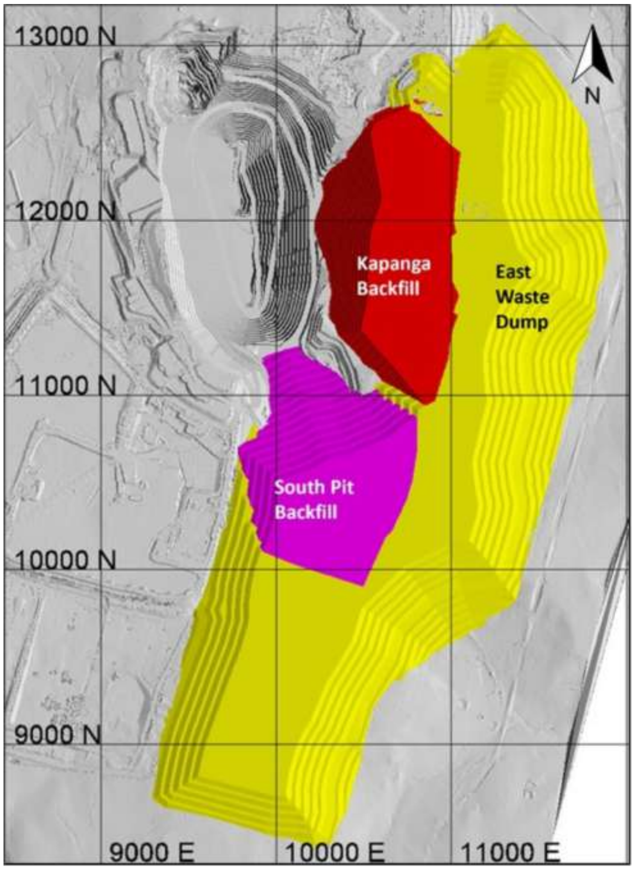
Source: SRK, 2023

Figure 12-3: Plan View of Phase Design (14 Phases)



Source: SRK, 2023

Figure 12-4: Section View of Phase Design (12,100N) – Central Lode and Kapanga



Source: SRK, 2023

Figure 12-5: Greenbushes Final Pit and Waste Dump Design in Plan View

12.2 Modifying Factors

Modifying factors are the factors that are applied to Indicated and Measured Mineral Resources to establish the economic viability of Mineral Reserves. For Greenbushes, the modifying factors include mining dilution, mining recovery, processing recovery (mass yield), and application of a cut-off grade (CoG). The CoG incorporates processing recovery and operating costs (mining, processing, G&A) and is applied to the diluted grade of each Indicated and Measured block inside the reserves pit. Each of the modifying factors is discussed below.

12.2.1 Mining Dilution and Mining Recovery

Based on reconciliation data for prior resource block models, the Greenbushes operation has historically applied a 95% grade factor and 100% mining recovery to the Mineral Reserves. The 95% grade factor was intended to account for, among other things, external dilution introduced by the mining process. SRK is of the opinion that this 95% grade factor should be applied to all ore blocks and, accordingly, the June 30, 2023 Mineral Reserves adopt this historical factor.

The SRK resource block model includes 2.8% internal dilution for all Indicated resource subblocks (5 m by 5 m by 5 m) inside the reserves pit. Including this internal dilution, the total block dilution is 7.8% (5% + 2.8%) for all blocks. The global mining recovery applied is 93%. The mining recovery is applied by targeting edge blocks that have greater than 2.3% Fe_2O_3. Any blocks above 2.3% Fe_2O_3 are removed from the ore reserves estimation. This results in the removal of approximately 11.4 Mt of edge blocks with high iron content (high iron content in the mill feed is detrimental to processing plant performance).

SRK is of the opinion that these mining dilution and mining recovery adjustments are appropriate for the conversion of Indicated Mineral Resources to Probable Mineral Reserves.

12.2.2 Processing Recovery

Processing recovery is discussed in Section 14 of this report. For the purposes of converting Mineral Resources to Mineral Reserves, three mass yield (MY) equations were applied. The MY estimated by the equations varies depending on the Li_2O% grade of the plant feed.

- The MY equation for reserves processed through the technical grade plant is MY%=26.629 x Li_2O% - 60.455. There is approximately 3.2 Mt of technical grade plant feed at 3.7% Li_2O. The average LoM mass yield for the technical grade plant is 38.0%.
- The MY equation for reserves processed through CGP1 is MY%=9.362 x Li_2O%^1.319, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.5%. The average LoM mass yield for CGP1 is 27.6%.
- The MY equation for CGP2, CGP3 and CGP4 is MY%=9.362 x Li_2O%^1.319 - 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. Recovery is set to zero when the equation result is less than zero. LoM average mass yields for CGP2, CGP3 and CGP4 are 17.7%, 17.9%, and 15.3%, respectively.

Although Greenbushes produces a technical grade product from the current operation, it is assumed that the reserves reported herein will be sold as a chemical grade product. This assumption is necessary because feed for the technical grade plant is currently only defined at the grade control or blasting level. Therefore, it is conservatively assumed that concentrate produced by the technical grade plant will be sold at the chemical grade product price (US$1,383/t of 6% Li_2O concentrate at the mine gate).

12.2.3 Reserves Cut-Off Grade Estimate

The CoG estimation is based on assumptions and actual performance of the Greenbushes operation. Concentrate attributes and production cost inputs to the cut-off calculation are presented in Table 12-3. Recovery of a 6% Li_2O concentrate is based on the previously noted weight recovery calculations from actual operational data.

The basis for the reserves price forecast is discussed in Section 16 of this report. Considering forecast operating costs, predicted mass yield and the forecast sales price, SRK calculated an economic CoG of 0.606% Li_2O. However, based on the internal constraints of the current operations, a nominal 0.7% Li_2O CoG was utilized to report Mineral Reserves.

Drilling, blasting, loading, hauling and mining overhead costs are excluded from the CoG calculation for in situ material because the pit design was guided by economic pit optimization. I.e., only incremental ore mining costs (RoM loader, rehandle from long-term stockpiles, grade control assays, and rock breaking) were considered in the decision whether to send material to the waste dump or to the processing plant. Because an incremental ore mining cost is used in the cut-off grade calculation, the value in Table 12-3 (US$2.67 per tonne of ore) is different from the average full mining cost shown in Table 19-5 (US$5.55 per tonne of ore and waste mined).

The processing recovery is discussed in Section 14 of this report and is summarized in Section 12.2.2 in the text that precedes Table 12-3. The mass yield equation used in the cut-off grade calculation is dependent on the Li_2O% grade as follows:

- Mass yield % = 9.362 x Li_2O%^1.319 - 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%
- Recovery is set to zero when the MY equation result is less than zero

This CoG was applied to both in situ and stockpile material, although SRK notes that stockpiles are generally used to augment other material types for processing during active mining.

It is important to note that the pit optimization process determines the economic potential of the reserves pit, given the costs involved in moving every block inside the optimized pit shell to some location, either a waste dump in the case of a waste block or an ore stockpile in the case of an ore block. For this reason, the mining cost used in the cut-off grade calculation is an incremental ore mining cost rather than the full mining cost.

Table 12-3: Reserves Economic Cut-Off Grade Calculation

Revenue	Units	Value
Cut-Off Grade	Li_2O%	0.606
Mass Yield	t of 6% Li_2O Concentrate	0.03338
Price at Mine Gate	US$/t of 6% Li_2O Concentrate	1,383.00
Total Revenue	**US$/t-RoM**	**46.16**
Costs		
Incremental Ore Mining	US$/t-RoM	2.67
Processing	US$/t-RoM	31.90
G&A	US$/t-RoM	9.24
Sustaining Capital	US$/t-RoM	2.35
Total Cost	**US$/t-RoM**	**46.16**

Source: SRK, 2023

- Mass yield % = 9.362 x Li_2O%^1.319 - 1.5, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. Recovery % = mass yield% x 6 / Li2O%.
- Mass yield varies as a function of grade and may be reported herein at lower mass yields than the chemical grade plant average.
- Incremental ore mining costs include RoM loader, rehandle from long-term stockpiles, grade control assays, and rock breaker. Full mining costs, including drilling, blasting, loading, hauling and overheads are not included in the CoG calculation but were included in the pit optimization and technical economic model. In the QP's opinion this methodology for the cut-off grade calculation is appropriate because the pit limits have been established by economic pit optimization.
- Based on the internal constraints of the current operations, a nominal 0.7% Li_2O CoG was utilized to report Mineral Reserves.
- RoM denotes material that is designated as process plant feed.

12.2.4 Material Risks Associated with the Modifying Factors

In the opinion of SRK as the QP, the material risks associated with the modifying factors are:

- Product Sales Price:
  - The price achieved for sales of spodumene concentrates is forecast based on predicted supply and demand changes for the lithium market on the whole. There is considerable uncertainty about how future supply and demand will change which will materially impact future spodumene concentrate prices. The reserve estimate is sensitive to the potential significant changes in revenue associated with changes in spodumene concentrate prices.
- Mining Dilution and Mining Recovery:
  - The mining dilution estimate depends on the accuracy of the resource model as it relates to internal waste dilution/dikes identification. Due to the spacing of the resource drillholes, it is not possible to identify all of the waste dikes the operation will encounter in the future. SRK studied the historical dilution factors and applied a 3D dilution halo around ore and waste contact blocks. This is accurate as long as the resource model identifies all the waste dikes; however, it is known that this is not always possible with the resource drilling. If an increased number of waste dikes are found in future mining activities, the dilution may be greater than estimated because there will be more ore blocks in contact with waste blocks. This would potentially introduce more waste into the plant feed, which would decrease the feed grade, slow down the throughput and reduce the metallurgical recovery. A potential mitigation would be to mine more selectively around the waste dikes, although this would result in reduced mining recovery.
- Impact of Currency Exchange Rates on Production Cost:
  - The operating costs are modeled in Australian dollars (AU$) and converted to US$ within the cash flow model. The foreign exchange rate assumption for the cash flow model was provided by Albemarle. If the AU$ strengthens, the cash cost to produce concentrate would increase in US$ terms and this could potentially reduce the Mineral Reserves estimates.
- Geotechnical Parameters:

  - Geotechnical parameters used to estimate the Mineral Reserves can change as mining progresses. Local slope failures could force the operation to adapt to a lower slope angle which would cause the strip ratio to increase and the economics of the pit to change.
- Processing Plant Throughput and Mass Yields:
  - The forecast cost structure assumes that the technical grade plant and the two existing chemical grade plants remain fully operational and that the estimated mass yield assumptions are achieved. Moreover, it is assumed that two additional chemical grade plants will be constructed in the future. If one or more of the plants does not operate in the future, the cost structure of the operation will increase. If the targeted mass yield is not achieved, concentrate production will be lower. Both of these outcomes would adversely impact the Mineral Reserves.
  - The mineral reserve is based on the assumption that CGP4 will be placed into production per the current Greenbushes LoM plan. It is noted by the QP that CGP4 is currently considered at a study-level and is subject to approval and permitting, but it is the QP's view that it is using the same technology as CGP3 which has been approved and therefore the QP does not see any technical risk for inclusion in the reserve. Should CGP4 not be approved, this will change the results of the reserve as presented below as the mine plan would need to be adjusted to account for production limits through CGP1, CGP2, and CGP3. This would likely extend the LoM but would present different project economics.

12.3 Summary Mineral Reserves

In the opinion of SRK as the QP, the conversion of Indicated Mineral Resources to Probable Mineral Reserves has been completed in accordance with CFR 17, Part 229 (S-K 1300). Mineral Reserves were estimated based on a spodumene concentrate (6% Li_2O) price of US$1,500/t of concentrate CIF China or US$1,383/t of concentrate at the mine gate. The reserves are based on a reserves pit that was guided by pit optimization. Appropriate modifying factors have been applied as previously discussed. The positive economics of the Mineral Reserves have been confirmed by LoM production scheduling and cash flow modeling as discussed in Sections 13 and 19 of this report, respectively.

Table 12-4 shows the Greenbushes Mineral Reserves as of June 30, 2023.

Table 12-4: Greenbushes Summary Mineral Reserves at June 30, 2023 Based on US$1,383/t of Concentrate Mine Gate – SRK Consulting (U.S.), Inc.

Classification	Type	100% Tonnes (Mt)	Attributable Tonnes (Mt)	Li_2O%	Mass Yield (%)
Probable Mineral Reserves	In situ	145.4	71.2	1.82	19.9%
	Stockpiles	2.9	1.4	2.43	19.9%
	In situ + Stockpiles	148.3	72.6	1.83	19.9%

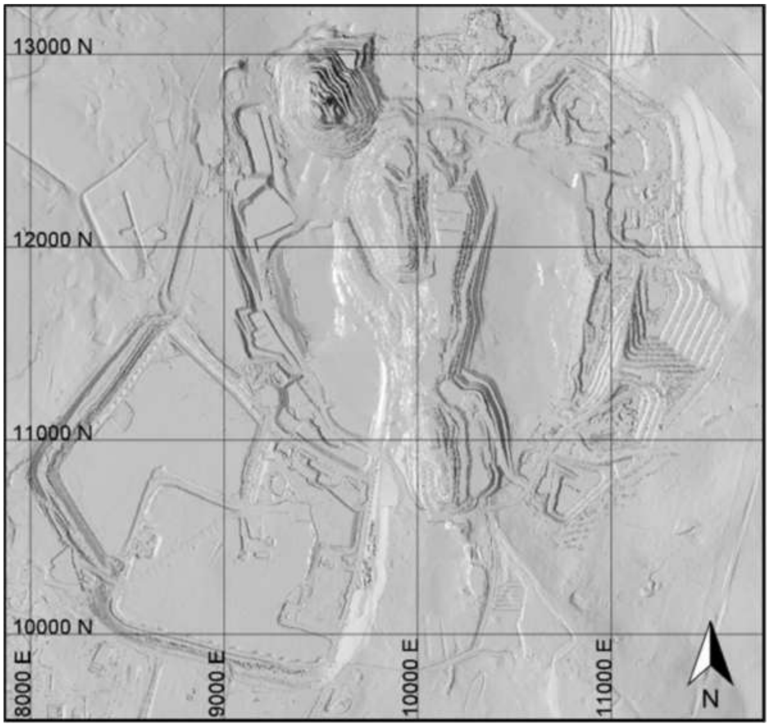
Source: SRK, 2023
Notes to Accompany Mineral Reserve Table

- Albemarle's attributable portion of Mineral Resources and reserves is 49%.
- Mineral Reserves are reported exclusive of Mineral Resources.
- Indicated in situ resources have been converted to Probable Mineral Reserves.
- Indicated stockpile resources have been converted to Probable Mineral Reserves.
- Mineral Reserves are reported considering a nominal set of assumptions for reporting purposes:
  - Mineral Reserves are based on a mine gate price of US$1,383/t of chemical grade concentrate (6% Li_2O).
  - Mineral Reserves assume 93% global mining recovery.
  - Mineral Reserves are diluted at approximately 5% at zero grade for all Mineral Reserve blocks in addition to internal dilution built into the resource model (2.8% with the assumed selective mining unit of 5 m x 5 m x 5 m).
  - The mass yield (MY) for reserves processed through the chemical grade plants is estimated based on mass yield formulas that vary depending on the Li_2O% grade of the plant feed. For CGP1, the formula is MY%=9.362 x Li_2O%^1.319, subject to a 97% recovery limitation when the Li_2O grade exceeds 5.5%. For CGP2, CGP3 and CGP4, the formula is MY%=9.362 x Li_2O%^1.319 - 1.5 subject to a 97% recovery limitation when the Li_2O grade exceeds 5.8%. The weighted average LoM mass yield for the four chemical grade plants is 19.5%.
  - The formula for MY for reserves processed through the technical grade plant is MY%=26.629 x Li_2O% - 60.455 . There is approximately 3.2 Mt of technical grade plant feed at 3.7% Li_2O. The average LoM mass yield for the technical grade plant is 38.0%.
  - Although Greenbushes produces a technical grade product from the current operation, it is assumed that the reserves reported herein will be sold as a chemical grade product. This assumption is necessary because feed for the technical grade plant is currently only defined at the grade control or blasting level. Therefore, it is conservatively assumed that concentrate produced by the technical grade plant will be sold at the chemical grade product price.
  - Derivation of economic CoG for reserves is based on mine gate pricing of US$1,383/t of 6% Li_2O concentrate. The mine gate price is based on US$1,500/t-conc CIF less US$117/t-conc for government royalty and transportation.
  - Costs estimated in Australian Dollars were converted to U.S. dollars based on an exchange rate of 1.00AU$:0.68US$.
  - The economic CoG calculation is based on US$2.67/t-ore incremental ore mining cost, US$31.90/t-ore processing cost, US$9.24/t-ore G&A cost, and US$2.35/t-ore sustaining capital cost. Incremental ore mining costs are the costs associated with the RoM loader, stockpile rehandling, grade control assays and rockbreaker
  - The price, cost and mass yield parameters produce a calculated economic CoG of 0.606% Li_2O. However, due to the internal constraints of the current operations, an elevated Mineral Reserves CoG of 0.7% Li_2O has been applied.
  - The CoG of 0.7% Li_2O was applied to reserves that are constrained by the ultimate pit design and are detailed in a yearly mine schedule.
  - Stockpile reserves have been previously mined and are reported at a 0.7% Li_2O CoG.
- Waste tonnage within the reserve pit is 716.6 Mt at a strip ratio of 4.93:1 (waste to ore – not including reserve stockpiles)
- Mineral reserve tonnage, grade and mass yield have been rounded to reflect the accuracy of the estimate, and numbers may not add due to rounding:
  - Mt = millions of metric tonnes
  - Reserve tonnes are rounded to the nearest hundred thousand tonnes
- SRK Consulting (U.S.) Inc. is responsible for the Mineral Reserves with an effective date: June 30, 2023.

13 Mining Methods

Greenbushes is an operating mine that uses conventional open pit methods to extract Mineral Reserves containing economic quantities of Li_2O to produce both chemical and technical grade spodumene concentrates. Historically there has been both underground and open pit mining at Greenbushes, but the Mineral Reserves and LoM plan are based only on open pit mining.

Figure 13-1 illustrates the current status of the Greenbushes Central Lode open pit.



Source: SRK, 2023

Figure 13-1: Greenbushes Central Lode Pit as of June 30, 2023

3.1 Current Mining Methods

The material encountered at Greenbushes is a combination of weathered material within the first 20 to 40 m with a small transition zone followed by fresh rock. The weathered zone is loosely consolidated sand which can be mined without the need for drilling and blasting. Mineralization is not present in the weathered zone thus drilling for the purposes of ore control and waste classification is not necessary. Sand and historical waste dumps are mined without blasting.

Drilling and blasting are required in all hard rock (both ore and waste). Drilling and blasting services are performed by a contractor. Production drilling is performed with Atlas Copco T45 and D65 drills with hole diameters ranging in diameter from 102 mm to 165 mm depending on material type and application. Blasthole depth is either 10 m or 5 m, depending on the bench height (with additional depth for subdrill). Grade control is performed by reverse circulation (RC) drills rigs that drill 137 mm diameter holes that are sampled on 2.5 m intervals.

Flitch height is variable. Waste is typically mined on a 10 m flitch. Ore is typically mined on 5 m flitches.

A contractor provides all necessary equipment and operating/maintenance personnel for the load and haul operations. The load and haul contractor's current main equipment fleet is shown in Table 13-1. Additional minor equipment not listed in Table 13-1 is operated by the load and haul contractor to support the mining operations.

Table 13-1: Load and Haul Contractor Mining Fleet

Make	Model	Type	No. of Units
Hitachi	EX3600	Excavator	1
Hitachi	EX2600	Excavator	3
Caterpillar	988	Loader	1
Caterpillar	992	Loader	3
Caterpillar	785	Dump Truck (138t)	14
Caterpillar	D10	Dozer	2
Caterpillar	16	Grader	1
Caterpillar	844	Wheel Dozer	1
Caterpillar	854	Wheel Dozer	1
Caterpillar	777	Watercart	1
Caterpillar	336	Excavator w/Rockbreaker	4

Source: Talison, 2023

Ore is taken to the RoM pad where it is stockpiled according to ore type, mineralogical characteristics and grade. Waste is taken to the waste dump to the east of the pits.

3.2 Parameters Relevant to Mine Designs and Plans

13.2.1 Geotechnical

Slope geotechnical design parameters were updated in April 2023 by PSM for the combined Central Lode and Kapanga Pits (PSM, 2023). The combined pit is 430 m below ground surface in Central Lode area and 290 m in the Kapanga area. The pit layout is shown on Figure 13-2.

This figure also indicates the historic underground mining workings in plan view, which are about 200 m below the current C3/Cornwall pit on the north. Data on the exact historic working locations is limited, but the workings are generally limited to the base of oxidation/ weathering. The expectation is the risk of encountering these workings/voids will be limited to the weathered zones. TL has developed a void management plan to manage these operational risks. This is an accepted way to manage void risks.

Additional geotechnical drilling occurred in 2022 where 9 PQ-sized core holes were drilled to an average depth of about 200 m. These oriented core holes were logged for geotechnical characterization parameters. The new characterization data was combined with previous geotechnical data (21 pre-2018 holes, 7-2018, and 15-2019 holes). This provides a substantial characterization database.

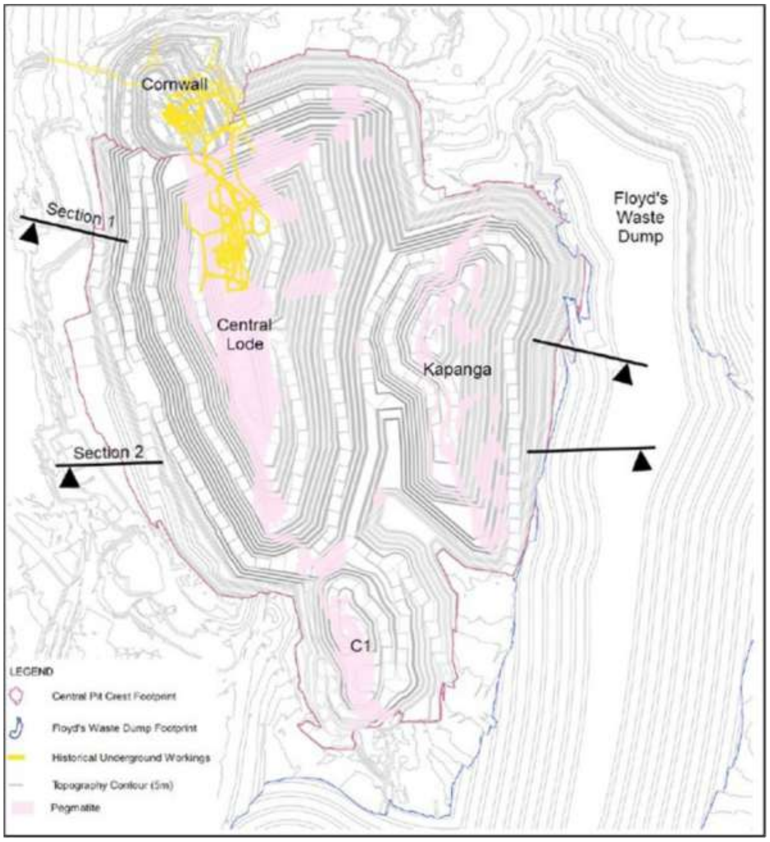
ATV and OTV surveys were conducted in all the drillholes for which about 2,833 defects were measured. Groundwater levels were collected from VWPs installed in four of the drillholes. Laboratory testing consisted of triaxial strength (40 tests), UCS (95 tests), tensile strength (13 tests), discontinuity direct shear strength (65 tests), Atterberg limits (8) and consolidated undrained triaxial strength (14 tests). These tests were conducted on the main rock types of pegmatite, dolerite, amphibolite, and granofels.

Bench face mapping and photogrammetry has been conducted in the pit. Figure 13-3 shows the locations where this mapping has been conducted. This data along with the ATV data has been used to update the structural model of the pit areas and identify major structures and better define the pegmatite zone. Ten structural domains have been identified for which average dip and dip directions of discontinuities were determined (PSM, 2023, Table 11). The discontinuity strength characteristics have been assessed for 8 dominant rock units for which friction values are similar or a little lower than previously estimated (PSM, 2023, Table 13).

Rock mass characteristics have been updated for a total of 10 units. The estimated GSI values (PSM,2023, Table 21) are relatively similar to previously estimated (i.e., some higher and some lower), with the exception of the sheared pegmatite being significantly lower. Hoek-Brown and Mohr-Coulomb strength values have been re-estimated (PSM,2023, Table 22).

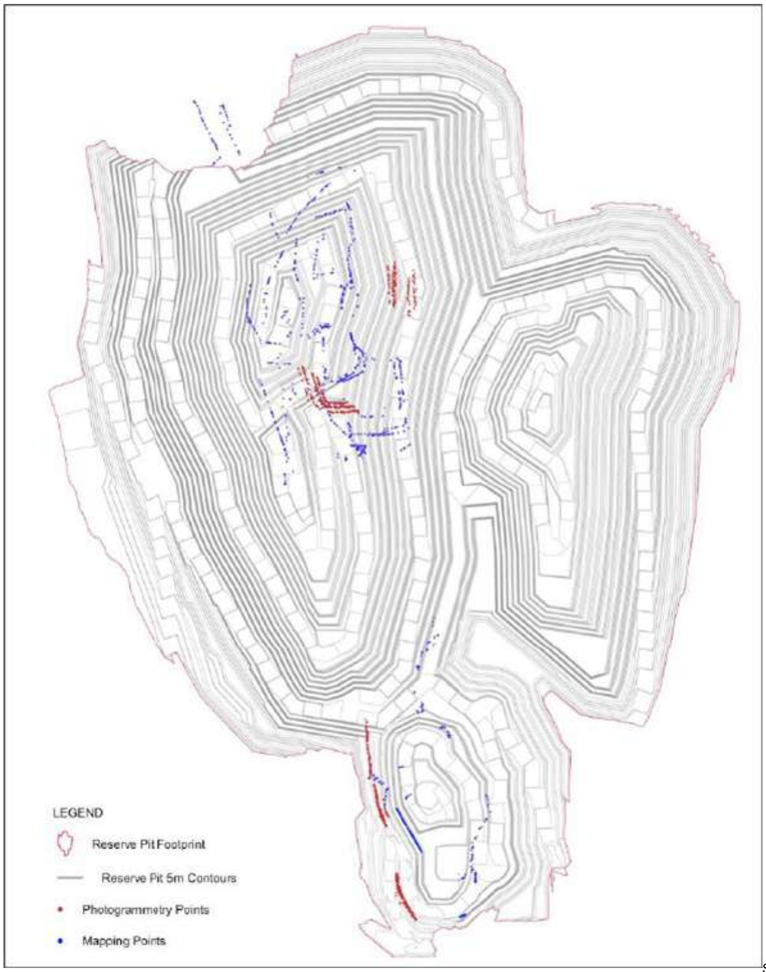
The updated characterization and lab testing data has been used to reassess structural stability and the required geotechnical design parameters. Inter-ramp angles (PSM,2023, Table 25) and bench face angles (PSM, 2023, Table 26) are similar to previous estimates with minor adjustments depending on slope conditions. Limit equilibrium stability analyses for 8 critical sections of the pit slopes have been updated and results (PSM, 2023, Table 27) indicate that predicted safety factors for the updated pit design are above the minimum acceptance value of 1.30. The recommended geotechnical design parameters for each sector of the pit are shown in Figure 13-4. It is noted that the pit design shown in Figures 13-2 through 13-4 is the design that was available at the time of PSM's study. SRK subsequently updated the pit design for the purposes of calculating the mineral reserves that are stated herein.

PSM has provided rockfall mitigation, wall performance monitoring, void management, final wall blasting and ongoing mapping recommendations. The purpose of these measures is to manage risks and identify opportunities for optimization of the pit walls.



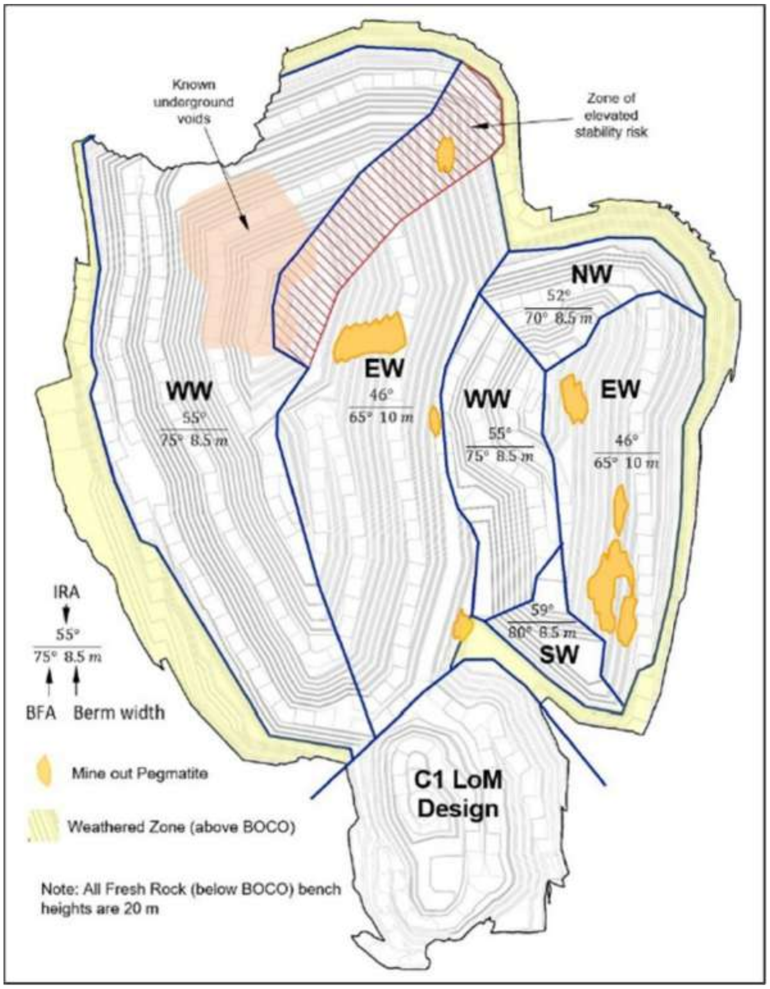
Source: PSM, 2023

Figure 13-2: Locations within the Site Reserve Pit Design where Stability was Assessed



Source: PSM, 2023

Figure 13-3: Locations of Geotechnical Face Mapping and Photogrammetry Data – Site Pit Design



Source: PSM, 2023

Figure 13-4:Recommended Geotechnical Design Parameters for Each Sector of the Pit – Site Pit Design

13.2.2 Ground Water

The low hydraulic conductivity of the resource hosting rocks, and lack of significant aquifer storage, decreases operational concerns for mine dewatering. Dewatering to date has been managed through in-pit sumps and pumping to remove passive groundwater inflow and storm event precipitation. Current passive groundwater inflow to the pit is less than 10 L/s. The inflow estimate for the expansion project requires further improvement. However, there is no anticipation to alter the primary methodology of dewatering (via in pit sumps). Due to the low hydraulic conductivity of the host rocks, pore pressure may be a concern, however this has been adequately managed to date. Based on geotechnical analyses, proposed expansion will not change the appropriateness of the current inflow management strategy within the pit, nor the adequacy based on the current available data.

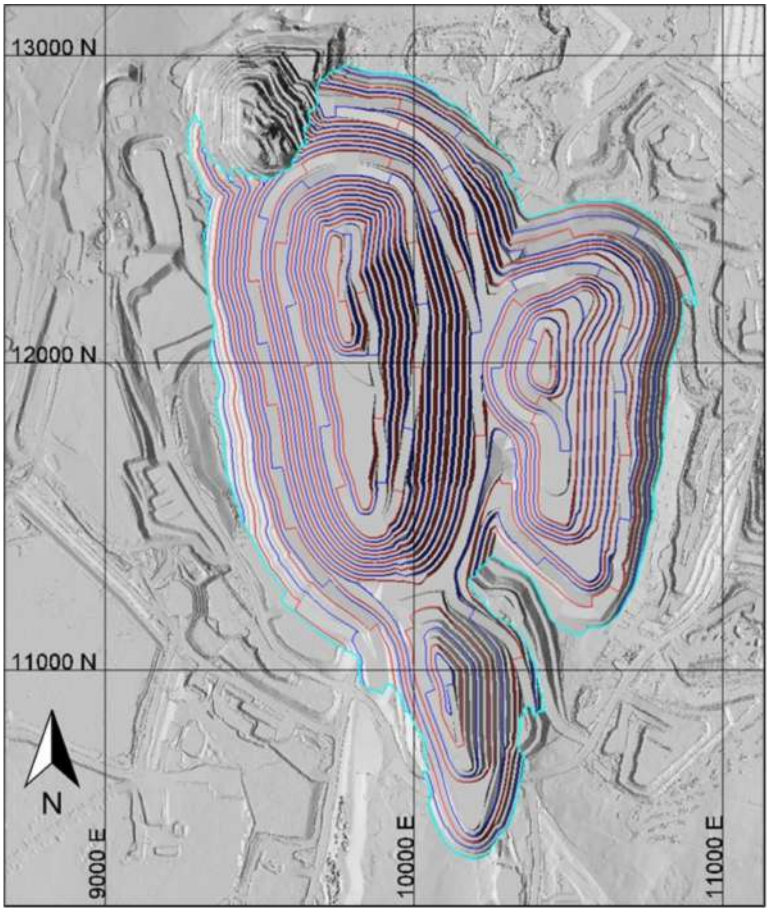
3.3 Mine Design

13.3.1 Pit Design

Pit optimization and design are discussed in detail in Section 12 of this report. The major design parameters used for the open pit are as follows:

- Ramp grade = 10%
- Full ramp width = 30 to 32 m (approximately 3x truck operating width)
- Single ramp width = 20 m for up to 60 m vertical or six benches
- Minimum mining width = 40 m but targets between 100 m to 150 m
- Flat switchbacks
- Bench heights, berm widths and bench face angles in accordance with current site-specific design criteria

Figure 13-5 illustrates the LoM reserves pit design and associated ramp system. Ramp locations targeted saddle points between the various pit bottoms with ramps also acting as catch benches for geotechnical purposes. Each bench has at least one ramp for scheduling purposes.



Source: SRK, 2023

Figure 13-5: LoM Pit Design

Grade Tonnage

Table 13-2 details the grade tonnage at various cut-offs within the reserves pit design. The CoG used for reserves is 0.7 Li_2O%.

Table 13-2: Grade Tonnage Curve within the Reserves Pit (Diluted) – Current Stockpiles and Material with Fe_2O_3 above 2.3% Not Included

Cut-off	Mineralized Material Tonnage (Mt)	Diluted Li_2O%	Diluted Fe_2O_3%
0.30	167.95	1.64	1.19
0.40	160.96	1.70	1.20
0.50	155.58	1.74	1.20
0.60	150.71	1.78	1.20
0.70*	145.39	1.82	1.19
0.80	140.77	1.86	1.19
0.90	135.46	1.90	1.18
1.00	129.39	1.94	1.17
1.10	129.39	1.94	1.17
1.20	115.27	2.04	1.15
1.30	106.77	2.11	1.13
1.40	98.14	2.17	1.12
1.50	89.56	2.24	1.10
1.60	81.10	2.32	1.08
1.70	72.67	2.39	1.06
1.80	64.95	2.47	1.04
1.90	57.87	2.55	1.01
2.00	50.93	2.63	0.99
2.10	50.93	2.63	0.99

Source: SRK 2023
* Cut-off of 0.7% of Li_2O defines the in situ Mineral Reserves. Excludes blocks with Fe_2O_3 above 2.3%

Phase Design Inventory

The ultimate pit has been broken into fourteen mine phases for sequenced extraction in the LoM production schedule. The design parameters for each phase are the same as those used for the ultimate pit including assumed ramp widths. Phase designs were constructed by splitting up the ultimate pit into smaller and more manageable pieces, while still ensuring each bench within each phase has ramp access. The phases have been developed by balancing mining constraints with the optimum extraction sequence suggested by pit optimization results presented previously.

The phases and direction of extraction allow for multiple benches on multiple elevations with a sump always available for pit dewatering. This means that during periods of heavy rainfall, perched benches will be available for extraction.

Once the phases have been designed, solid triangulations are created for each phase as they cut into topography from previous phases. These solid phases are then shelled (cut) on a 10 m lift height. These shells form a bench within each phase and represent the basic unit that is scheduled for the LoM production plan.

Table 13-3 details the phase inventory that formed the basis of the LoM production schedule.

Table 13-3: Phase Inventory (June 30, 2023 to End of Mine Life)

PHASE_ID	Total Mt	Ore Mt [1]	Waste Mt	Inferred Waste Mt	Li_2O% Diluted	FE_2O_3%
PH_01	0.45	0.44	0.00	0.00	3.55	0.49
PH_02	4.65	2.65	1.99	0.01	2.27	1.29
PH_03	15.91	8.32	7.49	0.09	1.94	1.19
PH_04	2.27	1.80	0.47	0.00	2.20	0.85
PH_04B	2.04	0.34	1.70	0.00	1.57	1.52
PH_05	110.16	32.49	77.40	0.27	2.14	1.14
PH_06	97.03	23.32	73.57	0.13	1.81	1.11
PH_07	86.52	13.08	73.23	0.21	1.70	1.10
PH_08	14.82	0.51	14.31	0.00	1.29	1.58
PH_09	32.08	2.37	29.69	0.02	1.36	1.64
PH_10	43.19	3.64	39.51	0.04	1.65	1.52
PH_11	133.57	9.67	123.69	0.22	1.93	1.45
PH_12	22.57	3.43	19.02	0.12	1.96	1.08
PH_13	132.54	15.94	116.56	0.05	1.38	1.42
PH_14	164.22	27.39	136.33	0.50	1.66	1.10
Total	**862.02**	**145.39**	**714.96**	**1.66**	**1.82**	**1.19**

Source SRK, 2023
[1] An additional 2.9 Mt of existing stockpile material as of June 30, 2023, is not included in the phase design

13.4 Mining Dilution and Mining Recovery

Based on reconciliation data for prior resource block models, the Greenbushes operation has historically applied a 95% grade factor and 100% mining recovery to the Mineral Reserves. The 95% grade factor was intended to account for, among other things, external dilution introduced by the mining process. SRK is of the opinion that this 95% grade factor should be applied to all ore blocks and, accordingly, the year-end 2022 Mineral Reserves adopt this historical factor.

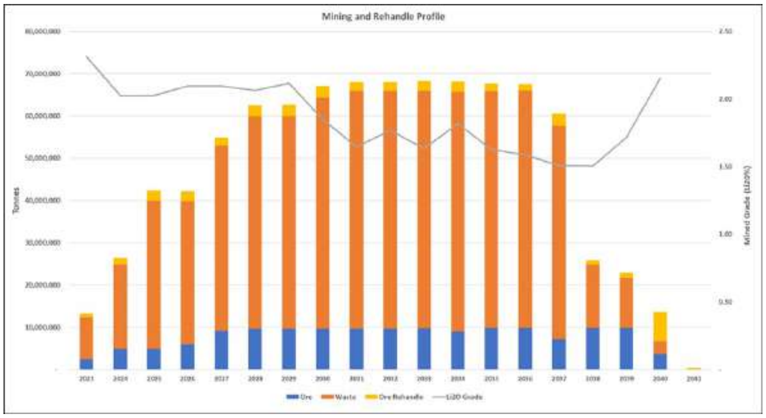
The SRK resource block model includes 2.8% internal dilution for all Indicated resource subblocks (5 m x 5 m x 5 m) inside the reserves pit. Including this internal dilution, the total block dilution is 7.8% (5% + 2.8%) for all blocks. The global mining recovery applied is 93%. The mining recovery is applied by targeting edge blocks that have greater than 2.3% Fe_2O_3. Any blocks above 2.3% Fe_2O_3 are removed from the Mineral Reserves estimation. This results in the removal of approximately 11.4 Mt of edge blocks with high iron content (high iron content in the mill feed is detrimental to processing plant performance).

Recent infill drilling in Kapanga has revealed areas of thinner ore mineralization. SRK employed a 3D dilution estimation for all areas, and the dilution estimation for Kapanga has been increased to account for these thinner mineralization zones. SRK is of the opinion that these mining dilution and mining recovery adjustments are appropriate for the conversion of Indicated Mineral Resources to Probable Mineral Reserves.

13.5 Production Schedule

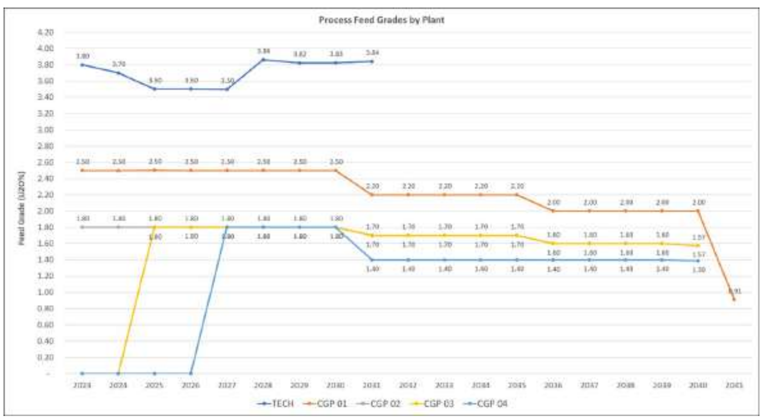
The LoM production is inherently forward-looking and relies upon a variety of technical and macroeconomic factors that will change over time and therefore is regularly subject to change. The schedule is based on June 30, 2023 pit topography, and the mine was scheduled on a quarterly basis for the full LoM timeframe. Bench sinking rates were limited to ten benches per phase per year.

Figure 13-6 through Figure 13-10 show the mine and mill metrics on a yearly basis.



Source: SRK, 2023
LoM values are provided in Table 19-12.

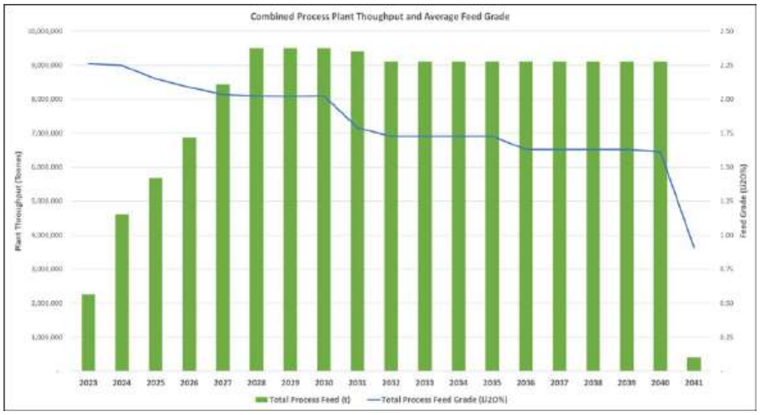
Figure 13-6: Mining and Rehandle Profile



Source: SRK, 2023

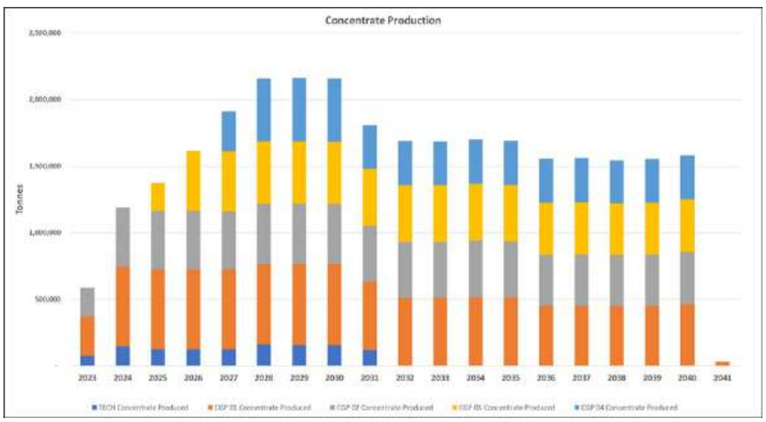
LoM values are provided in Table 19-12.

Figure 13-7: Feed Grade by Plant



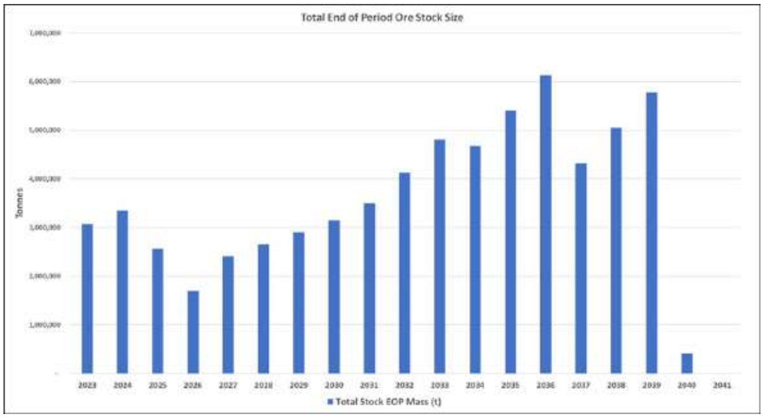
Source: SRK, 2023
LoM values are provided in Table 19-12.

Figure 13-8: Combined Process Plant Throughput and Grade (TECH, CGP1, CGP2, CGP3 and CGP4)



Source: SRK, 2023
LoM values are provided in Table 19-12.

Figure 13-9: Concentrate Production by Plant (TECH, CGP1, CGP2, CGP3 and CGP4)



Source: SRK, 2023
LoM values are provided in Table 19-12.

Figure 13-10: Long-Term Ore Stockpile Size

The LoM production schedule is detailed in Table 13-4.

Table 13-4: LoM Production Schedule – Ex-pit and Mill Concentrate Production

In-Pit RoM Summary	Total	1-Jun-23	1-Jan-24	1-Jan-25	1-Jan-26	1-Jan-27	1-Jan-28	1-Jan-29	1-Jan-30	1-Jan-31	1-Jan-32	1-Jan-33	1-Jan-34	1-Jan-35	1-Jan-36	1-Jan-37	1-Jan-38	1-Jan-39	1-Jan-40	1-Jan-41
		31-Dec-23	31-Dec-24	31-Dec-25	31-Dec-26	31-Dec-27	31-Dec-28	31-Dec-29	31-Dec-30	31-Dec-31	31-Dec-32	31-Dec-33	31-Dec-34	31-Dec-35	31-Dec-36	31-Dec-37	31-Dec-38	31-Dec-39	31-Dec-40	31-Dec-41
RoM (Mt)	145.4	2.5	4.9	4.9	6.0	9.2	9.8	9.8	9.8	9.8	9.8	9.8	9.0	9.9	9.9	7.3	9.9	9.9	3.7	-
RoM Li_2O (%)	1.82	2.32	2.03	2.03	2.10	2.10	2.06	2.12	1.85	1.65	1.77	1.64	1.82	1.63	1.59	1.51	1.51	1.72	2.16	-
Strip Ratio (w:o)	4.93	4.06	4.06	7.16	5.67	4.79	5.15	5.15	5.62	5.77	5.77	5.73	6.35	5.70	5.70	6.96	1.52	1.20	0.77	-
Total Mill Feed Tonnes (Mt) [1]	**148.3**	**2.3**	**4.6**	**5.7**	**6.9**	**8.4**	**9.5**	**9.5**	**9.5**	**9.4**	**9.1**	**9.1**	**9.1**	**9.1**	**9.1**	**9.1**	**9.1**	**9.1**	**9.1**	**0.4**
Mill Feed Li_2O (%)	1.83	2.26	2.25	2.15	2.09	2.04	2.02	2.02	2.02	1.79	1.73	1.73	1.73	1.73	1.63	1.63	1.63	1.63	1.62	0.91
Mill Feed Mass Yield (%)	19.93	25.98	25.71	24.15	23.46	22.67	22.70	22.74	22.69	19.21	18.51	18.47	18.67	18.54	17.05	17.13	16.91	17.04	17.33	8.27
TECH Conc Produced (Kt)	1,199	78	148	125	125	125	162	158	158	120	-	-	-	-	-	-	-	-	-	-
CGP 01 Conc Produced (Kt)	9,368	296	598	598	599	599	603	605	605	513	512	512	515	513	452	451	451	451	462	34
CGP 02 Conc Produced (Kt)	7,365	213	441	441	441	437	454	455	454	418	419	419	422	420	384	386	383	384	393	-
CGP 03 Conc Produced (Kt)	6,593	-	-	209	446	449	464	466	465	427	426	426	431	428	389	394	386	391	396	-
CGP 04 Conc Produced (Kt)	5,021	-	-	-	-	302	474	477	474	330	331	327	334	330	330	331	323	327	330	-

Source: SRK 2023
[1] Includes ex-pit RoM and approximately 2.9 Mt of existing stockpiles.

Bench Sinking Rate

Table 13-5 shows the benches mined from each pit/phase on an annual basis. In SRK's opinion, the sinking rate is reasonable.

Table 13-5: LoM Yearly Bench Sinking Rates (Number of 10-m-High Benches Mined per Phase per Year)

Year	PH_01	PH_02	PH_03	PH_04	PH_05	PH_06	PH_07	PH_08	PH_09	PH_10	PH_11	PH_12	PH_13	PH_14
2023	3.0	4.2	2.4	3.0	4.0	4.0	2.3	-	-	-	-	1.0	-	-
2024	-	1.8	3.3	4.0	2.0	2.0	3.0	-	-	-	-	1.0	-	-
2025	-	-	5.2	-	3.7	-	0.7	4.0	3.0	2.0	2.0	4.0	-	-
2026	-	-	3.1	-	4.4	1.1	1.0	-	-	1.0	1.0	2.0	-	-
2027	-	-	-	-	4.4	1.9	1.6	1.0	-	-	-	1.0	5.0	4.4
2028	-	-	-	-	3.8	-	0.4	4.0	4.0	2.2	2.0	-	1.0	1.6
2029	-	-	2.0	-	5.3	1.0	-	-	2.0	1.8	1.6	1.0	2.0	2.0
2030	-	-	-	-	3.3	8.9	-	-	-	0.8	0.4	8.0	1.0	1.0
2031	-	-	-	-	-	7.5	2.0	-	2.2	2.4	2.0	0.0	1.0	1.0
2032	-	-	-	-	-	3.7	-	-	1.8	6.2	4.2	-	1.0	0.9
2033	-	-	-	-	1.0	6.8	6.0	-	-	0.6	1.8	1.0	5.3	-
2034	-	-	-	-	-	-	5.0	-	-	-	10.2	-	0.7	0.3
2035	-	-	-	-	-	-	10.3	-	-	-	5.8	-	2.0	7.2
2036	-	-	-	-	-	-	5.7	-	-	-	-	-	10.0	2.9
2037	-	-	-	-	-	-	3.0	-	-	-	-	-	5.0	10.3
2038	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1
2039	-	-	-	-	-	-	-	-	-	-	-	-	-	5.4
2040	-	-	-	-	-	-	-	-	-	-	-	-	-	5.8

Source: SRK 2023

13.6 Waste Dump Design

Waste for the final pit will be distributed between the main dump to the east of the pits (East Dump), the southern pit backfill and the Kapanga pit backfill. The current East Dump design has a final slope angle of 11 to 12° overall. This is to support concurrent reclamation to final configuration. The pit backfill dumps have been assumed to be dumped at steeper angles and can then be dozed into the pit bottom to achieve desired reclaimed slope angles.

SRK has designed the waste dump to match the waste volumes in the LoM production schedule. Table 13-6 shows the volumetrics including the 27% compacted swell factor. Figure 12-5 in Section 12 of this report shows the final waste dump design and location in relation to the open pit. In the future it is possible that part of the waste dump will need to be relocated due to potential additional resources within its footprint.

Table 13-6: Waste Dump Capacities

Dump	Capacity
	Loose Million Cubic Meters (27% Swell Factor Compacted)
East Waste Dump	199.8
South Pit Backfill	46.7
Kapanga Pit Backfill	75.2
Total	**321.7**

Source: SRK 2023

14 Processing and Recovery Methods

Greenbushes currently has two ore crushing facilities (CR1 and CR2) and three ore processing plants which includes the Technical Grade Plant (TGP), Chemical Grade Plant-1 (CGP1) and Chemical Grade Plant-2 (CGP2) with a nominal capacity of 4.5 Mt/y of pegmatite feed to produce a nominal 1.3 Mt/y of spodumene concentrates (chemical and technical grades). This section provides a discussion of the operation and performance of the CR1, CR2, TGP, CGP1 and CGP2. In addition, Greenbushes is currently constructing Chemical Grade Plant-3 (CGP3), which is based on the CGP2 design. CGP3 is scheduled to come on-line during Q1 2025. Greenbushes also has plans to construct Chemical Grade Plant-4 (CGP4), which will also be based on the CGP2 design. CGP4 is currently planned to commence production during Q1 2027.

4.1 Technical Grade Plant (TGP)

TGP is a relatively small plant that processes approximately 350,000 t/y of ore at an average grade of about 3.8% Li_2O and produces about 150,000 t of spodumene concentrate products. The TGP produces a variety of product grades identified as SC7.2, SC6.8, SC6.5 and SC5.0 (specifications for each grade are presented in Section 14.8). There are two sub-products for SC7.2 designated as Premium and Standard, and these products carry the SC7.2P and SC7.2S designation. TGP can be operated in two different production configurations as shown in Figure 14-1. When operating in configuration 1 TGP produces SC7.2, SC6.8 and SC5.0 products. Configuration-1 can be split into two subsets, producing either SC7.2P or SC7.2S. When operating in configuration 2, the coarse processing circuit (SC5.0 circuit) and flotation concentrate circuit are combined to produce SC6.5 and SC6.8 products. All products, with the exception of SC6.8 are shipped in 1,000 kg bags or in bulk. SC6.8 is shipped only in 1,000 kg bags

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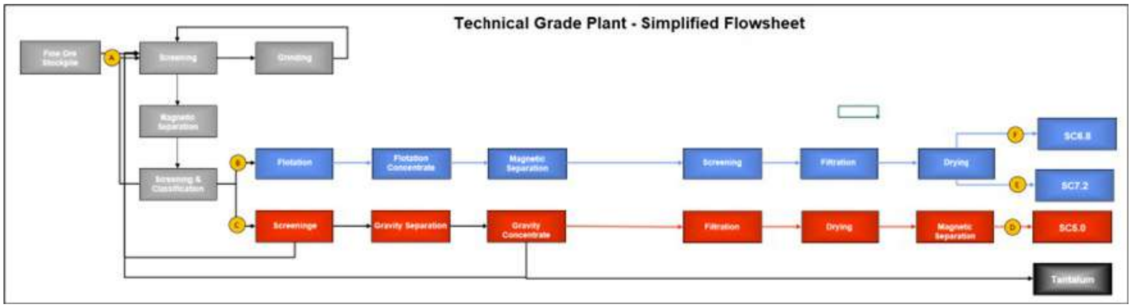


Source: Greenbushes 2023

Blue Represents Configuration-1 and Blue + Red Represents Configuration 2

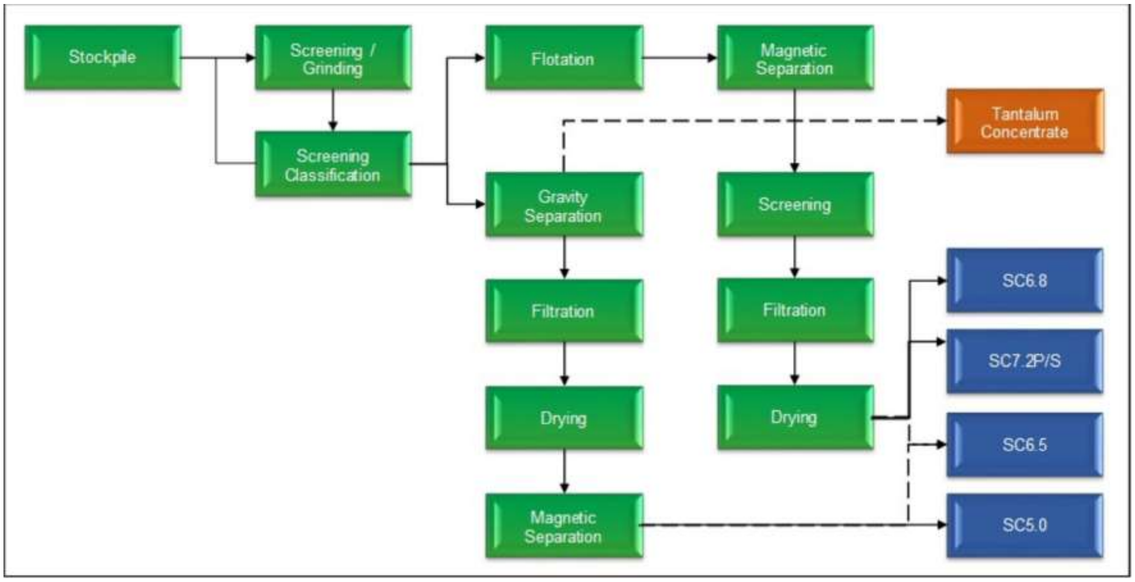
Figure 14-1: Simplified TGP Flowsheet

TGP has a current maximum sustainable feed rate of 50 dry tonnes per hour if maximum production for SC5.0 is required (configuration 1) and a maximum feed rate of 35 dry tonnes per hour if the SC5.0 circuit is off-line (configuration 2).

Feed to TGP is defined primarily by Li_2O grade and the iron grade that will achieve the final product iron quality specification for SC7.2. The iron grade for the plant feed is governed by mineralogy and is modeled using oxides of manganese, calcium, potassium, sodium and lithium in plant feed.

The TGP process flowsheet is shown in Figure 14-2 and incorporates the following unit operations:

- Crushing
- Grinding
- Classification
- Flotation
- Magnetic separation
- Filtration
- Drying



Source: Greenbushes, 2023

Figure 14-2: TGP Process Flowsheet

14.1.1 Crushing

TGP ore is crushed in crushing plant-1 (CR1), which serves both TGP and CGP1. The CR1 crushing plant is discussed in Section 14.2.

14.1.2 Grinding and Classification Circuit

TGP feed is blended with a front-end loader and fed by conveyor to a primary screen. Oversize from the screen is fed into a ball mill with the ball mill discharge reporting back to the primary screen fitted with a 3 mm screen. The +3 mm screen fraction is returned to the ball mill and the -3 mm fraction is subjected to low intensity magnetic separation to remove iron mineral contaminants, which are discarded to tailings. The nonmagnetic fraction is screened at 0.7 mm with Derrick Stacksizers. The -3 mm +0.7 mm fraction is recirculated back to the grinding circuit and the -0.7 mm fraction is advanced to the hydraulic classification circuit. The classifier underflow is processed in the coarse processing circuit and the classifier overflow is advanced to the fine processing circuit.

14.1.3 Coarse Processing Circuit

The coarse classifier underflow is advanced to the coarse processing circuit where it is first deslimed and then processed through a spiral gravity circuit to produce a rougher tantalum gravity concentrate that is further upgraded on shaking tables to produce a final tantalum gravity concentrate. The gravity circuit tailings are screened at 0.8 mm on a safety screen and then dewatered with hydrocyclones and filtered on a horizontal belt filter to produce the SC5.0 product (glass grade product). The SC5.0 product is then dried in a fluid bed dryer and then subjected to a final stage of magnetic separation to remove any remaining iron contaminants. The final SC5.0 product is then conveyed to a 180 t storage silo pending packaging and shipment. It should be noted that the coarse processing circuit is operated only to fill market demand for the SC5.0 product and can be bypassed when SC5.0 production is not required.

14.1.4 Fines Processing Circuit

The classifier overflow is advanced to the fines processing circuit where it is first deslimed and then subjected to two stages of reagent conditioning prior to spodumene rougher flotation. The spodumene rougher flotation concentrate is further upgraded with two stages of cleaner flotation. The spodumene cleaner flotation concentrate is then attritioned and processed through both low intensity magnetic separation (LIMS) and wet high intensity magnetic separation (WHIMS) to remove iron mineral contaminants. The nonmagnetic spodumene concentrate is filtered on a horizontal belt filter and then dried in a fluid bed drier. Dried concentrate from the lower portion of the fluid bed drier is final SC7.2 product which is conveyed to a 250 t storage silo pending packaging and shipment. The fine fraction that discharges from the upper portion of the fluid bed drier is classified in an air classifier. The classifier underflow is the SC6.8 product, which is conveyed to a storage silo. The air classifier overflow is captured in a baghouse and subsequently recycled back to the process.

14.1.5 Control Philosophy

A process control system (PCS) provides an operator interface with the plant and equipment. A programmable logic controller (PLC) and operator workstations communicate over a fiber optic Ethernet link and are linked to the workstations in CGP1. The PCS controls the process interlocks, and PID control loop set-point changes are made at the operator interface station (OIS). Local control stations are located in the field proximal to the relevant drives. The OIS' allow drives to be selected to local or remote via the drive control popup. Statutory interlocks such as emergency stops are hardwired and apply in all modes of operation.

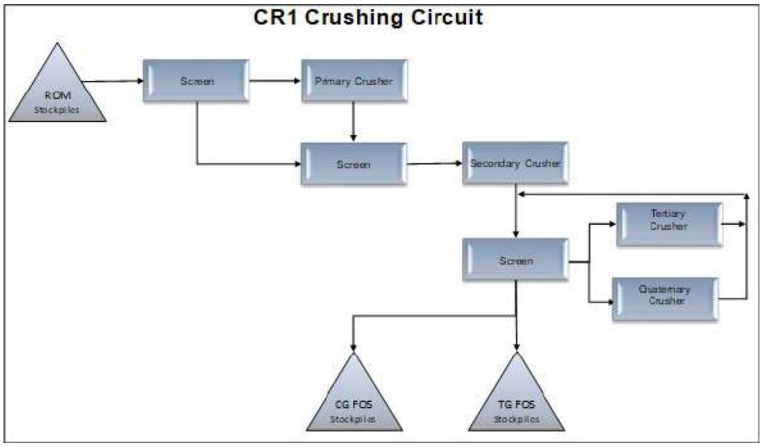
14.2 Chemical Grade Plant-1 Crushing and Processing Plants

The Chemical Grade Plant-1 (CGP1) process flowsheet includes the following major unit operations to produce chemical grade spodumene concentrates:

- Crushing
- Grinding and classification
- Heavy media separation
- WHIMS
- Coarse mineral flotation
- Regrinding
- Regrind coarse mineral flotation
- Fine mineral flotation
- Concentrate filtration
- Final tailings thickening and storage at the TSF

14.2.1 Crushing Circuit (CR1)

CR1 provides crushed ore to both the TGP and CGP1. The CR1 flowsheet is shown in Figure 14-3. RoM ore is delivered from the mine to the RoM storage bin. Ore is drawn from the RoM bin using a variable speed plate feeder that feeds a vibrating grizzly with bars spaced at 125 mm. The +125 mm grizzly oversize fraction reports to a Metso C160 primary jaw crusher, where it is crushed before recombining with the -125 mm grizzly undersize on the crusher discharge conveyor. The crusher discharge conveyor conveys the crushed ore to a second vibrating grizzly. The grizzly oversize fraction is fed to the secondary crusher. The grizzly undersize fraction and the secondary crusher discharge are combined and then conveyed to a double-deck banana screen. The oversize from the top deck is conveyed to a tertiary cone crusher which is operated in closed circuit with the banana screen. The oversize from the bottom deck is conveyed to two quaternary cone crushers which are also operated in closed circuit with the banana screen. The -12 mm bottom deck screen undersize is the final crushed product, which is conveyed to a 4,200 t (live capacity) fine ore stockpile (FOS). A weightometer is installed ahead of the FOS feed conveyor to monitor and record the crushing plant production rate and overall tonnage of crushed ore delivered to the FOS. The crushing circuit is controlled from a dedicated LCR located within the main crushing building.

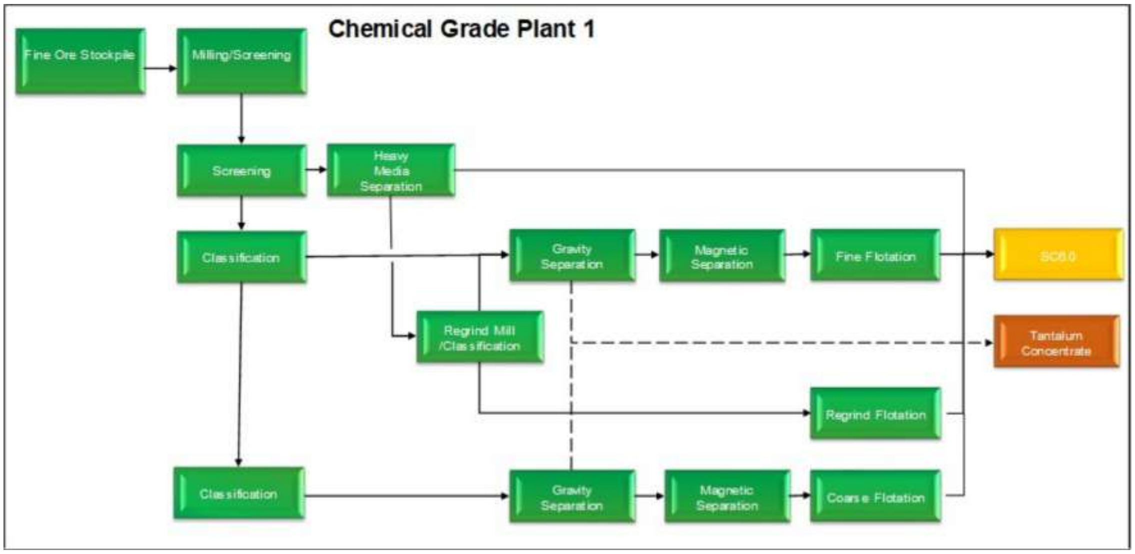


Source: Greenbushes, 2023

Figure 14-3: CR1 Crushing Plant Flowsheet

14.2.2 Chemical Grade Plant-1 (CGP1)

CGP1 has been upgraded over the years to a design capacity of 2 Mt/y. During 2022 CGP1 processed almost 1.8 million tonnes of ore at a grade of 2.69% Li_20 and recovered 72.1% of the contained lithium into final concentrates that averaged 6.0% Li_2O. During the first six months of 2023 CGP1 processed 881,032 t of ore at a grade of 2.70% Li_2O and recovered 75.4% of the contained lithium into a final concentrate that averaged almost 6.0% Li_2O. CGP1 produces concentrates from heavy media separation (HMS), coarse flotation and fine flotation circuits which are combined as a single product. A simplified flowsheet for CGP1 is shown in Figure 14-4.



Source: Greenbushes, 2023

Figure 14-4: CGP1 Process Flowsheet

Grinding and Classification

Plant feed is conveyed to the grinding circuit and is first screened on the primary vibrating screen. The screen oversize feeds a 3.6 m diameter x 4.06 m long ball mill which is operated in closed circuit with the primary screen. The screen undersize is then advanced to the primary screening circuit that consists of four five-deck Derrick Stacksizers. The Stacksizers serve to classify the ground ore into four size fractions. The coarsest fraction is processed in the HMS circuit, and the intermediate size fractions are processed by WHIMS followed by hydro-classification and then very coarse and coarse flotation. The fine screen fraction is processed by WHIMS and fine flotation. The screen undersize is too fine to process and is disposed of in the TSF. Several stages of classification throughout the flowsheet serve to remove the very fine fraction (slimes) that would otherwise interfere with the process.

HMS Circuit

The coarsest size fraction is processed in an HMS cyclone at a slurry feed specific gravity of about 2.55 which is adjusted with ferrosilicon to the correct specific gravity. The high specific gravity sink product is screened and washed to remove residual ferrosilicon and then filtered on a horizontal vacuum filter. The HMS float product is advanced to the regrind circuit for further processing.

WHIMS and Coarse Flotation

The intermediate-coarse screen fraction is processed by WHIMS to remove magnetic contaminants. The magnetic fraction is waste and sent to the TSF thickener. The nonmagnetic fraction is classified into coarse and very coarse fractions which are processed in separate flotation circuits to recover spodumene flotation concentrates, which are then filtered on horizontal vacuum filters as finished concentrate. The tailings from both the coarse and very coarse flotation circuits are advanced to the regrind circuit for further processing.

WHIMS and Fine Flotation

The intermediate-fine screen fraction is processed by WHIMS to remove magnetic contaminants. The magnetic fraction is waste and sent to the tailing thickener and then to the TSF. The nonmagnetic fraction is processed in a fine flotation circuit to recover spodumene flotation concentrate, which is then filtered as finished concentrate. The fine flotation tailing is waste and is sent to the tailing thickener and then to the TSF.

Regrinding and Regrind Flotation

The HMS float product and coarse and very coarse flotation tailings are reground and then classified into two size fractions. The coarse size fraction is processed in the regrind flotation circuit to produce a finished flotation concentrate which is then filtered and stockpiled in the concentrate storage bin. The regrind flotation tailing is recycled back to the regrind ball mill. The fine size fraction is processed in the fine flotation circuit. The fine flotation concentrate is filtered and sent to the concentrate storage bin. The fine flotation tailing is a waste product which is thickened and disposed of in the TSF.

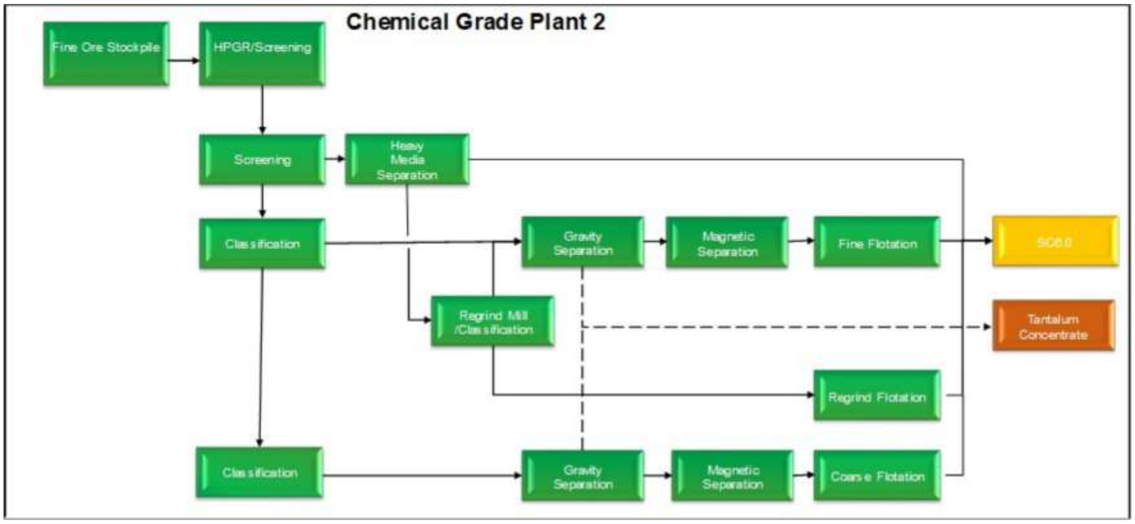
Tailings Thickening

Tailings are thickened and the thickener underflow is pumped to the TSF, and thickener overflow is recycled as process water back to the process.

14.3 Chemical Grade Plant-2 Crushing and Processing Plants

Crushing Plant-2 (CR2) was commissioned during 2019 and 2020 to provide crushed ore to CGP2, which was also commissioned during this same time period. CGP2 was designed to process 2.4 Mt/y of ore at an average grade of 1.7% Li_2O to produce final concentrates containing 6% Li_2O and meet the specification for Greenbushes' SC6.0 product. The flowsheet is very similar to CGP1 but was designed with a number of modifications based on HPGR (high pressure grinding rolls) comminution studies and CGP1 operational experience. A schematic flowsheet for CGP2 is shown in Figure 14-5. The most notable modifications include:

- Replacement of the ball mill grinding circuit with HPGRs
- Plant layout to simplify material flow and pumping duties
- Orientation of the HMS circuit to allow the sink and float products to be conveyed to the floats WHIMS circuit and sinks tantalum circuit
- Locating the coarse flotation circuits above the regrind mill to allow flow steams to gravity feed directly into the mill
- Orientation of the fines flotation cells in a staggered arrangement to allow the recleaner and cleaner flotation tails to flow by gravity into the cleaner and rougher cells, respectively
- Orientation of the concentrate filtration circuit to allow the sinks to be conveyed to the sinks filter
- Provision for sufficient elevation for the deslime and dewatering cyclone clusters to gravity feed to the thickener circuits located at ground level



Source: Greenbushes, 2023

Figure 14-5: CGP2 Process Flowsheet

14.3.1 Crushing Plant-2 (CR2)

Ore is crushed to 80% passing (P80) 25 mm in a two-stage crushing circuit with a nominal feed capacity of 500 t/h, sufficient to crush 2.4 Mt/y on a 4,800 hours/y schedule, which allows for additional crushing capacity if it is needed. RoM ore is truck-hauled to the RoM pad and is stored next to the RoM bin in separate stockpiles of varying ore types and grades to facilitate blending of the feed into the crushing plant.

The RoM bin is fed from the various ore stockpiles with a front-end loader and is protected by a grizzly with bars on a 670 mm spacing. A dedicated rock breaker is provided to break grizzly oversize material. Feed to the RoM bins is controlled by a "dump–no dump" traffic signal mounted on the RoM pad adjacent to the RoM bin. The traffic signal is controlled by a level sensor mounted above the RoM bin and by the crusher operator.

Ore is drawn from the RoM bin using a variable speed apron feeder which feeds a vibrating grizzly with grizzly bars on a 100 mm spacing. The +100 mm grizzly oversize fraction reports to a Metso C160 primary jaw crusher, where it is crushed and combined with the grizzly undersize on the crusher discharge conveyor.

The primary crushed ore is then screened on a double-deck banana screen. The screen oversize fractions are conveyed to the secondary feed bin which feeds the secondary cone crusher. The undersize fraction (P80 25 mm) is conveyed to the fine ore stockpile ahead of the HPGR circuit. The fine ore stockpile has a "live" capacity of 7,200 t and total capacity of approximately 56,000 t. A weightometer is installed ahead of the fine ore stockpile to monitor and record the crushing plant production rate and overall tonnage of crushed ore delivered to the fine ore stockpile. The crushing circuit is controlled from a dedicated LCR controller located within the main crushing building.

14.3.2 Chemical Grade Plant-2 (CGP2)

<u>HPGR Circuit</u>

The HPGR circuit is fed from the fine ore stockpile by a single reclaim conveyor and conveyed to HPGR feed bins via a series of transfer conveyors. Two HPGR's are installed in a duty/standby configuration. HPGR feed rate is measured by a weightometer on the HPGR feed transfer conveyor and is controlled to a set-point by independently varying the speed of the reclaim feeders. The HPGR product reports to the primary screens where the ore is separated into screen undersize, which enters the wet plant, and oversize which is recycled back to the HPGR. The HPGR circuit serves to crush the ore to -3 mm prior to processing in CGP2

<u>Plant Feed Preparation</u>

The -3 mm HPGR product is advanced to the primary screening circuit that consists of five-deck Derrick Stack Sizers. The stack sizers serve to screen the HPGR product into four size fractions. The coarsest screen fraction is processed in the HMS circuit, the intermediate size fractions are processed by WHIMS followed by hydro-classification and very coarse and coarse flotation. The fine screen fraction is processed by WHIMS and fine flotation. The screen undersize is too fine to process and is disposed of in the TSF.

HMS Circuit

The coarsest size fraction is processed in an HMS cyclone at a slurry feed specific gravity of about 2.55, which is adjusted with ferrosilicon to the correct specific gravity. The HMS sink product is further processed by WHIMS. The nonmagnetic WHIMS product is finished concentrate and is screened and washed to remove residual ferrosilicon and then filtered on a horizontal vacuum filter. The HMS float product is processed by WHIMS and advanced to the regrind circuit for further processing.

WHIMS and Coarse Flotation

The intermediate-coarse size fraction is processed by WHIMS to remove iron contaminants. The magnetic fraction is waste and sent to the TSF thickener. The nonmagnetic fraction is classified into coarse and very coarse fractions which are processed in separate flotation circuits to recover spodumene flotation concentrates. The flotation concentrates are filtered on horizontal vacuum filters and stockpiled in the concentrate storage bin. The tailings from both the coarse and very coarse flotation circuits are advanced to the regrind circuit for further processing.

Regrinding and Regrind Flotation

The HMS float product and the coarse and very coarse flotation tailings are reground and then classified into two size fractions. The coarse size fraction is processed in the regrind flotation circuit to produce a finished flotation concentrate which is then filtered and stockpiled in the concentrate storage bin. The regrind flotation tailing is recycled back to the regrind ball mill. The fine size fraction is processed in the fine flotation circuit.

WHIMS and Fine Flotation

The intermediate-fine size fraction is processed by WHIMS to remove iron contaminants. The magnetic fraction is waste and sent to the tailing thickener and then to the TSF. The nonmagnetic fraction is processed in a fine flotation circuit to recover spodumene flotation concentrate, which is then filtered as finished concentrate. The fine flotation tailing is waste and is sent to the tailing thickener and then to the TSF.

Tailings Thickening

Tailings are thickened and the thickener underflow is pumped to the TSF, and thickener overflow is recycled as process water back to the process.

14.4 CGP1 and CGP2 Mass Yield and Recovery Projection

Greenbushes has developed mass yield models for both CGP1 and CGP2 which are used to predict concentrate mass yield and lithium recovery, based on ore grade, into concentrates containing 6% Li_2O. The mass yield models were developed from an analysis of CGP1 plant performance at different feed grades. Greenbushes' Yield % model for CGP1 is given as:

CGP1 Yield Model

$$\text{Yield \%} = 9.362 * (\text{Plant Feed } Li_2O\%)^{1.319}$$

Greenbushes' yield model for CGP2 is based on the CGP1 yield model but includes provision for additional lithium recovery based on the use of HPGR's for plant feed comminution as opposed to ball mill grinding as practiced in CGP1. The provision for incrementally higher lithium recovery in

CGP2 is based on a metallurgical evaluation conducted by Greenbushes and the expectation that fewer unrecoverable fines will be generated during comminution with an HPGR compared to ball mill grinding. Greenbushes' Yield % model for CGP2 is given as:

CGP2 Yield Model

Yield % = 9.362 * (Plant Feed Li_2O%) $^{1.319}$ + (0.82 * Plant Feed Li_2O%)

Predicted mass yield and lithium recoveries versus ore grade are shown Table 14-1 for both CGP1 and CGP2 (assuming final concentrate grade of 6% Li_2O). At the average planned feed grade of 2.5% Li_2O, the mass yield for CGP1 is estimated at 31.4% and lithium recovery is estimated at 75.2%. At the design feed grade of 1.7% Li_2O for CGP2 the mass yield for is estimated at 20.2% and lithium recovery is estimated at 71.5%.

Table 14-1: CGP1 and CGP2 Model Yield and Li_2O Recovery vs. Feed Grade

Feed Li_2O%	CGP1		CGP2	
	Yield (%)	Li_2O Recovery (%)	Yield (%)	Li_2O Recovery (%)
0.5	3.8	45.0	4.2	49.9
0.6	4.8	47.7	5.3	52.6
0.7	5.8	50.1	6.4	55.1
0.8	7.0	52.3	7.6	57.2
0.9	8.1	54.3	8.9	59.2
1.0	9.4	56.2	10.2	61.1
1.1	10.6	57.9	11.5	62.8
1.2	11.9	59.5	12.9	64.5
1.3	13.2	61.1	14.3	66.0
1.5	16.0	63.9	17.2	68.8
1.6	17.4	65.3	18.7	70.2
1.7	18.9	66.5	20.2	71.5
1.8	20.3	67.8	21.8	72.7
1.9	21.8	68.9	23.4	73.9
2.0	23.4	70.1	25.0	75.0
2.1	24.9	71.2	26.6	76.1
2.2	26.5	72.2	28.3	77.2
2.3	28.1	73.3	30.0	78.2
2.4	29.7	74.3	31.7	79.2
2.5	31.4	75.2	33.4	80.2
2.6	33.0	76.2	35.1	81.1
2.7	34.7	77.1	36.9	82.0
2.8	36.4	78.0	38.7	82.9
2.9	38.1	78.9	40.5	83.8
3.0	39.9	79.7	42.3	84.7

Source: Greenbushes and SRK, 2023

14.5 TGP Performance

TGP performance for the period 2017 - 2023 (Jan-Jun) is summarized in Table 14-2. During this period ore tonnes processed ranged from 343,760 to 373,643 t (excluding 2020 production which was impacted by COVID) and ore grades ranged from 3.72% to 3.96% Li_2O. Overall lithium recovery ranged from 69.8% to 75.1% into six separate products (SC7.2-Standard, SC7.2-Premium, SC6.8, SC6.5, SC6.0 and SC5.0). Overall mass yield during this period ranged from 38.4% to 44.9%. Mass yield and lithium recovery are estimated based on mass yield and recovery equations developed by SRK from actual production, which are given as follows:

Li_2O Recovery = 16.116 * Li_2O% - 10.387 (R^2 = 0.6582)

Mass Yield = 26.692 * Li_2O – 60.455 (R^2 = 0.9745)

As shown in Table 14-2, there is good agreement between actual and estimated lithium recoveries. The TGP lithium mass yield and recovery equations have been used in resource and reserve modeling to provide estimates of TGP mass yield and lithium recovery at various ore grades in the mine plan.

Table 14-2: Production Summary for the Technical Grade Plant (TGP)

TGP	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023 (Jan - Jun)**
Feed Tonnes	343,760	363,462	373,643	232,055	354,075	370,893	183,894
Feed (Li_2O%)	3.96	3.93	3.75	3.72	3.88	3.94	3.84
Concentrate Tonnes							
SC7.2 - Standard	42,063	56,919	56,387	37,470	43,146	52,995	16,864
SC7.2 - Premium	35,808	26,621	23,164	13,349	28,749	32,518	6,587
SC6.8	12,340	13,380	11,063	9,115	13,156	14,762	4,615
SC6.5	12,718	14,183	14,532	14,536	21,381	3,266	1,686
SC6.0	6,190	1,322	849	257	917	12,549	28,753
SC5.0	45,200	47,735	40,529	14,478	46,757	47,244	19,302
Total Concentrate	**154,319**	**160,160**	**146,524**	**89,205**	**154,106**	**163,334**	**77,807**
Avg. Conc.(Li_2O%)	6.62	6.64	6.68	6.94	6.55	6.49	6.47
Mass Yield (%)	44.9	44.1	39.2	38.4	43.5	44.0	42.3
Li_2O Recovery (%)	75.1	74.5	69.8	71.6	73.4	72.5	71.3
Model Yield (%)	45.0	44.2	39.4	38.6	42.9	44.5	41.8
Model Recovery (%)	74.2	73.7	70.8	70.3	72.9	73.9	72.3

Source: Greenbushes Physical Report: 2017 - 2023

14.6 CGP1 Performance

The performance of CGP1 for the period 2016 to 2023 (Jan-Jun) is summarized in Table 14-3. Ore tonnes processed during this period ranged from 1.18 Mt to 1.83 Mt with ore grades ranging from 2.46 to 2.70% Li_2O. During 2022 CGP1 processed 1.79 Mt of ore at an average grade of 2.69% Li_2O with 72.1% of the contained lithium recovered into concentrates averaging 6.05% Li_2O. During 2023 (Jan -Jun) CGP1 processed 881,032 t of ore at an average grade of 5.95% Li_2O and recovered 75.4% of the contained lithium into concentrates averaging 5.95% Li_2O. CGP1 plant performance is also compared to Greenbushes' yield model for CGP1 in Table 14-3. Greenbushes' CGP1 yield model provides an estimate of plant performance and is used in resource and reserve modeling to provide estimates of mass yield and lithium recovery at various ore grades in the mine plan. SRK notes that during 2021 and 2022 Greenbushes' yield model over predicted mass yield by about 2%. This may be due to the impact of processing of weathered ore during this period.

Table 14-3: Summary of CGP1 Production

Year	Ore		Concentrate		Li_2O Recovery (%)		Yield (%)	
	Tonnes	$Li_2O\%$	Tonnes	$Li_2O\%$	Actual	Model	Actual	Model [1]
2016	1,184,572	2.51	355,199	6.08	72.7	76.3	30.0	31.5
2017	1,652,259	2.46	492,151	6.04	73.2	75.4	29.8	30.7
2018	1,817,853	2.49	563,883	6.04	75.3	75.6	31.0	31.2
2019	1,659,148	2.70	565,438	6.05	77.0	77.8	34.1	34.7
2020	1,401,625	2.51	435,772	6.06	74.9	76.1	31.1	31.5
2021	1,834,719	2.57	570,343	6.08	73.4	76.9	31.1	32.5
2022	1,795,316	2.69	574,876	6.06	72.1	77.8	32.0	34.5
2023 (Jan - Jun)	881,032	2.70	301,271	5.95	75.4	76.5	34.2	34.7

Source: Greenbushes, 2022
[1] Yield % = $9.362*Li_2O\%^{\wedge}1.319$

14.7 CGP2 Performance

CGP2 commissioning began during September 2019 and continued through April 2020 and was then shut down and put on care and maintenance during the period of March 2020 to April 2021 due to market demand considerations. CGP2 was then put back into production during May 2021 and has operated continuously since then. CGP2 performance during 2021 (May-Dec), 2022 and 2023 (Jan-Jun) is summarized in Table 14-4 and compared with Greenbushes' yield model for CGP2 and SRK's revised model (discussed in Section 14.7.2).

During 2021 (May to December), CGP2 processed 1,387,985 t of ore at an average grade of 1.97% Li_2O and recovered 50.5% of the lithium (versus a predicted recovery of 73.2%) into 229,521 t of concentrate at an average grade of 5.88% Li_2O. Concentrate yield for this period averaged 16.5% versus the model yield projection of 24.5%. Although, product quality specifications were generally achieved, lithium recovery and concentrate yield were substantially below target.

During 2022 CGP2 processed 1,999,006 t of ore at an average grade of 1.96% Li_2O and recovered 64.0% of the lithium (versus a predicted recovery of 74.3%) into 419,246 t of concentrate at an average grade of 5.98% Li_2O. Concentrate yield for this period averaged 21.0% versus the model yield projection of 24.4%. CGP2 performance improved steadily during 2022 with significant improvement during the fourth quarter. During the fourth quarter of 2022 lithium recovery averaged 68.2% versus the modeled recovery of 75.4% and the mass yield to concentrate was 22.5% versus the modeled yield of 24.7%.

During 2023 (Jan-Jun) CGP2 processed 1,037,617 t of ore at an average grade of 2.18% Li_2O and recovered 67.9% of the lithium (versus a predicted recovery of 76.9%) into 256,512 t of concentrate at an average grade of 6.00% Li_2O. Concentrate yield for this period averaged 24.7% versus the model yield projection of 28.0%.

Table 14-4: Summary of CGP2 Production (2021 - 2023 (Jan-Jun))

Year	Ore		Concentrate		Li_2O Recovery (%)			Yield (%)		
	Tonnes	Li_2O%	Tonnes	Li_2O%	Actual	Model (GB)	Model (SRK)	Actual	Model (GB) [1]	Model (SRK) [2]
2021 (May -Dec)	1,387,985	1.97	229,521	5.88	50.5	73.2	63.9	16.5	24.5	21.4
2022	1,999,006	1.96	419,246	5.98	64.0	74.3	64.8	21.0	24.4	21.2
2023 (Jan - Jun)	1,037,617	2.18	256,512	6.00	67.9	76.9	67.9	24.7	28.0	24.7

Source: Greenbushes, 2023
[1] GB yield model: Yield % = $9.362*Li_2O$^1.319 + $0.82*Li_2O$%
[2] SRK adjusted yield model: Yield % = $9.362*Li_2O$ - 1.5

14.7.1 CGP2 Process Performance Assessment

Greenbushes retained MinSol Engineering (MinSol) to undertake a performance assessment of CGP2 and identify areas where improvements in the plant could be made to increase lithium recovery. MinSol issued a report of their finding on October 27, 2022, which presented their findings and a path forward to improve CGP2 performance. MinSol noted that the following key changes to CGP2 had been made since commencement of the plant optimization program:

- Plant sampling and handling methods have been improved
- Accuracy of plant instrumentation has been improved
- Screen sizes have been adjusted throughout the plant to debottleneck process circuits and provide optimal sizing for improved performance
- Process split points throughout the plant have been adjusted to improve process efficiency, including:
  - Feed tonnage and sizing to the fine flotation circuit has been lowered to improve recovery by reducing coarse spodumene losses to rougher tails
  - More even feed distribution through the fine and coarse WHIMS to aid iron removal efficiency
  - Increased feed to the very coarse hydrofloat to increase high-grade concentrate production
- Operating conditions for the hydrofloat drum conditioners have been optimized and gearboxes upgraded. Density control and motor control upgrades were also made
- Modifications to flotation circuit pump arrangement to increase flotation cell slurry density from 11 to 20%w/w

These optimization changes have resulted in increasing average lithium recovery from about 50% reported for 2021 to 67.9% reported for the first half of 2023. This represents an almost 18% increase in recovery. However, overall lithium recovery remains about 5% less than the design recovery. MinSol has identified the following process areas that could be further optimized in an effort to achieve the original design lithium recovery:

- Blending of ore on the ROM pad to decrease plant feed variability
- Redirecting fines flotation cleaner tailings to allow for additional reagent conditioning
- Improve reagent conditioning efficiency of the fines flotation conditioner
- Improve reagent conditioning in the hydrofloat reagent conditioners.
- Prescreening HPGR feed to reduce slimes generation
- Add a scavenger flotation circuit
- Add a scavenger WHIMS circuit

14.7.2 Revised CGP2 Yield Equation

SRK notes that that CGP2 and CGP1 flowsheets for are similar and both plants process ore from the same mining operation, as such, SRK believes that it is reasonable to expect that if the optimization programs proposed by MinSol are successfully implemented, CGP2 will eventually achieve lithium yields and recoveries defined by Greenbushes' CGP1 yield model. SRK is of the opinion that the incrementally higher lithium recovery included in Greenbushes CGP2 yield model (attributed to the inclusion of the HPGR in CGP2's comminution circuit) is not warranted as it has been determined that the HPGR results in higher unrecoverable lithium slimes production than had been anticipated.

SRK recommends that Greenbushes' CGP1 yield model continue to be used for resource and reserve modeling for ore processed at CGP1 and recommends using the modified CGP2 yield model shown below for resource and reserve calculations for ore processed at CGP2. The revised yield equation applied to CGP2 for 2023 is given as:

Modified CGP2 Yield % = (9.362 * (Plant Feed Li_2O%) $^{1.319}$) - 1.5

14.8 Product Specifications

CGP1 and CGP2 are operated to produce a spodumene concentrate designated as SC6.0. The specification for SC6.0 is a minimum grade of 6% Li_2O and a maximum iron content of 1% Fe_2O_3. The moisture content is specified at 8% maximum (6% target) and there is no grain size specification. Greenbushes also produces a range of specialized spodumene concentrates in their technical grade plant. Table 14-5 provides a summary of the product specifications produced by Greenbushes.

Table 14-5: Greenbushes Lithium Product Specifications

Criteria	SC5.0	SC6.0	SC6.5	SC6.8	SC7.2 Std	SC7.2 Prem
Element (%)						
Li_2O	5 min	6 min	6.5 min	6.8 min	7.2 min	7.2 min
Fe_2O_3	0.13 max	1 max	0.25 max	0.20 min	0.12 max	0.12 max
Al_2O_3				24.5 min	25 min	25 min
SiO_2				63.5 min	62.5 min	62.5 min
Na_2O				0.50 max	0.35 max	0.35 max
K_2O				0.60 max	0.30 max	0.30 max
P_2O_5				0.50 max	0.25 max	0.25 max
CaO					0.10 max	0.10 max
LOI				0.70 max	0.5 max	0.5 max
Grain Size (µm)						
+1,000			<2%			
+850	0%					
+500					0%	0%
+212					18% max	18% max
+125				3% max		
+106	95%					
+75					60% min	60% min
-75				80% min		
Moisture (%)		8 max 6 target				

Source: Greenbushes, 2023

14.9 Process Operating Cost

Process operating costs for Greenbushes two crushing plant (CR-1 and CR-1), the TGP and the chemical grade plants (CGP1 and CGP2) are presented in this section.

14.9.1 Crushing Plant Operating Costs

Operating costs for CR1 and CR2 are summarized in Table 14-6. During 2021 CR1 operating costs were reported at AU$6.80/t, which increased significantly to AU$13.95/t during 2022 and AU$17.50/t during 2023 (Jan-Jun). CR2 operating costs were reported at AU$6.61/t during 2020, which increased to AU$13.29/t during 2023 (Jan-Jun). CR1 provides crushed ore to both the TGP and to CGP1, and CR2 provides crushed ore to CGP2.

Table 14-6: Crushing Circuit Operating Cost Summary

Cost Area	CR1 (AUS$)			CR2 (AUS$)		
	2021	2022	2023 (Jan-Sep)	2021	2022	2023 (Jan-Sep)
Overhead	7,629,132	12,917,145	15,533,726	4,613,871	8,508,337	13,639,514
Employee Overhead	2,289,432	2,647,561	2,908,602	1,059,446	1,780,782	1,927,556
Feed Preparation	4,926,383	14,605,376	9,925,368	3,482,693	5,334,205	3,606,318
Ancillary Equipment	23,021	30,609	30,617	16,095	48,417	28,147
Safety	9,936	11,224	16,656	4,226	4,942	19,593
Total	**14,877,904**	**30,211,915**	**28,414,969**	**9,176,331**	**15,676,683**	**19,221,128**
Ore Tonnes Processed	2,188,794	2,166,209	1,624,156	1,387,956	1,999,008	1,446,128
Aus$/t Ore	6.80	13.95	17.50	6.61	7.84	13.29

Source: Greenbushes Foreman's Reports 2021 – 2023

14.9.2 TGP Operating Costs

TGP operating costs for 2021 - 2023 (Jan-Sep) are shown in Table 14-7. During 2021 TGP processing costs were reported at AU$36.74/t ore processed, which increased to AU$44.36/t during 2022 and AU$56.96/t during 2023 (Jan-Sep). Operating costs per tonne of concentrate increased during this period from AU$84.42/t to AU$135.17/t.

Table 14-7: TGP Operating Cost Summary

Cost Area	AUS$		
	2021	2022	2023 (Jan-Sep)
Overhead	4,774,241	7,047,317	6,968,491
Employee Overhead	3,180,578	2,969,008	1,800,926
Primary Grinding	1,697,044	2,179,581	2,124,397
SC 5.0 Circuit	464,114	724,922	870,482
Concentrate Circuit	2,442,525	3,086,433	3,362,344
Product Handling	270	-1,343	972
Tailing Disposal	1,154	2,159	190
Tailings Dam	210,325	243,817	391,741
Ancillary Equipment	122,810	146,869	354,823
Safety	116,028	53,529	22,886
Total	**13,009,089**	**16,452,292**	**15,897,252**
TGP (AUS$/t ore)	36.74	44.36	56.96
TGP (AUS$/t conc.)	84.42	100.73	135.17
Ore Tonnes Processed	354,075	370,893	279,077
Concentrate Tonnes Produced	154,106	163,334	117,609

Source: Greenbushes Forman's Report: 2021 – 2023

14.9.3 CGP1 Operating Costs

CGP1 operating costs for 2021 - 2023 (Jan-Sep) are shown in Table 14-8. During 2021 CGP1 processing costs were reported at AU$16.76/t ore processed, which increased to AU$22.53/t during 2022 and AU$33.03/t during 2023 (Jan-Sep). Operating costs per tonne of concentrate increased during this period from AU$53.91/t to AU$94.26/t.

Table 14-8: CGP1 Operating Cost Summary

Cost Area	AUS$		
	2021	2022	2023 (Jan - Sep)
Overhead	7,053,327	10,630,825	11,981,156
Employee Overhead	5,550,993	6,297,295	5,666,054
Primary Grinding	3,484,385	4,986,455	4,912,684
HMS Circuit	1,043,843	1,750,777	2,188,091
Product Handling	5,049	1,342	12,167
Tailing Disposal	1,235,890	1,945,766	1,552,700
Tailings Dam	1,171,693	1,405,851	2,077,339
Ancillary Equipment	122,810	173,651	262,821
Safety	127,752	166,779	157,932
Classification	722,742	1,148,875	2,209,229
Filtration	1,655,663	1,659,968	1,810,917
Hydrofloat	2,753,915	3,230,670	3,331,058
Regrinding	3,142,269	3,945,923	2,823,064
Flotation	2,149,755	2,441,421	3,282,173
WHIMS	528,579	665,179	1,485,145
Total	**30,748,665**	**40,450,777**	43,752,530
CGP1 (AUS$/t ore)	16.76	22.53	33.03
CGP1 (AUS$/t conc.)	53.91	70.36	94.26
Ore Tonnes Processed	1,834,719	1,795,316	1,324,755
Conc. Tonnes Produced	570,342	574,876	464,146

Source: Greenbushes Foreman's Reports 2021-2023

14.9.4 CGP2 Operating Costs

CGP2 operating costs for 2021 - 2023 (Jan-Sep) are shown in Table 14-9. During 2021 CGP2 operating costs were reported at AU$18.64/t ore processed, which increased to AU$22.47/t in 2022 and AU$31.73/t during 2023 (Jan-Sep). Operating costs per tonne of concentrate increased during this period from AU$112.70/t to AU$119.86/t.

Table 14-9: CGP2 Operating Cost Summary

Cost Area	AUS$		
	2021	2022	2023 (Jan -Sep)
Overhead	8,800,643	16,154,599	15,635,931
Employee Overhead	3,887,965	6,214,171	5,569,340
Primary Grinding	2,561,244	5,046,645	5,249,228
HMS Circuit	1,043,038	1,859,675	1,978,651
Product Handling	41,018	4,054	3,774
Tailing Disposal	585,139	1,534,984	2,491,429
Tailings Dam	628,433	1,856,716	2,652,976
Ancillary Equipment	2,418	22,604	41,420
Safety	98,412	92,003	78,912
Classification	1,096,038	2,001,541	1,704,874
Filtration	259,139	884,387	1,020,903
Hydrofloat	1,259,464	1,962,083	1,671,948
Regrinding	2,080,193	4,375,851	4,042,976
Flotation	1,864,366	4,591,875	4,335,405
WHIMS	1,659,160	2,304,560	2,481,490
Total	**25,866,670**	**48,905,748**	**48,959,257**
CGP2 (AUS$/t ore)	18.64	24.47	31.73
CGP2 (AUS$/conc)	112.70	116.65	119.86
Ore Tonnes Processed	1,387,985	1,999,006	1,542,836
Conc. Tonnes Produced	229,521	419,246	408,454

Source: Greenbushes Forman's Report, 2021-2023

14.10 Expansion Plans

Greenbushes is currently constructing Chemical Grade Plant-3 (CGP3), which is based on CGP2 design, with a design capacity of 2.4 Mt/y. CGP3 is scheduled to come on-line during Q1 2025. Greenbushes also has plans to construct Chemical Grade Plant-4 (CGP4), which will also be based CGP2 at a design capacity of 2.4 Mt/y. CGP4 is currently planned to commence production during Q1 2027. For purposes of resource and reserve mine planning SRK recommends that the modified CGP2 yield model be used to estimate future production from CGP3 and CGP4:

Modified CGP2 Yield % = $(9.362 * (\text{Plant Feed } Li_2O\%)^{1.319}) - 1.5$

14.11 QP Opinion

TGP and CGP1 are mature processing facilities with a record of consistent and predictable production. Greenbush's yield equation for CGP1 provides a reasonable prediction of plant production versus ore grade and can be used for resource and reserve modeling.

SRK is of the opinion that the incrementally higher lithium recovery included in Greenbushes CGP2 yield model (attributed to the inclusion of the HPGR in CGP2's comminution circuit) is not warranted as it has been determined that the HPGR results in higher unrecoverable lithium fines production than had been anticipated. SRK recommends that Greenbushes' CGP1 yield model continue to be used for resource and reserve modeling for ore processed at CGP1 and recommends using the modified CGP2 yield model for resource and reserve calculations for ore processed at CGP2 CGP3 and CGP4.

SRK notes that that CGP1 and CGP2 flowsheets are similar and both plants process ore from the same mining operation, as such, SRK believes that it is reasonable to expect that if the optimization programs proposed by MinSol are successfully implemented, CGP2 may eventually achieve lithium yields and recoveries defined by Greenbushes' CGP1 yield model.

15 Infrastructure

Greenbushes is a mature operating lithium hard rock open pit mining and concentration project that produces lithium 6% spodumene concentrate. Access to the site is by paved highway off a major Western Australian highway. Employees travel to the project from various communities in the region. The established facilities on the site include security fencing and guard house access, communications systems, access roads and interior site roads, administrative and other offices, change houses, existing mine services area (MSA), warehousing, shops, crushing plants, processing plants (CGP1/CGP2/TGP/TRP), tailings facilities, new explosives storage facilities, water supply and distribution system with associated storage dams, power supply and distribution system, laboratory, fuel storage and delivery system, reverse-osmosis water treatment plant, health-safety-training offices, mine rescue area, storage sheds, mine waste storage area, miscellaneous waste storage facilities, and engineering offices. The concentrate is shipped by truck to port facilities located at Bunbury 90 km to the west of the mine. These facilities are in place and functional. A rail line is present north of the project but not currently used but being studied as an option for future concentrate transport.

Several modifications to the infrastructure are currently in construction or planned. An upgraded 132 kV power line was placed in service in 2023. The new Mine Service Area (MSA) is near completion and is planned to be operating in late-2023 to provide mine heavy and light equipment maintenance facilities and technical services offices as the existing MSA will be impacted by the planned pit progression. A mine access road will be added to reduce truck traffic through Greenbushes. The warehouse and laboratories are planned to be expanded. The tailings facilities are being expanded with the addition of a new two cell facility known as TSF4 located adjacent to and south of the existing TSF2 and TSF1 facilities. TSF1 will be expanded late in the mine life to meet tailings storage needs. The waste rock facilities will continue to expand on the west side of the pit toward the highway and south toward the permit boundary adjacent to TSF4. A new mine village will be constructed starting in 2023 to provide additional housing. It is expected to be completed in 2024.

5.1 Access, Roads, and Local Communities

15.1.1 Access

The project is located in southwest Western Australia, Australia south of the larger cities of Perth and Bunbury. The small town of Greenbushes, near the project location, is accessed by Australian Highway 1, known as the South Western Highway, and is approximately 80 km from Bunbury and 250 km from Perth. From Greenbushes the site is approximately 3 km south via paved Maranup Ford Road. Maranup Ford Road is called Stanifer St within the town of Greenbushes. Figure 15-1 shows the general location of the project.

Source: SRK, 2020

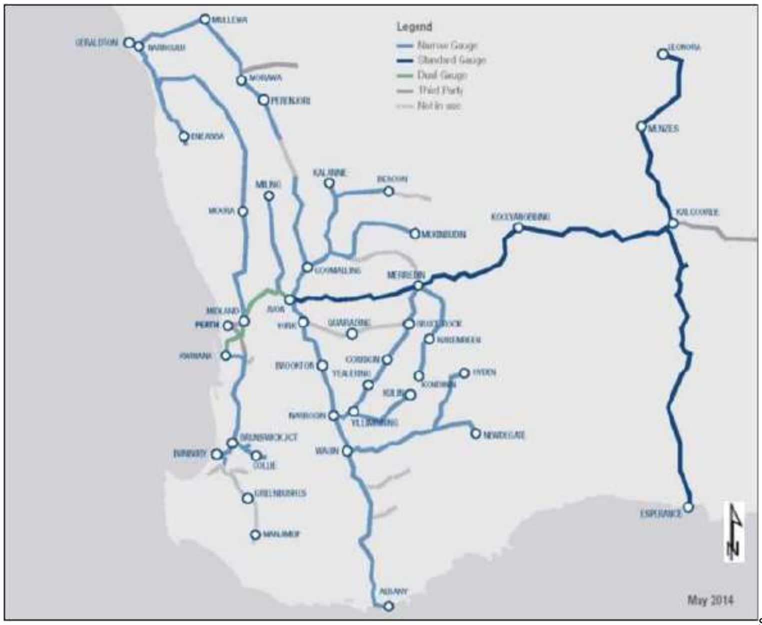
Figure 15-1: Greenbushes Project General Location

15.1.2 Airport

The nearest public airport is located approximately 60 km to the south in Manjimup. It is a small local airport with a 1,224 m asphalt runway. A larger airport with commercial flights is the Busselton Margaret River Airport located approximately 90 km to the northwest near Busselton, WA. A major international airport is located in Perth.

15.1.3 Rail

A rail line is located approximate 4 km north of the Greenbushes project. Known as the Northcliffe branch, the railway is controlled by Pemberton Tramway Company under arrangement with the Public Transport Authority. Talison is researching through a definitive feasibility study with key stakeholders, kicked off in June of 2023, a study to rehabilitate the line and utilize the line to transport concentrate to Bunbury port and other locations north of Bunbury. Figure 15-2 shows the location of the line. At Bunbury, it connects with lines to the north to Perth and through Perth to the east. Talison has been undertaking minor repair work to rehabilitate rail access to the site.



Source: Economics and Industry Standing Committee The Management of Western Australia's Freight Rail Network Report No. 3, October 2014

Figure 15-2: Western Australia Railroad Lines

15.1.4 Port Facilities

Port facilities are available and used at Bunbury, 90 km north of the project. Bunbury is a major bulk-handling port in the southwest of Western Australia (WA). The Berth 8-8 shed is used for product storage. The bulk product is loaded into ships that are less than 229 m long and with a permissible draft of 11.6 m. The ship loader operates at 1,500 to 2,000 t/h depending on the configuration on the feed side. The feed can either be by road hopper or directly form the bulk storage at the higher rate.

The loading unit and storage sheds are shown in the photograph in Figure 15-3.

Source: Port of Bunbury Web Site (www.byport.com.au/berth8), 2020

Figure 15-3: Berth 8 at Bunbury Port

15.1.5 Local Communities and Labor

The mine and processing facilities are located about 3 km south of the community of Greenbushes part of Bridgetown-Greenbushes Shire and the community of Greenbushes is the closest community to the site. Personnel working at the project typically live within a thirty-minute drive of the project. Table 15-1 shows the local communities and distance from the site. Note that Bunbury and Perth are included for reference as major cities in the region. Skilled labor is available in the region and Talison has an established work force with skilled labor. The 2023 Talison labor levels are approximately 701 at Greenbushes and 69 people in Perth as summarized in Table 15-2. Currently the total workforce including all contractors is 2,067. Full Time Equivalent (FTE) personnel refer to additional part-time contract personnel included to represent the total labor requirement by Talison.

Table 15-1: Local Communities

Community	Population	Distance from Greenbushes (km)
Greenbushes	390	3
Bridgetown	4,350	20
Manjimup	5,400	57
Nannup	1,400	50
Donnybrook	6,100	45
Boyup Brook	1,800	42
Bunbury	12,100	80
Perth	2,100,000	250

Source: SRK, 2020

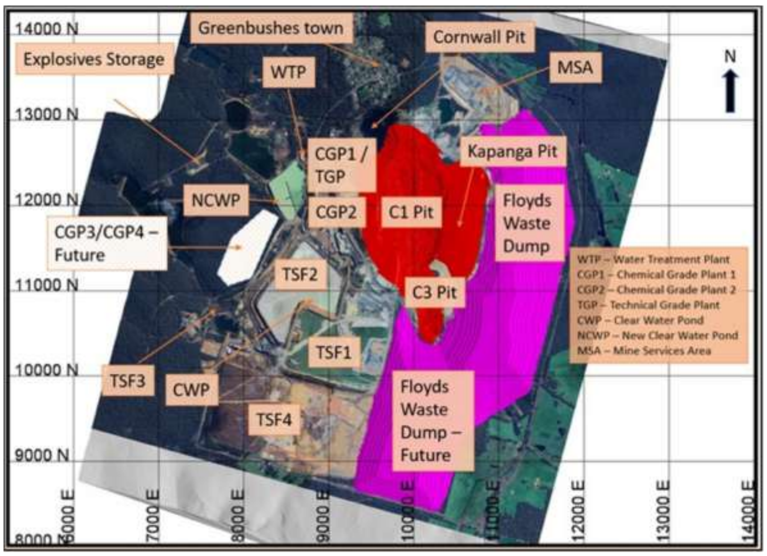
Table 15-2: 2023 Labor by Area

Employee Type – Location	Number
Employees - Perth	69
Employees - Greenbushes	701
Mining/Drill and Blast Contractor	454
Other Operating Contractors (FTE)	119
Operating Workforce	**1,343**
Construction (FTE)	724
Total Operational Workforce	**2,067**

Source: Talison, 2023

5.2 Facilities

The overall layout can be seen in Figure 15-4. The established facilities on the site include security fencing and guard house access, communications systems, access roads and interior site roads, administrative and other offices, change houses, existing mine services area (MSA), warehousing, shops, crushing plants, processing plants (CGP1/CGP2/TGP/TRP), tailings facilities, explosives storage facilities, water supply and distribution system, power supply and distribution system, laboratory, fuel storage and delivery system, reverse-osmosis water treatment plant, health-safety-training offices, mine rescue area, storage sheds, mine waste storage area, miscellaneous waste storage facilities, and engineering offices. These facilities are in place and functional.



Source: SRK, 2023

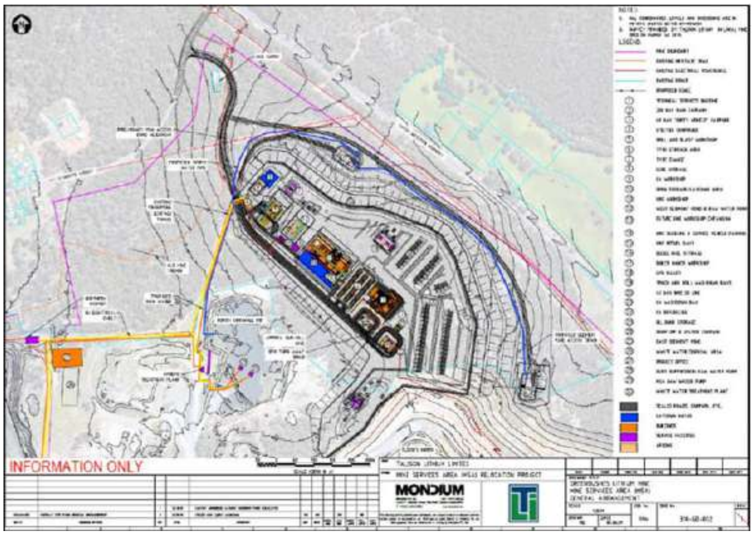
Figure 15-4: General Description with Facilities Map

15.2.1 Powerline Upgrade

The site power system is completed an upgrade that included a 15.3 km 132 kV power line routed to the north from Bridgetown North and then to the west along the south side of TSF4 past the end west of TSF4 and then north to the future location of CGP3/CGP4. The upgrade included a 132 kV outdoor busbar with 2 x 60 MVA transformer circuits and a 22 kV switch room. The upgrade included a combined 132 kV relay room and Western Power 132 kV control and measuring room.

15.2.2 Maintenance Service Area (MSA)

The current MSA is located on the IP dump near the existing open pit. The pit will consume the MSA, and relocation is necessary. Construction of the new MSA to the northeast of the pit area as seen in Figure 15-4 is nearing completion. Construction will be completed in Q3 2023. Full handover is expected in October 2023. The facility supports maintenance activities on heavy mobile equipment including drill and blast equipment. The facility includes welding shops, support facilities including heavy and light equipment wash bays, lube storage and dispensing, tire handling and storage facilities, laydown yards, mining equipment parking, lighting, diesel storage and delivery facilities for light and heavy equipment, and a technical services complex with three separate offices and shared common areas. A parking area for contractor and employee parking is included in the facility design. The new facilities have a separate water supply, surface water control ditches and ponds, and waste-water treatment system. Figure 15-5: shows the new MSA layout.



Source: Talison, 2020

Figure 15-5: Layout of the New MSA Facilities

15.2.3 Mine Access Road

Construction of a new mine access road to the site that bypasses the town of Greenbushes will be initiated in Q4 2023 with completion expected in 2025.

15.2.4 Warehouse Workshop Expansion

The warehouse workshop is planned to be expanded for additional space. The design work has been initiated and the expansion will be completed in 2024.

15.2.5 Laboratory Expansion

The laboratory geological preparation facility is being expanded to provide additional materials handling capacity. The lab upgrade also will include an XRF upgrade to handle additional testing. An ICP will also be included in the expansion. The expansion is expected to be complete in 2024.

15.2.6 New Camp Facilities

Construction has begun on the new 500-person camp facility with completion in 2024 to allow housing for additional workforce associated with the addition of CGP3 and CGP4. The facilities are located to be southwest of the project. Additional facilities are being considered to manage staffing levels.

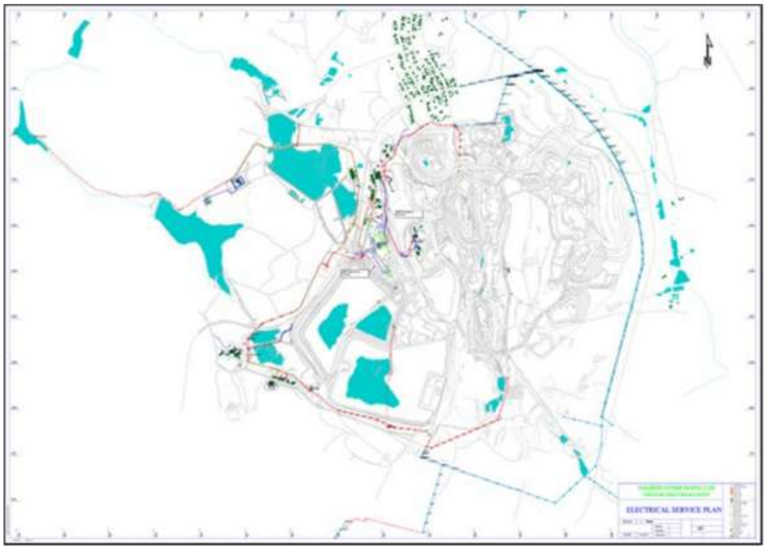
5.3 Waste Rock Storage and Temporary Stockpiles

Waste rock storage and temporary stockpiles are discussed in detail in Section 13.6.

5.4 Energy

15.4.1 Power

Greenbushes has a mature power delivery system with two feeds from Western Power with wholesale power from Alinta Energy through the Talison's retailer Perth Energy. The power supply system is in a loop configuration so that the project has redundancy (Figure 15-6). Main Western power line runs from north, west of the town of Greenbushes, along the west side of the Project parallel to the South Western Highway to a point where it turns due west to a point approximately aligned with the center of the deposit and then continues due south. The Talison 22 kV power system connects to the north near the town of Greenbushes and then to the south near the location of TSF4. The Talison 22 kV connection from the south runs along the TSF1 and TSF2 to the west then turns north to the processing facilities on the north end of the deposit where it connects with the Talison north feed. Portions of the Talison supply system is on poles above ground other portions are underground to reduced congestion with other infrastructure and facilities.



Source: Talison, 2023

Figure 15-6: Greenbushes Power Layout

Talison has a current connected load of approximately 20 MW and a running load of approximately 17 MW.

15.4.2 Propane

Propane (LPG in Au) is used for drying in the TGP, laboratory sample furnaces, shipping floor sweeping. The site consumes approximately 1.2 M liters annually. Storage is on site in LPG tanks. A 118,000-liter bulk tank is near TGP. A cylinder bank (210 kg capacity) is located at the lab. Two small 45 kg cylinders are used by the sweepers. Supply is by tanker truck for the large bulk tank.

15.4.3 Diesel

The site has four diesel tanks with a capacity of 55,000 liters each. Three are associated with the current MSA. One is located in the processing area. The three tanks associated with the existing MSA will be removed from service and disposed of once the new MSA is constructed. The new MSA has two new 220,000 liter tanks when initial construction is complete. An additional 220,000 liter tank will be added in 2025, with the first site majority of the use is for the mining fleet. Supply is by tanker truck.

15.4.4 Gasoline

No gasoline is stored on site.

5.5 Water and Pipelines

15.5.1 Water Supply and Storage

Mine water supply is sourced from surface water impoundments for capture of precipitation runoff, pumping from sumps within the mining excavations and recycled from multiple TSFs. No mine water is sourced directly from groundwater aquifers through production or dewatering wells. This lack of significant groundwater production for mine usage indicates the overall importance of the surface water and TSF water management systems to the operational capacity of Greenbushes.

Existing water sources and storage facilities at the mine include active and flooded historical mining excavations (C1/C2/C3 pits, and Vulcan pit), surface water impoundments/dams (Cowan Brook, Southampton/Austin's Dam, Clear Water Dam, Clear Water Pond, Mt. Jones Dam, Norilup Dam, Dumpling Gully Dam, Schwenke's Dam, and Tin Shed Dam), and tailings storage facilities (TSF1 and TSF2). Additional near-term storage is planned through the construction of TSF4 and expansion of the waste rock landform (WRL) storage infrastructure. The majority of these water sources and impoundments are linked through constructed surface pumps and conveyance.

15.5.2 Water Balance

GHD updated the sitewide water balance model in 2021 to support current and future proposed operations at Greenbushes. The results of the water balance model confirmed that there could be water supply shortfalls, potentially limiting operation of the proposed larger network of processing facilities, with significant depletion of water levels within the storage facilities. While the addition of water storage within TSF4, and more significantly the WRL, do serve to alleviate the magnitude of near-term supply shortages most commonly in the summer months; these structures will not serve to reduce the frequency of these supply shortfalls (GHD, 2018). Long term security of supply appears to be challenged by both insufficient storage capacity during very wet years and shortages in very dry years (GHD, 2023). Evaluations were conducted by Talison to increase the water storage options through raising the dam embankments on several storage structures including the Cowan Brook, Austins and Southampton dams. The design of these water retention dam raises is being led by GHD and includes and is undergoing independent third-party review. Talison received approval to raise the Cowan Dam embankment and is actively raising the dam. Talison also has lowered the lower operating limits on the dams which effectively increases water supply available for operations. Regulatory approval for raises on Southampton and Austins dams to increase their capacities will be pursued in 2024. Additionally, Talison will seek approval to construct a new greater than 1 gigaliter dam in Salt Water Gulley.

Long term security of water supply is a significant risk for Greenbushes, given the scope of the proposed expansion of operations. Talison has developed plans and executed on several to reduce these risks.

5.6 Tailings Disposal

SRK performed a review of tailings data, relevant to the estimation of reserves, provided by Talison. Greenbushes has four tailings storage facilities (TSF) and SRK's review focused on the currently active TSF and plans for two future TSFs. Documentation available to SRK included the design data, the two most recent annual site inspection reports, and supporting data. SRK's review is for the purpose of supporting the resource and reserve disclosure reported herein and should not be interpreted by the reader to reflect an analysis of or any certification of TSF dam stability or associated risk and in no way should be interpreted to substitute for the role or any responsibilities of the Engineer of Record for the TSFs. SRK's scope of work included review to confirm that applicable design documentation exists, review the operational aspect of the TSFs, check that the planned TSF capacity is adequate to support extraction of the full reserve for the Project, and to note risk and opportunity associated with the operation and capacity of the TSF, as applicable to estimation of reserves.

15.6.1 General Overview

Greenbushes has four TSFs on site. Greenbushes utilizes pumped slurry tailings through pipelines that are deposited by spigot in conventional tailings storage for long term tailings storage. The four tailings storage areas are designated TSF1, TSF2, TSF3, and TSF4. TSF2 is the only currently active TSF. Figure 15-7 shows the existing and future tailings locations.

- TSF1, currently approximately 110 ha in size, was constructed in 1970 and operated for approximately 30 years mainly for tantalum production and was placed on care and maintenance in 2006. It was initially laid out in a three-cell configuration but has subsequently modified into a single cell with a central decant. At the existing mRL 1280 crest it holds approximately 333 Mt of storage capacity. A 5 m high upstream lift was constructed in 2018 using mine overburden materials. This capacity allows TSF1 to be available for emergency storage of tailings if needed (GHD/Talison, 2020). Talison is reprocessing tailings from TSF1 in the Tailings Reprocessing Plant (TRP). Talison will temporarily store dry excavated store tailings from TSF2 in TSF 1 that is available due to the removal of old tailings for reprocessing in the TRP (GHD, 2023d). The capacity in TSF1 will allow flexibility in TSF2 to support construction completion in TSF4. The TSF1 tailings facility will be upgraded, and additional lifts added for further use late in the mine life.
- TSF2, currently approximately 35 ha in size, is the only active TSF and has been in operation since 2006. The facility was constructed in 2006 with additional upstream raises that elevated the crest level to mRL 1271, the current elevation, which is approximately 36 m above lowest ground level, (GHD/Talison, 2020). The TSF will eventually be elevated to a final elevation of mRL 1280, this raise is currently underway. The additional planned additional capacity will be 9.9 Mt.
- TSF3 is a small (5 ha) historic tailings storage area approximately 1 km south of TSF1 and is closed and undergoing trial reclamation. The small storage pre-dates 1943 and was historically used to dispose of slimes from the Tin Shed operations, which are thought to contain about 800,000 t of process waste. Local information is that deposition ceased around the late 1980s or early 1990s (GHD/Talison, 2020).
- TSF4 is a two-cell 240 ha new downstream construction currently being constructed that will be the primary storage area for the next phase of mine development. The TSF4 facility is lined two-cell design adjacent to TSF1 for a portion of the northern edge. The two-cell system will allow balancing of the fill between the cells while the facility is in service from 2024 through 2048. The starter embankment elevation will be RL 1265 m for cell 1 of TSF4. The Cell 2 liner has been modified from a clay liner to a bituminous geomembrane liner (BGL) to mitigate construction and logistical issues on TSF4 Cell 2 construction. The final elevation for TSF4 will be 1295 mRL. The total capacity of the facility is planned to be 68.2 Mt.
- Water is managed at the TSF1 and TSF2 facilities through local ponds. The 8.5 ha old Clear Water Pond (CWP) is a small water storage facility located between TSF1 and TSF2. It held

water from the TSF2 decant system before water was returned to the process facilities. CWP now acts as the TSF2 decant system. The New Clear Water Pond (NCWP) is the primary water storage for TSF2. Water management, as summarized by GHD (GHD/Talison, 2020) follows:

> *'Rainfall runoff from the surfaces directly surrounding TSF 1 and TSF 2 collects within local surface water ponds. Runoff from the western side of TSF 1 and TSF 2 embankments and foundations is directed into open drains and pipe work running alongside Maranup Ford Road. The seepage water from TSF1 eastern wall reports back to Vultan dam via existing old mining channels. Vultan water is then pumped back to the TSF2 decant and into process.*
>
> *Decant water from TSF 2 is pumped via a floating suction decant to the NCWP from where it is pumped back to CGP1, CGP2 and TGP. Water is pulled from the circuit into the ATP where the processed water is returned back to the mine process water circuit.*
>
> *Surface water runoff on the southern and eastern sides of TSF 1 is diverted east by a channel into the Old Pits and is pumped back into CWP where it is returned to the plant water circuit.*
>
> *At the time of this audit there was no decant pond on TSF 1 and no active return water system in operation.*
>
> *Decant water from TSF 2 is pumped via a floating suction decant to the NCWP and mainly returned to the plant water circuit after removal of arsenic or to Austin's Dam for return to the plant when required. Surplus water is pumped to Southampton Dam and some surplus from there is stored in underground workings until recovered in summer. Cowan Brook Dam is also used on occasion to top up the plant water circuit during dry periods.*
>
> *The TSF4 water handling system will include a centralized tailings pumping station capable of moving tails from CGP1, CGP2, and TGP, power reticulation install and upgrade to the existing CGP1 tails booster pump system. The TSF4 design includes a decant system, underdrainage, toe drains, surface collection trenches and the associated sediment collection ponds.'*

Source: Talison, 2020

Figure 15-7: Greenbushes Tailings Locations

15.6.2 Design Responsibilities and Engineer of Record

Design responsibilities for the active tailings facilities have been performed by GHD. GHD is the established Responsible Technical Person (RTP) or Engineer of record formally documented July 12, 2022. SRK documents the key engineering activities and the companies involved as follows:

- TSF1:
  - D E Cooper and Associates (DCA) is understood to have been the original design engineer and Talison has limited documentation through 1998 from DCA.
  - GHD has done inspections since 2013 including this facility.
  - GHD is the RTP for TSF1.
- TSF2:

- Constructed in 2006 under the direction of DCA:
  - Stability modeling (DCA 2005) confirmed that the embankments met government guidelines and the stability modeling assumptions were confirmed by monitoring readings (GHD 2013a). Further geotechnical investigation and analyses indicated that there was some potential for liquefaction of the tailings under earthquake conditions (GHD 2013c). After consideration of alternatives, it was decided that a stability buttress should be added to the southern and western walls. To achieve the wider footprint, part of the Maranup Ford road was realigned further to the west. The current design also incorporates internal seepage interceptor drains with discharge pipes carrying the water through the embankment to an external collection system. (GHD).
- GHD is and will be the Engineer of Record for TSF2.
- GHD has performed inspections on this facility since 2013.
- GHD completed an engineering design for the development of TSF2 from mRL 1265 to mRL 1280 in 2015. An updated design was completed in 2020 to raise the facility to mRL 1275.
- GHD monitored construction (Feb 2019 – Oct 2019) and provided a summary construction report at the completion of construction. (GHD, TSF2 Construction Report, February 2020).
- A Dambreak Study was conducted by GHD in 2019 updating the 2014 Dambreak Study by GHD (GHD Draft Report dated October 2019):
  - Key findings from GHD included potential impact of TSF2 breaches to the north or west on CGP2 and other planned future facilities at mRL 1300. Based on GHD's analysis, breaches at mRL 1280 would have significantly lower impact.
  - GHD provided a preliminary engineering design for a ground improvement project on TSF2 in 2021 that will support buttressing the central section of theTSF2 western wall.
- GHD has design responsibilities for the active facilities TSF 2 and TSF4.
- The raise to 1280 mRL is underway and will be completed in 2023.
- The TSF2 buttress project is well progressed and nearing completion.
- GHD has developed plans to move dry material from TSF2 to TSF1.

- TSF3:
  - There is limited design data available for TSF3 and no significant deposition has occurred since 2008. The facility is in the process of being reclaimed. GHD continues to inspect the area during their annual inspections.
- TSF4:
  - TSF4 is a new construction and GHD is the Engineer of Record for the design and is participating in the construction and monitoring of the construction. Talison plans to use GHD to monitor the ongoing operations consistent with their use on the annual tailings dam inspections. The TSF4 design was modified to include a liner during the regulatory approval process. Additionally, TSF4 Cell 2 design was modified to utilize a BGL liner instead of the clay liner originally included in the design.

15.6.3 Production Capacities and Schedule

The production schedule over the life of mine requires a total storage capacity of 85 million m^3 (119 million tailings tonnes at 1.4 t/m^3) of tailings. This equates to approximately 4.8 million m^3 per year of tailings placement. The tailings construction plans allow for placement of tailings in two or more locations to balance rate of rise needs. The tailings placement schedule with start and end year as well as capacity available and used is summarized in Table 15-3.

Table 15-3: Capacity Confirmation

Storage Location	Status	Start (year)	Finish (year)	Size (ha)	Current mRL	Final mRL	Additional Capacity (Millions of m^3)	Capacity Used (Millions of m^3)
TSF1	Inactive*	2034	2042	110	1280	1305	31	30
TSF2	Active	2020	2024	35	1271	1280	6	6
TSF4	Construction	2023	2034	240	N/A	1295	49	49
Total Capacity (accounting for design freeboard)							**86**	**85**

*TSF1 being mined for TRP and prepped to accept dry material from TSF2.
Source: SRK, 2023

15.6.4 Tailings Risk Discussion

Several risks are noted in review of the tailings data:

- Tailings storage facilities are typically one of the highest risk aspects of a mining operation. Even if the probability of occurrence of a major incident is low, the magnitude of potential impact is often high which results in overall high risk to the business. Therefore, while SRK is not evaluating TSF dam stability or risk, it recommends that Talison follows all recommendations from its Engineer of Record in a prompt manner.
- SRK recommends a Comprehensive Dam Safety Review by a third party to be completed on all TSFs as soon as possible. This review will further clarify any issues of significance that have not been flagged by GHD and will provide guidance to Talison on any other key issues. The review will also note any deficiencies in the underlying design data and could flag additional technical work (geotech, hydro, materials characterization) to support future design or mitigation needs.
- The timing on construction of TSF4 is important from an operational flexibility standpoint with TSF2 being the only active TSF and TSF1 only available for emergency use. Ongoing monitoring of TSF4 progress will be critical in the short term and any acceleration on Cell 2 would be beneficial to de-risk ongoing tailings deposition.
- SRK recommends ongoing detailed plan development for TSF1 so that it can be available if needed for future expansion or if problems develop with the other active TSFs. SRK recommends that Talison follow all recommendations by the EOR. Other alternatives should be considered including dry stack tailings storage if space constraints continue to exist for LoM.
- SRK recommends that the tailings life of mine planning be integrated into the LoM mine planning effort to confirm long term planning needs and to prioritize issues if expansion plans move forward. Current reserves are limited by tailings and waste rock storage. Coordination and finding space for tailings and waste is accelerated with the additions of CGP3 and CGP4 into the production mix.

16 Market Studies

Fastmarkets was engaged by Albemarle to perform a preliminary market study to support resource and reserve estimates for Albemarle's mining operations. This report covers the Greenbushes mine and concentrator and summarizes data from the preliminary market study, as applicable to the estimate of resources and reserves for Greenbushes. The preliminary market study and summary detail contained herein present a forward-looking price forecast for applicable lithium products; this includes forward-looking assumptions around supply and demand. Fastmarkets notes that as with any forward-looking assumptions, the eventual future outcome may deviate significantly from the forward-looking assumptions.

The Greenbushes facilities include a large-scale, long-life, low-cost hard rock mine and a spodumene concentrate plant that produces a range of spodumene concentrate products that are sold primarily into the chemical lithium markets, with some products sold into the technical lithium markets. Talison's ability to predict lithium production for technical-grade products at a level that meets the standard of uncertainty for a reserve requires grade control drilling and has therefore been excluded from this reserve estimate. Instead of predicting reserves of technical-grade concentrate, Fastmarkets has assumed that all products produced by the operation is sold into chemical markets.

As the technical-grade production is not included in the reserve, it has also been excluded from this market discussion.

The Greenbushes operation also has the ability to produce tantalum concentrate. However, Talison does not own the rights to this production and does not receive any economic benefit from it; therefore, it has not been included in this analysis.

16.1 Lithium Market Information

A summary of the lithium market has been provided to offer context on developments and the basis for Fastmarkets' assessment of price.

Historically, the dominant use of lithium was in ceramics, glasses, and greases. This has been shifting over the last decade as demand for portable energy storage grew. The increasing need for rechargeable batteries in consumer devices, such as mobile phones, and lately in electric vehicles (EVs) saw the share of lithium consumption in batteries rise sharply. While 40.1% in 2016, battery demand expanded at 36.6% compound average growth rate (CAGR) each year between 2016 and 2022 and is now responsible for 75.0% of all lithium consumed.

Beside EVs and other electrically powered vehicles (eMobility), lithium-ion batteries (LIBs) are starting to find increasing use in energy storage systems (ESS). This is a minor sector for now but is expected to grow quickly to overcome issues like fungibility in renewable energy systems.

16.1.1 Lithium Demand

In recent years, the lithium industry has gone through an evolution. The ceramic and glass sectors, which, were traditionally the largest source of demand for lithium products globally have lost their dominant position. In 2000, when combined these sectors accounted for more than half of total lithium demand. However, the growth in mobile electronics and recently EVs has seen traditional sectors usurped.

Until as recently as 2016, Fastmarkets estimates that total global lithium demand was under 200,000 t, as lithium carbonate equivalent (LCE). The growth in demand from around 65,000 t LCE in 2000 to around 200,000 t in 2016 was robust with a CAGR of 7.2% (Table 16-1). However, this has changed rapidly with the arrival of hybrid and fully electric vehicles.

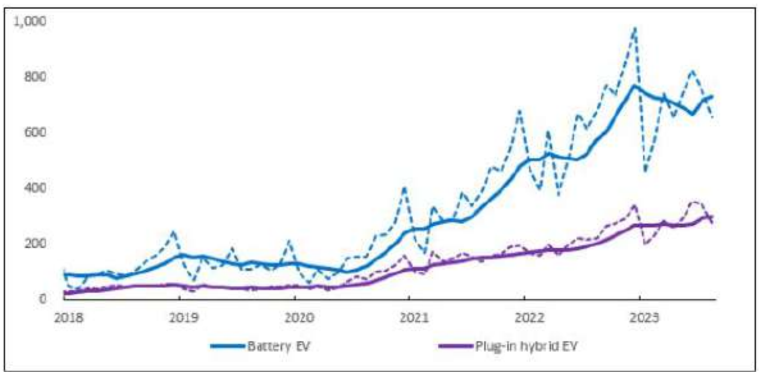
Table 16-1: Global Lithium Demand – 2000 to 2016 (000's, %)

	2000	2011	2012	2013	2014	2015	2016	CAGR (2000 -2016)
Rechargeable batteries	3.4	34.5	38.5	50.6	62.4	81.3	83.5	22.1%
Ceramics	13.5	20.5	22.1	22.6	23.2	23.8	24.5	3.8%
Glass-ceramics	8.9	18.0	19.5	20.1	20.7	21.2	23.0	6.1%
Greases	8.1	13.9	13.5	13.8	13.9	14.0	14.0	3.5%
Polymer	4.2	7.1	7.5	7.8	8.6	8.9	9.2	5.0%
Glass	3.5	8.4	9.0	9.0	9.0	9.0	9.0	6.1%
Metallurgical powders	3.0	7.2	8.0	8.4	8.8	8.0	8.0	6.3%
Primary batteries	1.2	2.8	3.0	3.4	3.9	4.3	4.6	8.8%
Air treatment	5.2	5.4	5.3	4.9	4.8	4.4	4.4	-1.0%
Other	13.8	16.9	17.3	17.6	17.1	16.9	16.8	1.2%
Total	**64.8**	**134.6**	**143.7**	**158.3**	**172.4**	**191.8**	**197.1**	**7.2%**

Source: Fastmarkets, Roskill, 2017

Looking forward, Fastmarkets expects demand from eMobility, especially battery electric vehicles (BEVs), to continue to drive lithium demand growth. While traditional and other areas will all continue to add to lithium demand, the significance of the EV sector to lithium demand is clear.

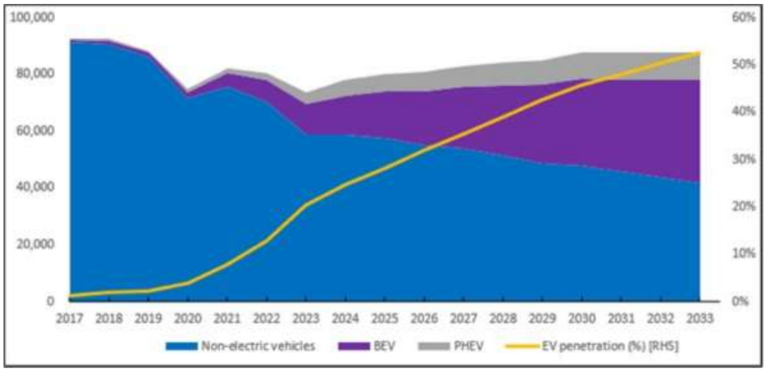
Before around 2018, EV sales globally were insignificant beyond specialist vehicles, but have expanded in recent years. Published EV sales data shows the rapid increase in EV sales over the last 5 years. This is despite the economic turmoil of the global pandemic and recent high prices of lithium. Indeed, in 2021, passenger EV sales grew 44.0% year-on-year (Y-o-Y) in the United States, while sales of all passenger vehicles shrank 8.2% Y-o-Y (Figure 16-1).



Source: Fastmarkets

Figure 16-1: Passenger EV Sales: China, Europe, and United States (000's Units, 6-Month Moving Average)

EVs have already shown exceptional growth over the past decade. Fastmarkets believes that demand will continue to accelerate in the next decade, as they become increasingly affordable, and a greater range of models enter the market. Legislation will also force the transition in the mid-term. Additionally, commercial fleet electrification is expected to advance as governments and businesses seek to develop green domestic transportation networks (Figure 16-2).



Source: Fastmarkets

Figure 16-2: Global Light Vehicle Sales and EV Penetration (000's Units, %)

Of note is the expected shift towards BEVs. BEV sale annual growth rate is 13.0% CAGR over the next 10 years, compared to 8.5% for PHEV and 1.7% for all vehicles (Table 16-2).

Table 16-2: EV and Light Vehicle Sales and Compound Average Growth Rates (000's vehicles, %)

	Sales (000's vehicles)		Growth Rate (% CAGR)		
	2022	2023	2023-2026	2023-2028	2023-2033
EV	11,000	15,500	11.7%	17.3%	12.2%
BEV	7,600	10,700	12.2%	18.2%	13.0%
PHEV	2,700	4,400	9.5%	13.3%	8.5%
All vehicles	80,600	73,800	1.9%	2.6%	1.7%

Source: Fastmarkets

Converting EV sales forecasts to expected LCE demand is obfuscated by the intensity of lithium use in different batteries and different types. Estimates of the actual amount of lithium in a LIB range from 0.35 kg LCE per kilowatt-hour (kg LCE/kWh) to over 2.0 kg LCE/kWh. The main reason for this is the variety of battery cathode chemistries, which offer different energy densities (Table 16-3).

Table 16-3: LIB Chemistry Types and Uses

Cathode type	Abb.	Example uses	Notes
Lithium cobalt oxide	LCO	Mobile phones, tablets, laptops, cameras	High specific energy, limited specific power
Lithium manganese oxide	LMO	Power tools, PHEVs	Low specific energy, so often mixed with NMC to improve
Lithium nickel cobalt aluminum oxide	NCA	Tesla's primary battery choice, eBikes, power tools	High specific energy and capacity
Lithium nickel manganese cobalt oxide	NMC	BEVs – Dominant chemistry outside China	High specific energy and capacity
Lithium iron phosphate	LFP	BEVs – Favored in China and for short-range Tesla models, eBuses, grid storage	High specific power, lower specific energy, but cheaper than NMC and NCA
Lithium titanate	LTO	Uninterruptable power supplies, limited use in PHEVs	Comparatively expensive. Long life and fast charging, low specific energy

Source: Battery University, Fastmarkets

Most long-range BEVs use nickel-rich chemistries, while shorter range BEVs and most of those sold in China, use chemistries that do away with nickel and cobalt. These come with a penalty to power densities and charging rates, but with lower costs and a safer track-record.

However, this is changing as technological developments improve the energy densities of all batteries and manufacturers arrange their offerings to satisfy different segments of the market. For example, at its launch in 2017 and until 2021, all Tesla Model 3 cars were fitted with nickel rich, NCA batteries. However, in 2021 the standard range Tesla Model 3 shifted to nickel-free LFP batteries, while the longer-range, dual motor versions continue to use NCA.

This has some impact on lithium intensity. Over time, Fastmarkets sees battery manufacturers improving manufacturing processes and increasing energy densities to reduce lithium intensity in the batteries (Table 16-4).

Table 16-4: Global EV Sales by Cathode Chemistry and Typical Lithium Intensity (%, kg LCE/kWh)

Cathode Chemistry	Share of Global EV Sales – 2023 (%)	Lithium Content (kg LCE/kWh)
NCA, NCMA	15.9%	0.64
NMC217	3.5%	0.82
NMC523, NMC622	30.5%	0.72
NMC712, NMC811	30.8%	0.62
LFP	19.1%	0.49
Other (e.g., LCO, LMO)	0.1%	0.51
Weighted average (kg LCE/kWh)		0.64

Source: Roland Berger, Fastmarkets

Further out, new battery technologies may be developed, but there is little expectation that these will be available commercially for 10 years, at least. So, Fastmarkets has assumed no major novel battery technology will be commercialized.

Besides the energy density, the required size of battery pack in the vehicle changes to reflect the needs of the market (Table 16-5). An urban 'run-around' can benefit from a range of 100 km, for instance, while an executive saloon would be expected to offer 400 km or more. This is reflected in the size of battery pack.

Fastmarkets calculates battery average pack sizes across regional markets to estimate typical current battery capacity. For example, in China BEVs average around 38 kWh, in Europe 60 kWh and in the United States 80 kWh. From this, Fastmarkets has developed a global average battery pack size in 2023 of 66 kWh for BEVs and 15 kWh for PHEVs.

Table 16-5: Electric Vehicle Battery Pack Size – Global Average (kWh/vehicle)

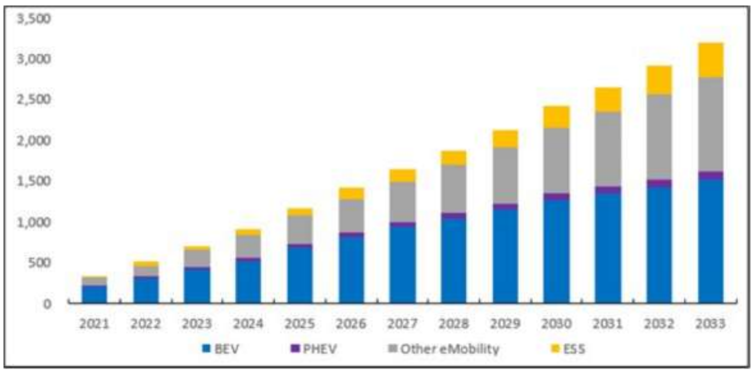
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
PV	BEV	64	65	66	67	68	69	70	70	70	69	69	69	69
	PHEV	16	16	15	15	15	14	14	14	14	14	14	14	14
CV	Light	46	46	50	55	60	60	60	60	60	60	60	60	60
	Heavy	300	325	350	400	402	405	410	412	414	415	415	415	415

Source: Fastmarkets
PV: Personal Vehicle, CV: Commercial Vehicle

Based on estimates of EV demand, lithium intensities and battery pack sizes, Fastmarkets has calculated the typical, average lithium consumption and so lithium demand in terms of LCE (Figure 16-3 and Table 16-6).

Besides car-buyers' growing preferences for EVs, looming bans on pure-internal combustion engine (ICE) vehicles and then hybrid vehicles are seeing auto makers and their suppliers investing heavily to expand EV supply chains. Several auto makers have signaled that they will stop producing ICE vehicles altogether.

Although there are concerns about availability of raw materials charging infrastructure and the initial cost, in Fastmarkets' opinion, many of these barriers are being eroded and strengthening the case for EV uptake.



Source: Fastmarkets

Figure 16-3: Lithium Demand in Key Sectors (000's LCE t)

Table 16-6: Lithium Demand per Vehicle (kg LCE/vehicle)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
BEV	36	35	38	37	39	39	39	38	37	36	36	36	36
PHEV	10	11	11	10	9	9	9	9	9	9	9	9	9
MHEV	2	1	1	1	1	1	1	1	1	1	1	1	1
2/3-wheeler	2	2	4	4	4	4	4	4	4	4	4	4	4
LSEV	N/A	N/A	N/A	84	92	103	95	92	89	87	85	83	81
eBus	209	209	230	244	249	258	263	270	273	278	289	300	306
eTruck	N/A	N/A	N/A	113	123	133	143	152	167	181	196	204	213

Source: Fastmarkets
N/A Not available

The biggest near-term threats are macroeconomic in nature, rather than EV specific. Weak economic growth is reducing consumer spending and dampening the outlook for new vehicle sales. While Fastmarkets expects total vehicle sales to be negatively impacted, this will be focused on ICEs. EVs, offering reduced running costs and lower duties in some areas, are seen as a way of cutting costs and as being more futureproof. Recently, some OEMs have cut the costs of their EVs to grow market share, making EVs even more attractive than ICEs.

With government-imposed targets and legislation banning the sale of ICE vehicles, strong growth in EV uptake is expected once the immediate economic challenges are overcome. This, though, does not discount risks to EV uptake, such as alternative fuels, different battery types or a shift in car ownership would all reduce EV or LIB demand.

Overall, Fastmarkets' forecast EV sales to reach 50 million by 2033. At 56% of global sales this is an impressive lift, but also highlights room for further growth.

16.1.2 Demand Growth Model

Overall, in-line with the discussion above, Fastmarkets expects near- to mid-term growth in the BEV market to remain robust, continuing the trajectory of the last 24-36 month (Table 16-7 and Figure 16-4).

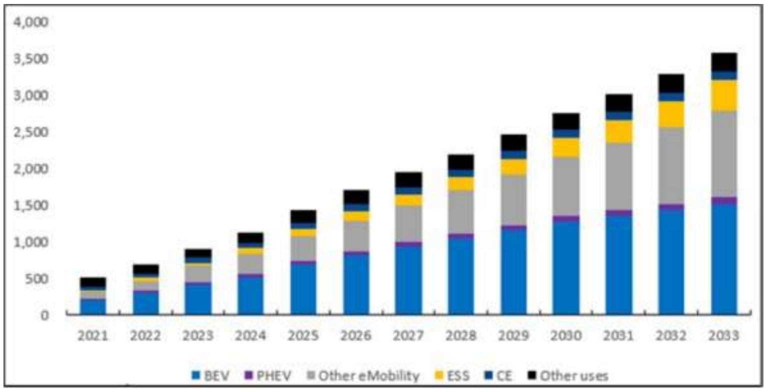
BEVs are no longer considered a niche vehicle in many major markets. They made up at least 5% of all sales in 19 countries in 2022, including the United States and EV sales across Europe accounted for 10.6% of all passenger vehicles.

The most serious risks that Fastmarkets can foresee are technology related. These may be substitution of alternative technology, such as hydrogen fuel cells gaining share, or battery costs plateauing, with BEVs remaining uncompetitive as low-cost vehicles. However, Fastmarkets believes that these are unlikely considering the stated plans of OEMS, current demand for EVs and downward cost movements. On the contrary, if EV prices were to fall below parity with comparable ICE vehicles, then demand could be stronger than anticipated. This is an upside risk.

Table 16-7: Lithium Demand (000's t LCE)

	2021	2025	2030	2031	2032	2033
BEV	204	680	1,264	1,346	1,423	1,515
PHEV	20	49	78	84	90	95
Other eMobility	89	344	815	921	1,042	1,165
ESS	24	94	258	301	354	421
CE	40	86	104	111	116	121
Other uses	124	173	237	245	253	261
Total	**501**	**1,426**	**2,756**	**3,008**	**3,278**	**3,578**

Source: Fastmarkets



Source: Fastmarkets

Figure 16-4: Lithium Demand in eMobility and Other Sectors (000's LCE t)

16.1.3 Lithium Supply

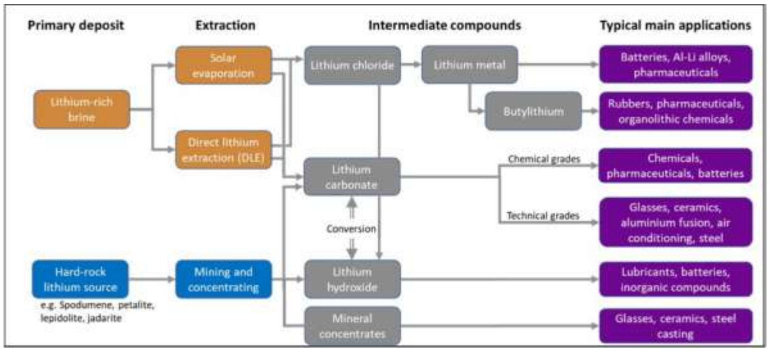
While several minerals are lithium bearing, it has traditionally been sourced from two main types of deposits:

- Hard rock deposits of spodumene
- Saline brines hosted within evaporite basins, salars, found in Chile, Argentina, China and Bolivia

The most common commercial hard rock mineral is spodumene (aluminum-lithium silicate, $LiAlSi_2O_6$). Brine operations typically process a chloride-rich solution in which most of lithium occurs as lithium chloride (LiCl), but some sources have carbonate brines (Figure 16-5).

Once extracted, the lithium compounds are processed into the forms needed by different customers. Depending on the application, lithium metal or one of its chemicals are needed. The lithium used in EV and other eMobility batteries will be either lithium carbonate (LiC_2O_3) or lithium hydroxide (LiOH).

Historically, brine operations have had a significant cost advantage over hard rock operations for lithium carbonate and a smaller cost advantage for lithium hydroxide. This made hard rock operations swing producers. In the price downturn in 2018-2020, hard rock producers were the first to announce cutbacks, while production from brine producers was less affected. As many new producers enter the market, with both hard rock and brine sources, this prior norm is changing – Many of the new brine producers have relatively high operating costs when compared to traditional hard rock production, especially if the planned production is lithium hydroxide.

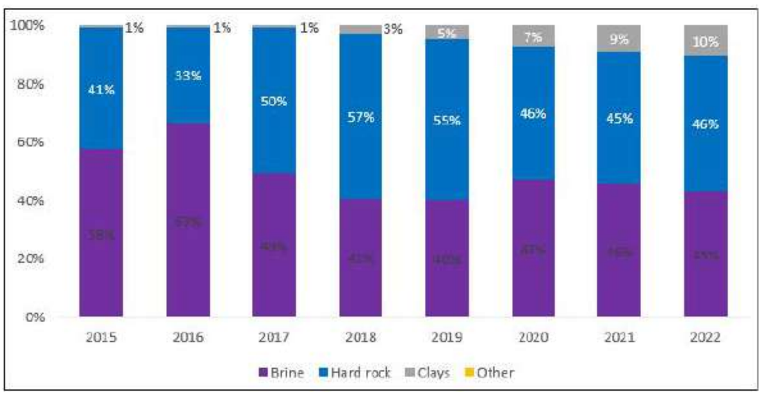


Source: Fastmarkets

Figure 16-5: Simplified Lithium Supply Chain

In recent years, supply from petalite and lepidolite clays has started to be added. Technically, these can be considered hard rock deposits, but given the different economics are best broken out.

Exploration and technical studies are currently ongoing into other deposits. Although extensive study has been completed and much is being invested in these alternate lithium sources, they are yet to provide meaningful supply (Figure 16-6).

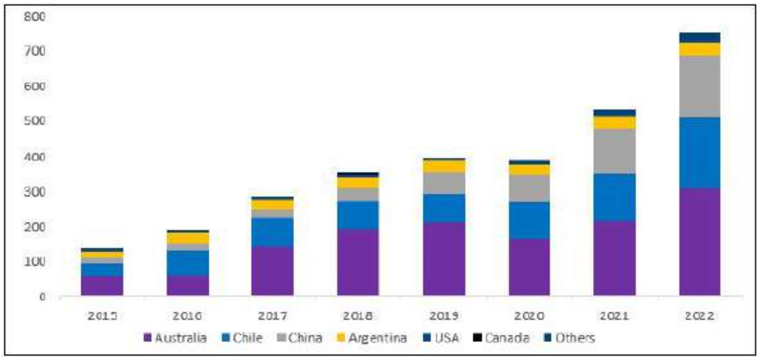


Source: Fastmarkets

Figure 16-6: Lithium Supply by Source (%)

Up until 2016, global lithium production was dominated by two deposits: Greenbushes (Australia, hard rock) and the Salar de Atacama (Chile, brine), the latter having two commercial operators, Albemarle and SQM.

Spurred on by the demand for lithium, recent years saw capacity being added globally. Production climbed from 186,000 t LCE in 2016 to 749,000 t LCE in 2022 (Figure 16-7). Though, even with the greater geographic diversity, just three countries accounted for over 92% of global supply – Australia with 41.4%, Chile 26.7% and China 23.5%. As of the end of 2022, Fastmarkets reckons that 43 operations were in operation, though not all were operating and producing material. Of these, 16 were brine operations, 25 spodumene and 2 clay.

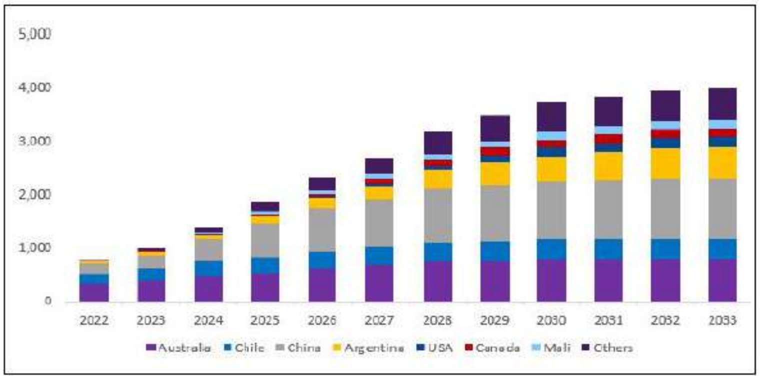


Source: Fastmarkets

Figure 16-7: Lithium Production (000's t LCE)

The high lithium prices of the previous 24 months and a strong political focus on net-zero initiatives have been supportive to companies looking to bring on new production and bringing them on quickly. Many governments have helped by offering grants and tax breaks, with the Inflation Reduction Act (IRA) a prime example of how subsidies can incentivize the build out of the EV supply chain.

Looking forward, Fastmarkets forecasts that supply will grow significantly to match demand – mine supply is forecast to increase from 749,000 t in 2022 to 2,680,000 t in 2027 – 29% annual CAGR (Figure 16-8).



Source: Fastmarkets

Figure 16-8: Forecast Mine Capacity (000's t)

New techniques and technologies along the lithium supply chain are being developed. A few may offer meaningful improvements in recovery rates or reduced costs, but in Fastmarkets' opinion, it is unlikely there will be changes in the next few years that revolutionize production or noticeably reduce costs.

Besides primary sources of lithium, lithium recycling will add additional supply. Recycling is currently hampered by low volumes of scrap batteries and limited recycling facilities, but both of these hurdles are diminishing. Fastmarkets estimates that in 2023 there will be 90 GWh of total scrap batteries, which increases to 479 GWh of scrap batteries in 2033. In anticipation, recycling facilities are being developed and technological improvements will improve yields.

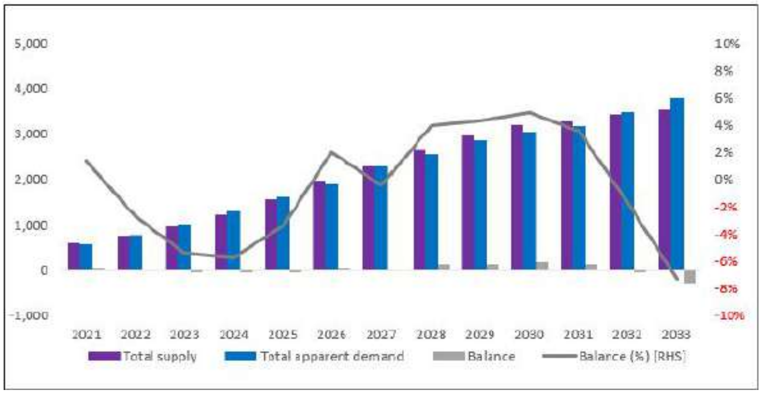
Overall, Fastmarkets; forecasts that there is likely to be sufficient supply to avoid production shortages, but new projects are likely to bring higher costs than established projects. This has been fed into price forecasts.

16.1.4 Supply-Demand Balance

Overall, Fastmarkets sees a balanced supply-demand picture for lithium, with a growing deficit developing towards the end of the forecast. A small deficit at the end of the forecast is to be expected, as new facilities will only be developed if supply tightness are expected (Figure 16-9).

16.1.5 Lithium Prices

Lithium prices reacted negatively to the supply increases that started in 2017, with spot prices for battery grade lithium carbonate, cif China, Japan, Korea (CJK) falling from a peak of US$20/kg in early 2018, to a low of US$6.75/kg in the second half 2020.

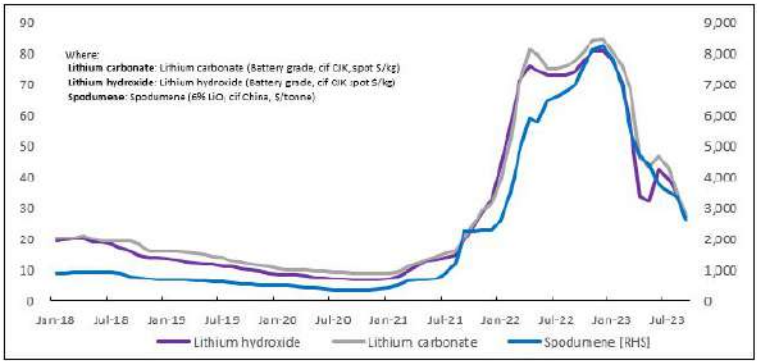


Source: Fastmarkets

Figure 16-9: Lithium Supply-Demand Balance (000's t LCE, %)

Prices were then catapulted higher – averaging US$17.2/kg in 2021 and US$72.8/kg in 2022 – as supply tightness became evident and battery manufacturers and auto producers moved to secure themselves supply. The market was somewhat caught off guard when prices started to race higher, as it was believed that spodumene stocks had been built up in the previous years, which would allow producers to respond to the jump in demand.

As it turned out, the stock of spodumene was held in limited hands and supply tightness developed. Spodumene supply, was unable to meet the new demand and spodumene prices increased by 433% in 2021 and stayed high (Figure 16-10).



Source: Fastmarkets

Figure 16-10: Lithium Battery Material Prices (US$/kg, US$/t)

As 2022 turned into 2023, a more concerted supply response gained pace. With underutilized capacity restarting, some expansions being added and new mines starting up. Supply adapted to the situation. At the same time demand slackened, as EV sales dropping.

Prices of both spodumene and lithium battery compounds reacted to the loosening supply picture by dropping sharply. Such a price response was to be expected, and arguably necessary to support the development of cheaper EV offerings. However, prices have not collapsed. Demand is still stronger than historically, even if supply has improved. Prices have slid over 2023, with lithium carbonate prices averaging US$51.9/kg over the first 9 months.

With demand forecast to stay strong over the coming decades, the market will need to continue to add fresh supply to satisfy demand. This means lithium prices will have to exceed the production costs of new projects and provide an adequate rate of return on investment to justify developments.

Given this view, Fastmarkets expects prices to hold above incentive prices. With price spikes likely due to relatively small free supply and limited supply options.

The still tight market of 2023 is expected to loosen further, but to post a small deficit of 73,000 tonnes LCE, due partly to processing loses and the build-up of working stock. Thereafter, fundamentals are expected to be almost neutral, but with a slowly increasing deficit from 2032. The deficit extends to 7% by 2033.

Fastmarkets has forecast prices out to 2033 (Table 16-8) for the most utilized market prices. Fastmarkets recognizes that Albemarle's current operations are expected to continue for at least another 20 years, but due to the recent significant changes in the market and a lack of visibility, prices beyond 2033 are unusually opaque for an industrial commodity

Constrained supply and auto manufacturers' fears of stock outs are expected to keep prices above incentive prices for the whole forecast period, albeit with lower premia than those seen in 2022.

Volatility will remain a key theme, due to supply additions arriving in waves and the tight supply-demand balance. Fastmarkets expects periods when supply will be greater than demand, leading to surpluses, and downward pressure on prices on spot prices. Though these will be short lived, as suppliers respond and demand catches up with any excesses.

Table 16-8: Key Lithium Prices – Real (US$/kg, US$/t)

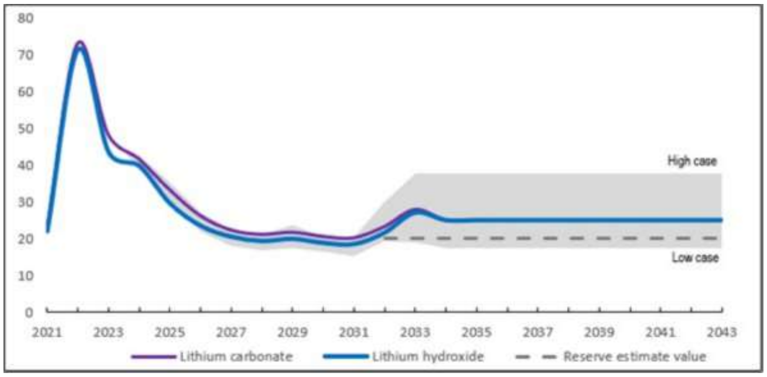
Low Case	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Lithium carbonate	22.3	72.9	45.4	38.8	30.5	21.7	17.8	16.7	17.3	16.3	15.1	19.1	18.9
Lithium hydroxide	22.0	71.2	57.9	36.9	28.7	19.9	16.1	15.0	15.6	14.6	14.3	17.4	17.2
Spodumene	1,567	6,084	4,249	3,595	2,680	1,806	1,428	1,232	1,388	1,199	1,093	1,577	1,557
Base Case													
Lithium carbonate	22.3	72.9	48.3	41.6	33.3	26.2	22.3	21.1	21.7	20.6	20.2	23.2	27.9
Lithium hydroxide	22.0	71.2	43.5	39.7	29.6	23.5	20.5	19.4	19.9	18.8	18.5	21.6	27.0
Spodumene	1,567	6,084	4,457	3,784	3,050	2,258	1,874	1,760	1,821	1,713	1,681	1,992	2,459
High Case													
Lithium carbonate	22.3	72.9	52.2	44.5	37.0	28.9	24.1	22.9	25.2	22.3	21.0	31.5	39.3
Lithium hydroxide	22.0	71.2	63.7	42.6	35.1	27.1	22.3	21.1	23.4	20.6	20.2	29.9	37.7
Spodumene	1,567	6,084	5,022	4,163	3,420	2,529	2,052	1,936	2,168	1,884	1,765	2,905	3,688

Source: Fastmarkets
Where: Lithium carbonate: Lithium carbonate (Battery grade, cif CJK, spot US$/kg)
Lithium hydroxide: Lithium hydroxide (Battery grade, cif CJK spot US$/kg)
Spodumene: Spodumene (6% LiO_2 cif China, US$/t)

Between 2033 and 2043, Fastmarkets expects the lithium hydroxide and carbonate prices to be at parity and average US$25/kg over the period.

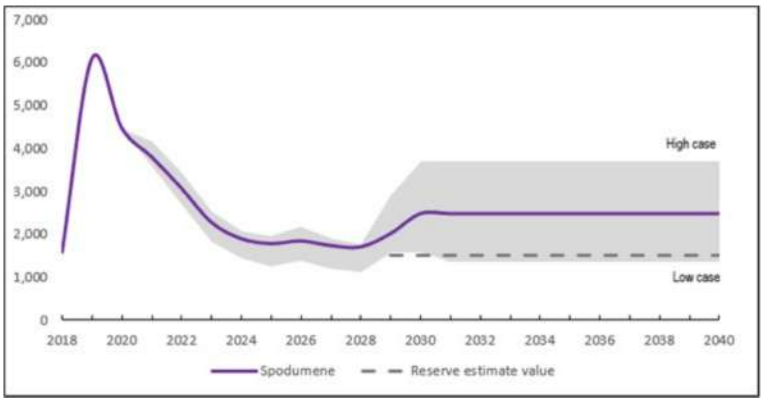
Fastmarkets have provided a base, high, and low case price forecast, to give an indication of the range of which prices could sit, depending on reasonable assumptions around potential impacts to the base case market balance. Fastmarkets recommends that a real price of US$20/kg for lithium carbonate cif CJK and of US$1,500/t for spodumene SC6 cif China should be utilized by Albemarle for the purposes of reserve estimation. Recommended prices are on the lower end of Fastmarkets low-case scenario.

These scenarios are shown in Figure 16-11 and Figure 16-12. In both graphs, 2023 has been assumed to be constant for clearer visualization.



Source: Fastmarkets

Figure 16-11: Lithium Battery Materials Long-Term Forecast Scenarios (Battery grade, spot, cif CJK, US$/kg, real)spot, cif CJK, US$/kg, real)



Source: Fastmarkets

Figure 16-12: Spodumene Long-Term Price Forecast Scenarios (6% LiO spot, cif China, US$/t, real)

6.1 Product Sales

Greenbushes is an operating lithium mine. The mine produces a chemical-grade spodumene concentrate and a range of technical-grade spodumene concentrates. Table 16-9 provides the specifications for the primary product (chemical-grade spodumene), which is the focus of this market study.

Table 16-9: Chemical Grade Spodumene Specifications

Chemical	Specification	
Li_2O	min.	6.0%
Fe_2O_3	max.	1.0%
Moisture	max.	8%

Source: Talison Shareholders Agreement, 2014

Table 16-10 presents historic production quantities for chemical-grade spodumene concentrate. In addition, historic consolidated technical grade spodumene concentrate sales are presented for reference.

Table 16-10: Historic Greenbushes Production (Tonnes Annual Production, 100% Basis)

Spodumene	2015	2016	2017	2018	2019	2020	2021	2022
Chemical grade	351,243	357,018	498,341	565,205	618,896	433,000	734,000	1,185,000
Technical grade	86,714	136,795	148,129	158,838	145,676	91,000	146,000	163,000

Source: Talison Physicals Reporting, 2015-2022 Technical grade concentrate tonnage includes SC7.2 (Standard and Premium), SC6.8, SC6.5 and SC5.0 products

Talison constructed a second chemical grade lithium concentrate production plant (CGP2) that opened in 2019, which doubled capacity to 1.34 Mt/y. Since then, a TRP has been built and is being ramped up and a final investment decision has been approved to build a third chemical grade plant (CGP3), and there are plans for a fourth plant (CGP4). CGP1, CGP2, and TRP now mean the mine has 1.5 Mt/y of spodumene capacity; when/if CGP3 and CGP4 are added, it would take the capacity to 2.5 Mt/y. Spodumene from Greenbushes will then feed Albemarle's Kemerton lithium hydroxide plant and Tianqi Lithium/IGO's JVs Kwinana lithium hydroxide plant.

As a chemical-grade spodumene concentrate, the primary customer for the product is lithium conversion facilities that convert the spodumene concentrate into various chemical products, including battery-grade lithium carbonate and hydroxide that can be utilized as feedstock for electric vehicle batteries (the forecast primary growth market for lithium products). Chemical-grade spodumene concentrate is currently fully consumed by the joint venture owners of the operation (i.e., Albemarle and Tianqi/IGO JV) for their downstream conversion facilities. Including the recently expanded production capacity for Greenbushes, Albemarle expects to continue to fully consume its allocated proportion of chemical-grade concentrate production from the operation internally.

16.2 Contracts and Status

As outlined above, the lithium chemical-grade spodumene concentrate produced by Greenbushes is consumed internally by the current joint venture owners of the operation (Albemarle and Tianqi/IGO JV). The purchase of this concentrate from the Greenbushes operating entity (Talison) is governed by the 2014 joint venture agreement between the two owners. This joint venture agreement establishes that while Albemarle is an owner, it is entitled to take an election of up to 50% of the annual production from Greenbushes, with that election made on an annual basis. The sales price of chemical-grade concentrate to Albemarle or Tianqi/IGO JV is based on the market price, as would be any third-party concentrate sales.

17 Environmental Studies, Permitting, and Plans, Negotiations, or Agreements with Local Individuals or Groups

The following sections discuss reasonably available information on environmental, permitting, and social or community factors related to the Project. Where appropriate, recommendations for additional investigation(s), or expansion of existing baseline data collection programs, are provided.

On August 19 and 20, 2020, SRK conducted an inspection of the Greenbushes mine site. This inspection was to confirm the conditions on the mine site and any potentially material information that could affect mine development. No additional site visits by an environmental specialist have been conducted since 2020. The Project has been in operation as a hard rock mine since 1983 and is fully permitted for its current operations. The Project is in the process of obtaining further approvals for expansion; where appropriate and available, some information relevant to the proposed expansion has been included in this evaluation. This review is compiled from information provided by Talison Lithium Australia Pty Ltd (Talison) and publicly available documents.

Talison holds the mining rights to lithium at the Project, and Global Advanced Metals (GAM) holds the rights to non-lithium minerals. GAM processes tantalum and tin extracted by Talison during mining activities within the Project area under their own Part V Environmental Protection Act 1986 Operating Licence. GAM is responsible for compliance with their Part V Operating Licence; however, Talison provides assistance to GAM in the form of environmental monitoring and reporting under a shared services agreement. As GAM operates within Talison-owned mining tenements and Mine Development Envelope (MDE), GAM's compliance with environmental conditions associated with these approvals is the responsibility of Talison.

7.1 Environmental Study Results

The mine is in the southwest of WA in the Shire of Bridgetown-Greenbushes. The town of Greenbushes is located on the northern boundary of the mine. The majority of the mine is within the Greenbushes Class A State Forest (State Forest 20) which covers 6,088 ha and is managed by the Department of Biodiversity, Conservation and Attractions (DBCA) as public reserve land under the Conservation and Land Management Act 1984 (CALM Act). The DBCA manages State Forest 20 in accordance with the Forest Management Plan that aims to maintain the overall area of native forest and plantation available for forest produce, including biodiversity and ecological integrity. The remaining land in the mine area is privately owned.

The Greenbushes region has been mined for various minerals since the 1880s, initially by alluvial mining via shafts and sluices, and later by dredging of deep alluvium. A smelter and associated crushing and dressing plant were constructed in 1900 and operated for four years, and several treatment plants also commenced operations at the same time (IT Environmental, 1999). Soft rock mining of the weathered pegmatite occurred in the 1970's and was processed at multiple wet and dry treatment plants before being consolidated at a single Integrated plant site. Hard rock mining commenced in 1983, and a tin smelter, chemical plant, and Tailings Retreatment Plant were commissioned at the same time. Since this time, environmental studies and impact assessments have been completed to support project approval applications, some of which are summarized below.

17.1.1 Flora and Vegetation

The mine is located in the Jarrah Forrest Bioregions under the Interim Biogeographic Regionalization of Australia classification system (Australian Government, 2012). Several flora and vegetation studies have been reported in support of project approvals, with the most recent detailed flora and vegetation surveys conducted in spring and autumn 2018 across areas proposed for the mine expansion and access corridors (Onshore Environmental, 2018a; Onshore Environmental, 2018b). A total of nine vegetation types have been mapped in the MDE that consists of two types of Eucalyptus Forest, two types of Corymbia Forest, Eucalyptus Woodland, Podocarpus Heath A, Hypocalymma Low Heath C, Melaleuca Forest and Pteridium Dense Heath A, with Allocasuarina Forest and Heath reported for the infrastructure corridors for access and pipelines.

No Threatened Ecological Communities, Priority Ecological Communities or threatened flora listed under the federal Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) or the Western Australian Biodiversity Conservation Act 2016 (BC Act) have been reported in the vicinity of the mine site. The nearest population of threatened vegetation within the Mining Leases identified by Onshore Environmental (2012) are Caladenia harringtoniae in M01/3, approximately 560 m west of the southwest in a declared Environmentally Sensitive Area (ESA). One priority flora species (Priority 4 – rare and near-threatened), Acacia semitrullata, was recorded by Onshore Environmental in 2018 adjacent to State Forest 20.

The vegetation condition is predominantly rated as good or very good according to the classification developed by Keighery (1994), with degraded areas typically those that have been logged in the past, areas of historical mine rehabilitation (e.g., gravel pits), and pasture (Onshore Environmental, 2018a). A total of 886 introduced flora species have been reported, including three which are Declared Plants under the Biosecurity and Agriculture Management Act 2007, Bridal Creeper (Asparagus asparagoides), Blackberry (Rubus anglocandicans) and Sorrel (Rumex acetosella). The Project is located in an area at risk of Dieback (Phytophthora cinnamomi) that results in widespread vegetation death. Areas of infestation are known within the MDE and require ongoing management.

17.1.2 Terrestrial and Aquatic Fauna

Terrestrial Fauna

A number of fauna studies have been conducted in support of project approvals, most recently in 2011 and 2018 (Biologic, 2011; Biologic, 2018a; Harewood, 2018). There have been seven conservation significant fauna species recorded in the MDE. Recorded species listed under the EPBC Act includes the vulnerable Chuditch (Dasyurus geoffroii), the critically endangered Western Ringtail Possum (Pseudocheirus occidentalis), the endangered Baudin’s Cockatoo (Calyptorhynchus baudinii) and Carnaby’s Cockatoo (Calyptorhynchus latirostris), and the vulnerable Forest Red-tailed Black Cockatoo (Calyptorhynchus banksia naso). Species listed under the state’s BC Act includes two priority four species; Southern Brown Bandicoot (Isoodon fusciventer) and the Western Brush Wallaby (Notamacropus irma), and one conservation dependent species, the Wambenger Brush-tailed Phascogale (Phascogale tapoatafa wambenger). Additional species that may be present based on desktop assessments, but have not been recorded in the field, include three mammals, seven birds, and one reptile.

The presence of the Black Cockatoos resulted in the determination of the waste rock dump expansion in 2016 to be a ‘controlled action’ under the EPBC Act and was conditionally approved with a requirement for biodiversity offsets and the protection of the habitat for this species

Six introduced mammals have been recorded in the MDE, pig (Sus scrofa), cat (Felis catus), rabbit (Oryctolagus cuniculus), fox (Vulpes vulpes), house mouse (Mus musculus), and the black rat (Rattus rattus).

Short Range Endemic (SRE) Species

A SRE species study conducted by Biologic (2018a; 2018b) was not able to conclude the regional significance of the 20 specimens collected due to limited available information regarding the taxonomy of those species. However, the Jarrah/Marri Forest and Jarrah/Marri Forest over Banksia, which is suitable habitat for SRE species, is well represented outside the MDE, and SRE species are likely to exist in the surrounding areas as well.

17.1.3 Surface and Groundwater

The region has a Mediterranean climate, with warm dry summers and cool wet winters, with average annual rainfall of 820 mm, mainly falling between April and September (Talison, 2019a). The active mining area lies along a topographic ridge which hosts the mineralized pegmatite zone. The majority of the mine is located in the Middle Blackwood Surface Water Area. Surface watercourses within the mining leases are all tributaries of the Blackwood River, which has the largest catchment in southwest WA, approximately 22,000 square kilometers (km^2) (Centre of Excellence in Natural Resource Management, 2005). The entire river is registered as a significant Aboriginal site (Site ID 20434) that must be protected under the State Aboriginal Heritage Act 1972.

The topographic ridge diverts surface water either west into the Norilup Brook sub-catchment or east into the Hester Brook sub-catchment. The Project relies on surface water to supply mining activities; therefore, management of surface water between storage areas is important. The western catchment contains the mine infrastructure, processing plants, and TSFs. Surface water in the western catchment is stored in several dams that are part of the mine water circuit and that are impacted by mine waters, the Clean Water Dam, Austin’s Dam, Southampton Dam and Cowen Brook Dam. The Tin Shed Dam is the responsibility of GAM under their operating license. Schwenke's Dam and Norilup Dam are outside of the MDE, but can potentially receive water from the mine water circuit as a result of overflows from the Southampton Dam or Cowen Brook Dam respectively. Water discharges from Cowen Brook Dam or Southampton Dam are not permitted. The current Water Management Plan (Talison, 2020a) describes the Norilup Brook watercourse as fresh (500 to 1,500 microSiemens per centimeter (µS/cm)). The eastern catchment contains Floyds WRL which impacts the surface water. Discharges are permitted from Floyds Gully (below Floyds WRL) to Salt Water Gully which flows to the Hester Brook and onto the Blackwood River. The Hester Brook watercourse has elevated salinity (1,000 to 5,000 µS/cm).

Groundwater is not a resource in the local area due to the low permeability of the Archaean basement rock, as evidenced by low rate of groundwater ingress (approximately 5 L/s) into the existing Cornwall pit and underground workings (GHD, 2019a). In general, the mine site is underlain by a lateritic weathered basement of clays 15 to 40 m thick that has relatively low permeability (total hydraulic conductivity average 0.05 meters per day (m/d), range from 0.001 to 0.1 m/d) that is interpreted to limit the downward migration of water. Higher permeabilities are inferred to occur where the laterite is vuggy and have been identified from drilling data at the relatively sharp transition between the clays and the oxidized basement rocks (total hydraulic conductivity average 0.3 m/d, range from 0.05 to 1.3 m/d) (GHD, 2019a).

Earlier studies indicated that the pits would overflow to the south approximately 300 years after mine closure (Talison, 2016). More recent pit lake predictive modeling, however, suggests that water levels will stabilize in approximately 500 to 900 years (based on the mine expansion) and that water levels will remain 20 m below the pit limits and will, therefore, not overflow after closure (GHD, 2020). The results of this revised assessment are recommended to be confirmed by groundwater level and abstraction monitoring and additional hydrogeological investigations in order to describe the characterization of deeper bedrock hydraulic properties.

Paleochannels predominantly of sand between 2 m to 30 m thick are incised into the basement rock that traverse the MDE and were dredged as part of historically alluvial mining activities. Low-lying wetlands and surface water within the Project area, including the Austin's and Southampton Dams, are coincident with the paleochannels and indicates a high degree of hydraulic connectivity between surface water and the alluvial material (GHD, 2019a). The channels also occur beneath the TSFs, which are unlined (Note: TSF4 – Cell 1 is proposed as partially lined), and connectivity between the channels and seepage derived from the TSFs was reported by GHD in 2014 (GHD, 2019b).

Groundwater quality is variable across the site based on groundwater quality monitoring and is inferred to be locally influenced by groundwater recharge from surface water, mineralization (resulting in elevated magnesium, carbonate, and low pH) or by possible influence of seepage derived from historic mine/dredge workings (GHD, 2019a). Background groundwater quality has been noted as difficult to determine due to a lack of monitoring wells upgradient from the mine, and as monitoring wells are located close to the TSFs and/or in the historically dredged channels (GHD, 2014). Some monitoring wells have been impacted by seepage; however, only one well was determined to be impacted by seepage in 2019, which is a shallow well south of TSF2 (GDH, 2019c).

Downstream surface or groundwater users consist of private rural holdings and State Forest 20 that typically use water for stock, pasture, and garden irrigation. Surveys of users with direct access to Norilup Brook and Waljenup Creek confirmed that water is not relied upon as a resource, and the higher salinity of Hester Brook indicates potential for seasonal stock use only (Talison, 2020a). Groundwater may also discharge as baseflow to watercourses in the area and, therefore, supports the ecological values of the Blackwood River (GHD 2019a).

17.1.4 Material Characterization

Several materials characterization studies of waste rock and tailings have been completed since 2000 and include analysis of the Floyds Dump drainage water quality between October 1997 and May 2013 (GCA, 2014), tailings seepage water quality between 1997 and 2014 (GHD, 2014), analysis of the potential for acid rock drainage and metal leaching (ARD/ML), and short-term tailings leach testing (GHD, 2023).

Waste Rock

Studies between 2000 and 2019 indicate:

- Waste rock is not typically acid generating, with average concentrations of 0.1% sulfur of waste rock and 0.006% sulfur for the pegmatite ore (GHD, 2019d). Sulfide-minerals (e.g., pyrrhotite) in the pit waste-zone are sporadic in distribution and invariably occur as trace components (GCA 2014).

- Waste rock that is potentially acid generating (PAG) are the granofels (metasediments) typically located in the footwall of the orebody. The amphibolite and dolerites also contain occasional stringers and pods of sulfides such as pyrite, pyrrhotite and arsenopyrite.
- Significant acid neutralizing capacity (ANC) has been shown to exist in waste rock and pit walls, predominantly in the amphibolite where frequent calcite veins occur (Baker 2014) and, therefore, leaching and mobilization of metals under acidic conditions is considered low risk (GCA, 2014; GHD, 2019d).
- Leachate analysis in 2019 concluded that there is a moderate risk that leaching of metals, such as arsenic, antimony, and lithium from waste rock, and may be a concern where there is hydraulic connection to groundwater and surface water systems (GHD, 2019d).
- The occurrences of high sulfur lithotypes are estimated to constitute less than 1% of the total volume of waste rock for the current mine plan (GCA, 2014). The mine expansion predicts that 17% of the mined waste rock will be PAG granofels (GHD, 2019d).
- Sulfide oxidation is occurring from Floyds Dump, as indicated by the elevated sulfate levels in the drainage water, which correlates seasonally with electrical-conductivity (EC) values within the range 2,500 to 3,500 µS/cm (GCA, 2014). Leach tests on 21 samples in 2019 suggest that elevated sulfate concentrations are due to the presence of granofels (GHD, 2019d).
- A close correlation of leachate-Li and leachate-SO_4 concentrations for a granofels sample tested in 2002 suggests a dependence of Li solubility on sulfide-oxidation (GCA, 2014).

Further studies into the geochemistry of the waste rock are currently underway and should help clarify some of the uncertainties ahead of the proposed mine expansion.

Tailings

The mine produces two grades of lithium oxide for the processing plant: technical grade (greater than 3.8% lithium oxide), and chemical grade (greater than 0.7% lithium oxide). The process water pH is raised to 8.0 s.u. with the addition of sodium carbonate (Na_2CO_3) prior to deposition in the tailings dams, as slurry and ionic ratios provide an indicator to identify seepage. Tailings characterization studies indicate:

- Tailings and ore have a low sulfur content (less than 0.015%) and are without inherent mineralogy that can provide carbonate buffering capacity (GHD, 2016).
- Analysis of tailings assay results (1,932 samples) identified that arsenic, cesium, lithium, rubidium, and tungsten were relatively enriched, with tungsten likely to be derived from the tungsten carbide balls in the mill (GHD, 2016).
- An assessment of long-term tailings water quality, as measured from decants and ponds, were summarized between 2011 and 2014 and indicated that the water is slightly basic, with a dissolved salt content of between 800 and 11,200 mg/L, and elevated metals such as arsenic, lithium, boron, nickel, and zinc (GHD, 2016).
- Specific leaching studies have not been carried out on the tailings and ARD is considered unlikely considering the low sulfur content; however, leaching studies of the ore indicate a moderate risk for leaching of arsenic, antimony, lithium, and rubidium under neutral pH conditions (GHD, 2019d).
- More recent studies (GHD, 2023) suggest that tailings solids should not contribute to dissolved metals at concentrations above the relevant guidelines (freshwater aquatic and drinking water)

once the residual decant is flushed from the pore spaces. However, additional field investigations were recommended to assess the distribution and cause of acidic and saline conditions observed in one test sample.

Soils

Soils have been characterized to consist of lateritic crests and upper hill (1a) slopes of sandy topsoil and gravelly sandy loam that are underlain by caprock at about 550 mm depth, lateritic mid and lower slopes (1b) sandy topsoil over gravelly sandy loam subsoil up to 1,100 mm depth, and sandy lower slopes and flats (2a) grey sand up to a minimum depth of 800 mm over laterite caprock (Talison, 2019a).

Radionuclides

Studies into the potential for radionuclides have consistently returned results that are below trigger values. This includes waste rock and ore samples (GHD, 2019d), radon flux assessments across the mine site (IT Environmental, 1999), and ongoing water monitoring for Radium-226 (Ra-226), and Radium-228 (Ra-228) within 20 monitoring wells, as required for the Licence.

17.1.5 Air Quality and Greenhouse Gas Assessment

The town of Greenbushes, located on the northern boundary of the MDE, has a population of about 365 people, and includes a primary school approximately 100 m north of the Cornwall pit (currently in care and maintenance) and several rural residences nearby. The local existing air quality is primarily influenced by mining, and to a lesser extent surrounding agricultural activities, vehicle movements, burning (including residential wood burners, bush fires) and mechanical land disturbance (Talison, 2019). Air quality is regulated under the operating Licence (L4247/1991/13) and monitored by a continuous high-volume air sampler with a particle matter (PM_{10}) limit of 90 µg/L at a single location at the boundary between the mine and the town. Dust monitoring results show that the rare exceedances of the National Environment Protection (Ambient Air Quality) Measure (NEPM) limit (50 µg/L averaged over a 24-hour period) were attributed to bushfires and earthworks for water services near the sampler (DWER, 2020). The surface of the tailings is prone to dust generation, and dust is currently managed by a crop of rye grass on TSF1 which is not currently in use. In 2020, the method of tailings deposition was changed from a single discharge point to multiple spigots around the circumference to help minimize fugitive dust generation. Additional air quality samplers are planned for the monitoring network for the mine expansion and will determine the effectiveness of the new tailings deposition plan, and reduce uncertainties regarding potential exceedances of soluble barium, an issue identified by the Department of Health (DOH), suggesting that more stringent dust management measures may be required to manage dust emissions.

Reporting of greenhouse gas emissions is required annually under the National Greenhouse and Energy Reporting Act 2007, and emissions reports for the Greenbushes Lithium Operation – Facility show an increase from 60,506 t CO_2-e (Scope 1 and 2) in 2017 to 79,030 t CO_2-e (Scope 1 and 2) in 2019, a decrease to 74,526 t CO_2-e (Scope 1 and 2) in 2021, and a substantive increase to 156,490 t CO_2-e (Scope 1 and 2) in 2022 (Greenbase Environmental Accountants, 2018; Greenbase Environmental Accountants, 2019; Clean Energy Regulator, 2021; Clean Energy Regulator, 2022). According to Talison, the marked increase in 2022 was due to an increase in overall production requiring increased energy utilization (both electrical and diesel usage) as well as the commissioning of the Tailings Retreatment Plant. These figures are reported publicly, as they exceed the corporate threshold of 50,000 t CO_2-e, and as the project also consumes more than 200TJ energy per year. Historical and current Scope 1 direct emissions have not exceeded 100,000 t CO_2-e, which is the trigger for assessment under EPA guidelines (EPA, 2020); however, project expansion is projected to exceed this threshold in the future.

17.1.6 Noise, Vibration and Visual Amenity

Due to the proximity of the mine to the Greenbushes town, a safety berm/sound wall has been constructed. The mine is unable to meet the noise limits specified by the Environmental Protection (Noise) Regulations of 1997and has been granted approval to exceed the limits through the Environmental Protection (Talison Lithium Australia Greenbushes Operation Noise Emissions) Approval 2015 (a Regulation 17 exemption). GAM also operates under an identical approval, and the combined noise emissions cannot exceed the specified limits (Talison, 2019a). There were no reported noise exceedances in 2018 and 2019 (Herring Storer Acoustics, 2018; Talison, 2019b), one-blasting overpressure non-compliance was reported, and four noise and blasting complaints were received in the 2018 to 2019 Annual Environmental Report period. While several nighttime noise complaints were reported in 2020, 2021, and 2022, review of monitoring data did not indicate any regulatory exceedances. It was noted in the vibration assessment for the mine expansion that the current monitoring network is prone to false triggers due to the receiver locations. It is recommended that this is reviewed.

The mine and associated light spill are obscured from the town by the safety/ sound barrier; however, several rural residences located east of the mine and some sections of the South Western Highway can see Floyds Dump, a significant feature located between the open pits and the highway. Talison undertakes progressive rehabilitation of the Floyds Dump embankment with only active dumping areas exposed, and currently the mine is screened by the surrounding State Forest and undulating topography (Onshore Environmental 2018c).

17.1.7 Cultural Heritage

The Blackwood River (ID 20434) is the only registered Aboriginal heritage site of significance in the location of the mine and is a site of mythological significance as the home created by the Waugal and also a customary path from inland to the coast (Brad Goode and Associates, 2018). Cultural, archaeological, and ethnographic surveys that involved representatives of the Gnaala Karla Booja, South West Boojarah, and Wagyl Kaip Native Title Groups, and ethnographic consultation with the nominated Noongar representatives, were conducted in 2015, 2016, and 2018. No sites or artifacts of significance, as defined under Section 5 of the Aboriginal Heritage Act of 1972, were identified (Brad Goode and Associates, 2018).

There are no other cultural sites listed within the MDE, and the nearest (non-Aboriginal) heritage sites listed on the inHerit database of Western Australia are the Golden Valley Site 7.25 km northeast, and the Southampton Homestead approximately 6.5 km west of the mine. Local municipal listed cultural sites include several sites and buildings in Greenbushes town and the South Cornwall Pit (place number 6,639, Category 2) due to the continuous history of mining activity since 1903.

7.2 Environmental Management and Monitoring

The mine operates under approvals that contain conditions for environmental management that include waste and tailings disposal, site monitoring, and water management. Primary approvals are authorized under the federal Environment Protection and Biodiversity and Conservation Act 1999 (Cwlth) (EPBC Act), the Environmental Protection Act 1986 (EP Act), including the environmental impact assessment approval for the proposed mine expansion (Ministerial Statement 1111), the operation of a prescribed premises (Licence L4247/1991/13), approval for the construction and commissioning of a prescribed premises for the proposed mine expansion (W6283/2019/1), and under the Mining Act 1978 under an approved Mine Closure Plan (Reg ID 60857) and several Mining Proposals (Section 17.3).

17.2.1 Environmental Management

The mine has operated using an Environmental Management System (EMS) that has been accredited under ISO 14001 since 2001 (Sons of Gwalia Ltd., 2004). The current ISO 14001:2015 certificate is valid until March 17, 2026. The mine has a Quality Management System accredited under ISO 9001. The current ISO 9001:2015 certificate is valid until September 5, 2025. The EMS was last accredited in March 2023 with no significant issues (Bureau Veritas, 2023) and key environmental management plans (EMP) must also be reviewed and approved by the regulatory authorities (under approval conditions):

- Conservation Significant Terrestrial Fauna Management Plan (Ministerial Statement 1111)
- Visual Impact Management and Rehabilitation Plan to minimize visual impacts including light spill (Ministerial Statement 1111)
- Disease Hygiene Management Plan to minimize impacts to flora and vegetation, including from marri canker and dieback (Ministerial Statement 1111)
- Water Management Plan (Licence L4247/1991/13)
- Noise Management Plan (Environmental Protection (Talison Lithium Australia Greenbushes Operation Noise Emissions) Approval 2015)
- Dust Management Plan reviewed by DWER

It was noted in the EPA's environmental impact assessment report for the proposed expansion (2019) that the mine "has been operating since 1983 with no significant impacts to the environment having occurred as a result of activities at the Mine during this time."

Additional management plans include:

- Conservation Management Plan for Exploration on E70/5540 in Hester State Forest
- Waste Minimization and Management Plan
- Heritage Management Plan
- Integrated Pest Management Plan
- Hydrocarbon Management (Storage, Disposal and Maintenance and Cleanup Plans)
- Emergency Management Plan (and location specific Emergency Repossess Plans)

17.2.2 Tailings and Waste Disposal

Tailings Disposal

Tailings are disposed of as a slurry from the processing plant into the active TSF2 under the Operation Manual – Tailings Storage Facility (Talison, 2020). TSF1 commenced operations around 1970 (GHD, 2014) and was originally used for tin mining operations prior to the 1990's, and later for hard rock mining tailings deposition until 2006 (Talison, 2011). TSF1 is currently covered with rye grass to minimize dust. TSF3 is currently partially rehabilitated and was originally used for tantalum tailings. All the TSFs are unlined (Note: TSF4 – Cell 1 is to be partially lined):

- The tailings dams have been classified in accordance with ANCOLD guidelines (2012) as Significant for TSF1, High C for TSF 2, and Low for TSF2, and that Hazard Rating for all three TSFs are Category 1 in accordance with the Code of Practice for Tailings Storage Facilities in Western Australia (DMP, 2013).
- The emergency actions and response plans for the TSFs are defined using Trigger Actions Response Plans for actions to be taken at different escalation levels for flooding, seepage, embankment instability or damage, and earthquake scenarios.
- Seepage was identified in the shallow aquifer (paleochannels) in six bores; however, the deep aquifer was not impacted (GHD, 2014). Recent monitoring data only confirm one well.
- Seepage from the western embankment of TSF2 has been reported in the AERs since 2015. Significant works have been undertaken since 2017 to install buried pipe collector drains that transport the seepage to the mine water circuit. The requirement for ongoing active seepage management is due to the location of the TSF over the shallow sand aquifer/paleochannels.
- The tailings deposition strategy was updated in the winter of 2020 to include multiple spigots around the circumference of TSF2 to minimize dust generation during the summer months.
- Tailings deposited in TSF3 have been classified as predominantly NAF, with small quantities of PAG material generated as a result of sulfide flotation concentrate. Management of the small quantities of PAG material was by co-disposal with the NAF material (GCA, 1994).
- TSF3 has already been closed and partially rehabilitated. On closure, the TSFs will be capped, landscaped, and rehabilitated. The final design is not yet determined.

It is recommended that the closure designs for the TSFs are undertaken as soon as possible.

Waste Rock Disposal

Potentially hazardous waste rock has been managed on the site since 2003, whereby waste rock with a sulfide content greater than 0.25% is segregated for special treatment. In 2014, it was estimated that approximately 1% of samples of waste met this criterion (Baker, 2014). The site currently manages waste rock under the Waste Rock Management Plan (OPM-MP-11000, issued 2020) and Environmentally Hazardous Waste Rock Management (GEO-PR-2024, issued 2018). Waste rock with a sulfide content greater than 0.25%, or arsenic content greater than 1.000 ppm, is segregated with high sulfide material encapsulated in an unlined cell in the center of Floyds Dump, and material containing high arsenic is sent to the TSF. Historically, high arsenic material was sent to the Integrated Plant (IP) Waste Rock Dump which is no longer active (IT Environmental, 1999). The embankments of Floyds Dump are re-graded to 18º batters and covered with topsoil or weathered growth media for rehabilitation.

17.2.3 Water Management

The mine is reliant on surface water and operates under a holistic Water Management Plan (WMP) which has been revised to include the current approval conditions for the mine expansion (Talison, 2020). The mine water circuit operates as a closed system and is comprised of the four primary storage dams (Southampton Dam, Austin’s Dam, Clear Water Dam, Cowen Brook Dam), the TSF2 decant (Clear Water Pond), pits, seepage drains, collection sumps, and associated pipelines and pumps. The mine is currently upgrading the water circuit with the installation of additional pipeline tracks which will permit the movement of water between all the primary water storages to manage levels during periods of high rainfall. Contaminated water and seepage are pumped to the Clear Water Dam, which is the primary source of water for the adjacent processing plants. The Cornwall Pit and Vultan Pit are currently being used for water storage, but this will change with the proposed mine expansion.

Water levels and quality are monitored throughout the water circuit, as per the conditions of the Licence (L4247/1991/13). The primary source of arsenic in the mine water circuit was historically from tantalum processing activities and was contained within the Tin Shed Dam under GAM's responsibility, with some precipitation into dam sediments (Talison, 2017). Current arsenic and lithium sources are from lithium processing and pit dewatering. Over time, the water quality of the mine water circuit has shown increasing levels of arsenic and lithium. In 2014, arsenic remediation units (ARU) were established to manage arsenic concentrations which have now stabilized below license limits, and the ARUs have recently been replaced with a larger capacity unit. Lithium concentrations are planned to be managed at a Water Treatment Plant (WTP), currently being commissioned, which will remove lithium by reverse osmosis and is located at the Clear Water Dam.

Offsite discharge of water from the Southampton Dam and the Cowan Brook Dam is explicitly prohibited in the Licence due to potential downstream receptors from the accumulation of lithium and metals/metalloids in the mine water circuit, and connection to seepage from TSF2 via the underlying aquifer. Prior to 2018, discharges were permitted from the Cowen Brook Dam, and typically occurred during the winter months. Talison anticipates that water treatment will improve the quality of water to acceptable discharge levels in the future. In the meantime, Talison has received approval to raise the Cowan Brook Dam embankment to increase storage capacity and is seeking approval of the same for the Southampton and Austins dams. They are also seeking approval to construct a new water dam in Salt Water Gully. The dam raising projects are expected to improve conditions for downstream receptors relative to the baseline (2022) conditions.

Discharge remains permitted from emission points specified in the Licence (L4247/1991/13) and Works Approval (W6283/2019/1) which are Floyds North and Floyds South (adjacent to Floyds Dump), Carters Farm and Cemetery.

There has been no predictive modeling of the pit lake water quality as far as SRK is aware, and this is recommended to inform closure management strategies. There is potential for site water management to be required post-closure until seepage from TSF2 attenuates.

17.2.4 Solid Waste Management

Talison is required under Licence (L4247/1991/13) to dispose of solid waste in the waste rock dump by landfill (no more than 200 t) or by burial (batches of no more than 1,000 whole tires), or at a licensed third-party premises. Talison was non-compliant with the landfill criteria in the 2018-2019 AER period due to increased operations. The Licence was subsequently amended to allow disposal of 450 t of inert waste annually, an increase of 250 t/y from the previous Licence condition.

17.2.5 Environmental Monitoring

DEMIRS and DWER are charged with ensuring that mining projects comply with environmental conditions. Specific requirements for compliance and ambient monitoring are defined in the Licence (L4247/1991/13) and Works Approval (W6283/2019/1). The monitoring results for the Licence must be reported to the DWER on an annual basis and include point source emissions to surface water including discharge and seepage locations, process water monitoring, permitted emission points for waste discharge to surface water, ambient surface water quality and ambient groundwater quality monitoring, ambient surface water flow and each spring, complete an ecological assessment of four sites upstream and six sites downstream of the Norilup Dam.

The Mines Safety and Inspection Regulations 1995 require the mining industry to regularly sample for atmospheric contaminants and report the results to DEMIRS. Certain conditions on sampling for atmospheric contaminants are detailed in the regulations to ensure samples are representative and use approved procedures.

7.3 Project Permitting Requirements

17.3.1 Legislative Framework

Australia has a robust and well-developed legislative framework for the management of the environmental impacts from mining activities. Primary environmental approvals are governed by the federal EPBC Act and the environmental impact assessment process in Western Australia is administered under Part IV of the Environmental Protection Act 1986 (EP Act). Additional approvals in Western Australia are principally governed by Part V of the EP Act and by the Mining Act 1978 (Mining Act) as well as several other regulatory instruments.

17.3.2 Primary Approvals

The mine is currently approved under the EPBC Act and Part IV of the EP Act.

Environmental Protection and Biodiversity and Conservation Act 1999 (Cth)

The mine was referred to the federal Department of Environment and Heritage (now called the Department of Climate Change, Energy, the Environment and Water - DCCEEW)) under the EPBC Act in 2013 for expansion of the waste rock dump, and in 2018 for further expansion of the waste rock dump and tailings storage facilities. The works were determined to be a ‘controlled action’ due to potential impacts to listed threatened species and ecological communities and was approved with conditions for biodiversity offsets and to protect the habitat of black cockatoos (EPBC 2013/6904 and EPBC 2018/8206).

Part IV, Environmental Protection Act 1986 (WA)

The principal legislative framework in Western Australia for environmental and social impact assessment is the EP Act. Assessments under Part IV of the EP Act are made by the Environmental Protection Authority (EPA), an independent statutory authority. Under the EP Act, projects that have the potential to cause significant impacts to the environment are referred to the EPA which determines if a proposal should be formally assessed. At the completion of the Part IV assessment process, the EPA provides advice to the Minister for the Environment who then, taking in to account the advice of the EPA and other relevant Ministers and decision-making authorities, determines whether or not an approval should be granted. If the Minister decides to grant approval, a Ministerial Statement is issued. The current operations do not require approval under part IV of the EP Act. The proposed mine expansion has been approved, and the Project now operates under Ministerial Statement 1111 (MS1111). MS1111 authorizes the clearing of up to 350 ha of native vegetation.

17.3.3 Other Key Approvals

Part V, Environmental Protection Act 1986 (WA)

DWER administers Part V, Division 3 of EP Act, which involves the regulation of emissions and discharges from 'Prescribed Premises' as defined by the Environmental Protection Regulations 1987 (Schedule 1). Mining (in general) is not a prescribed activity; however, pit dewatering, ore processing, storage of tailings, crushing and screening, and power generation are among the prescribed activities regulated by the DWER.

A license is required for the operation of Prescribed Premises. Talison holds Licence L4247/1991/13, which was originally granted on December 12, 2013. The Licence, and subsequent amendments, is valid until December 27, 2026. The Licence (as of the effective date of this report) authorized operation of Category 5 Prescribed Premises, processing or beneficiation of metallic or non-metallic ore, up to 5.0 Mt/y of processing capacity and 5.0 Mt/y deposited tailings (amended December 19, 2022). Following the effective date of this report, the Licence was further amended to approve an increase in the Category 5 processing capacity to 7.1 Mt/y.

The site operates two chemical grade processing plants (CGP 1 and 2) and one TSF (TSF2). TSF3 is closed and has been rehabilitated, and TSF1 is not currently receiving tailings and is approved for use only for emergency deposition.

Off-site discharge of water from the Southampton Dam and the Cowan Brook Dam is explicitly prohibited in the Licence due to the high risk from accumulation of lithium and metals/metalloids in the mine water circuit.

A Works Approval (W6283/2019/1) was granted on April 2, 2020, for the construction and commissioning of additional processing plants, a crusher, and a tailings retreatment plant to increase the processing capacity of spodumene ore to a maximum of 11.6 Mt/y, and the Project's current management and operating strategies include compliance with the conditions of the Works Approval.

Clearing authorization (for example, through a clearing permit) is required for the disturbance of native vegetation under the EP Act. Talison holds two clearing permits (in addition to Ministerial Statement 1111), CPS 5056/2 valid until December 27, 2026, for clearing up to 120 ha for mine disturbances and CPS 5057/1 valid until December 27, 2026, for clearing up to 10 ha for rehabilitation purposes outside the mine development envelope. Offset proposals are required under these permits to address residual impacts to the Forest Red-tailed Black Cockatoo, Baudin's Cockatoo and Carnaby's Cockatoo.

Mining Act 1978 (WA)

The environmental impacts of mining and related activities are also assessed by DEMIRS, the statutory body for the regulation of mineral exploration and associated resource development activities. Environmental and social assessment requirements are defined by the Statutory Guideline for Mining Proposals and the Statutory Guidelines for Mine Closure Plans which are enabled under Section 70O of the Mining Act and the MCP must be revised a minimum of every three years. The commitments made in mining proposals for a project generally accrue rather than superseding each other, so that obligations arising from earlier approvals become binding. The applicable mining proposals and approvals are shown in Table 17-1.

A Mining Proposal and MCP must be approved by the DEMIRS before mining activities commence and must contain a description of all the relevant environmental approvals and statutory requirements that must be obtained and that will affect the environmental management of the Project. A Memorandum of Understanding (MoU) exists between the DEMIRS and some other regulatory agencies to minimize duplication of effort and to enable consultation in cases where expertise relating to a particular type of impact resides with another agency.

Table 17-1: Summary of Previous Mining Act Approvals

Reference ID	Title	Approval Date	Activities
14168	Greenbushes Tantalum/Lithium Project, Greenbushes Western Australia (NOI 747)	August 1991	Extension of mining into hard rock from Cornwall pit and Spodumene (C3) pits. Upgrade of plant/facilities for hard rock processing.
15064	Proposed Construction of Lithium Carbonate Plant – Greenbushes Mine	July 1994	Construction and operation of a lithium carbonate plant.
15785	Letter of Intent – Extension to IP Waste Dump	January 1997	Expansion of the Integrated Plant Waste Rock Landform (IP WRL) to the south. Final height 330 m above height datum (mAHD) (1,330 m reduced level (mRL)) and total footprint of 60 ha.
15942	Letter of Intent – Extension to Tantalum Pit Sound Wall	April 1997	Extension of the sound wall either side of the Cornwall pit. The sound wall will be 10 m high and have a 25° slope on the town side.
15898	Letter of Intent – Building of New Workshop on IP Waste Dump	April 1997	Establishment of a heavy vehicle workshop on the IP WRL.
16158	Preliminary Project Proposal Continuation of Hard-Rock Mining (NOI 3131)	October 1999	Ten-year mining plan to 2013. Completion of mining at Cornwall and moving to the Central Lode area. Increased ore mining rate and PTPP capacity from 1.5 Mt/y to 2.5 Mt/y.
NOI 3384, 16771	Proposal to Vary the Existing NOI For the Continuation of Hard Rock Mining to Include Underground Mining	August 2000	Establishment of an underground decline to access ore below the Cornwall pit.
NOI 4870, 18245	Tailing Management New Cell NOI M01/6 & G01/2	October 2005	Establishment of an additional tailings storage cell, Tailings Storage Facility #2 (TSF2), to the west of the existing TSF1.
NOI 5221, 18589	Letter of Intent – Greenbushes Tailings Rehabilitation Trial	April 2006	Rehabilitation of historic Tailings Storage Facility #3 (TSF3) to trial cover options for TSFs.
30733	Lithium Plant Expansion Mining Proposal 2011.	July 2011	Expansion of Lithium processing capacity to 1.75 Mt/y.
45382	2013 Mining Proposal – Continuation of Hardrock Mining III (M01/3, M01/6, M01/7, M01/16, G01/1 & G01/2	April 2014	Mine plan for 2014 to 2035 based on the lithium reserve. Expansion of Floyds Waste Rock Landform (Floyds). Expanded Central Lode pit combining existing pits. Expansion of lithium process capacity to 3.3 Mt/y. Further embankment rise of TSF1 and TSF2.
56542	Mining Proposal – 2015 Tailing Storage Expansion (M01/6 & G01/2)	2016	Embankment raises of TSF2 to 280 mAHD (1,280 mRL).

63657	CG Plant #2 2016 Lithium Processing Plant Upgrade (M01/6 & G01/2)	April 2017	Increase processing capacity to 4.7 Mt/y through construction of Chemical Grade Plant #2 (CGP2) and Chemical Grade Plant #3 (CGP3) – stage crusher.
70390	2017 Mining Proposal – Tenements M01/6	December 2017	Construction of an additional crusher, new Clear Water Dam (CWD) and a Water Treatment Plant (WTP) to reduce lithium concentration within the Mine Water Circuit (MWC).
80328	2019 Mining Proposal Infrastructure	20 September 2019	Clearing of up to 350 ha, increase processing capacity to 9.5 Mt/y of ore and 2.1 Mt/y of tailings (retreatment) through construction of CGP3/Chemical Grade Plant #4 (CGP4) and Tailings Retreatment Plant (TRP), construct new Mine Service Area (MSA), Explosives Facility, MAR.
87604	Talison Infrastructure 2020 on Mining Lease 01/03	June 2020	Infrastructure and road works for vehicle access to explosives magazine and batching facility, perimeter security fencing, and services corridors.
95694	Talison Infrastructure 2021	April 2021	MSA boundary extension, MDE expansion for Gate 5 access transport corridor, and expansion and realignment of infrastructure corridor adjacent to TSF2.
96748	TSF2 Buttressing and Ground Stability Enhancement Project	July 2021	Ground stability enhancement works and buttressing of TSF2 embankment to support lift to 1,275 mRL.
101871	Talison Pit Domain Amendment 2021	Feb 2022	Amendment of mine pit footprint.
102901	Mining Proposal Tailings Storage Facility #4 (TSF4) and Re-mining TSF1	Feb 2022	Development of new TSF4 and re-mining of historical TSF1.
111238	10 year Mine Plan	December 2022	Mining Proposal and Mine Closure Plan: development of an expanded open pit
115051	Mining proposal- Temporary Accommodation camp	February 2023	Development of temp accommodation camp.
115689	Mining Proposal- Cowan Brook Dam Raise and Accommodation village	June 2023	Raise of Cowan Brook Dam Spillway and construction of accommodation village.
119573	Greenbushes Lithium Operation – Tailings Facility #4 and Re-Mining Tailings Facility #1 Mining Proposal – Revision 6 Version 1	July 2023	Development of new TSF4 with partial bituminous geomembrane lining of Cell 1 and re-mining of historical TSF1.

Source: Talison Lithium Australia Pty Ltd., 2023.

Aboriginal Heritage Act 1972 (WA)

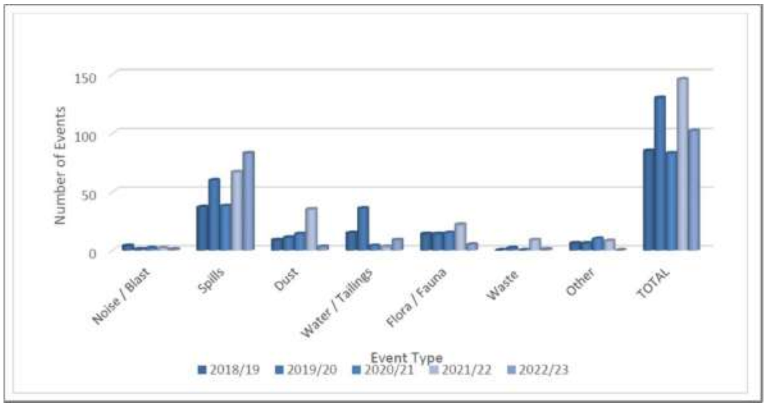
The Aboriginal Heritage Act 1972 (AH Act) provides for the protection of all Aboriginal heritage sites in Western Australia regardless of whether they are formally registered with the administering authority, the Department of Planning, Lands and Heritage (DPLH). Overall, the surveys have not identified any heritage sites; therefore, Section 18 consents are not required at this time.

Contaminated Sites Act 2003 (WA)

The mine has five registered contaminated sites due to known or suspected contamination of hydrocarbons and metals in soil, and elevated concentrations of metals in groundwater and surface water (Site IDs 34013, 73571, 73572, 75019, and 75017). While the area of potential contamination may be limited, the Act registers the entire legal parcel of land as ‘contaminated,’ even if the entire parcel of land is not actually affected by contamination. The classification of the Mine as ‘Contaminated – Restricted use’ restricts land for commercial and industrial uses only. The mine cannot be developed for more sensitive uses, such as recreation open space or residential use without further contamination assessment and/or remediation.

17.3.4 Environmental Compliance

The mine has not incurred any significant environmental incidents. Reportable incidents in the 2022-2023 AER period totaled approximately 100 incidents and consist primarily of spills, followed by water or tailings incidents, flora and fauna incidents, and dust incidents. Figure 17-1 provides a summary of incident frequency and type reported at the mine for the past 5-year period (since the 2018-19 reporting period).



Source: Talison Lithium Australia Pty Ltd., 2023. 2022-2023 Annual Environmental Report: L4247/1991/13

Figure 17-1: Environmental Events Summary Since the 2018-19 Reporting Period

Complaints comprised nine complaints for noise and blasting, seven dust complaints, two light spillage complaints, one litter complaint, and one water quality complaint. The following exceedances of a descriptive or numerical limit occurred during the 2022-2023 reporting period for the Licence:

- The lithium concentration in treated process water from the reverse osmosis water treatment plant (WTP) exceeded the numerical limit of 0.5 milligrams per liter (mg/L) in seven (7) weekly spot samples.
- The arsenic concentration in treated process water from the arsenic remediation unit (ARU) exceeded the numerical limit of 0.1 mg/L in 19 weekly spot samples.

All exceedances were reported to DWER. These exceedances were not considered to be environmental incidents, so details are not included in the environmental incident summary in the 2022-2023 AER.

DWER note in the Works Approval decision report (2020) that there have been 36 dust related complaints since the 2015/2016 reporting period; however, dust monitoring for Licence L4247/1991/13 from previous years (2010-2019) confirms consistent dust measurements well below the NEPM standard, with results over 50 μg/m^3 observed on only rare occasions.

7.4 Local Individuals and Groups

The mining tenure for the mine was granted in 1984 and, therefore, is not a future act as defined under the Native Title Act 1993 (a "future act" is an act done after January 1, 1994, which affects Native Title). The mine is, therefore, not required by law to have obtained agreements with the local native title claimant or determined groups. Nonetheless, Talison regularly engages and maintains strong ties and working relationships with local Aboriginal people and Traditional Custodians of the area, including, but not necessarily limited to, policies and practices regarding employment, contracting, establishing advisory groups, etc. Talison recognizes the Traditional Custodians' unique connections to their lands and waters, lore, language, kinship, and ceremony, particularly the Gnaala Karla Booja, Karri Karrak, and Wagyl Kaip Southern Noongar, whose traditional lands intersect the land on which Talison operates and works.

Greenbushes is within the South West Native Title Settlement agreement area between the Noongar people and the Western Australian (WA) Government. The Settlement, in the form of six ILUAs, was negotiated between the Noongar people and the WA Government and commenced on February 25, 2021, with the intent to elevate economic, social, and community outcomes of the Noongar people.

Also, as part of its efforts to build stronger communities, six multi-year partnerships have been established with key groups which directly influence local communities. These partnerships have a strong focus on education and health for people of all ages. In 2022, Talison signed two new multi-year partnerships. Specific details regarding the local communities and partnerships can be found in the *Talison Lithium 2022 Sustainability Report*.

The mine lies immediately south of the town of Greenbushes and maintains an active stakeholder engagement program and information sessions to groups such as the "Grow Greenbushes." Senior mine management reside in the town. Talison promotes local education (the Greenbushes Primary School and tertiary sponsorships) and provides support community groups with money and services (allocated in the Environmental and Community budget).

Talison has two agreements in place with local groups:

- Blackwood Basin Group (BBG) Incorporated – offset management agreement whereby BBG have agreed to manage and improve the condition of native vegetation for the purpose of the Black Cockatoo offset requirements.
- Tonebridge Grazing Pty Ltd. – site conservation agreement for the protection and improvement of native vegetation to protect Black Cockatoo habitat.

In addition, Talison entered into a revised MOU for the delivery of environmental offsets with the Department of Biodiversity, Conservation and Attractions (DBCA) in 2022.

7.5 Mine Reclamation and Closure

17.5.1 Closure Planning

The requirements for Mine Closure Plans (MCPs) in Western Australia are defined in the Mining Act 1978 and the *Statutory Guidelines for Mine Closure Plans* (DEMIRS, March 2020) which is statutory guidance under s70O(1) of the Mining Act (1978). Talison has a MCP prepared in 2022/2023 (GHD, 2023a) to cover current conditions at the site and future activities for the following 10 years.

Talison states in in the 2022 MCP that the closure concept for the Greenbushes site is to re-integrate the mine into the surrounding state forest. All of the project facilities would be part of the re-integration including artificial landforms such as tailings storage, two contoured waste rock dumps, and a large pit void.

Based on progressive rehabilitation that has been performed at the site, Talison believes that the rehabilitated landscape will be stable and non-polluting. However, the site is currently classified as Contaminated: restricted use and water from several areas does not meet current discharge criteria. Talison has stated this does not impact the proposed use to allow native fauna and general public to conduct normal activities and has included activities in the MCP to address current and potential sources of contamination. Short-term leach tests conducted on unsaturated tailings solids in early 2023 (GHD, 2023b) indicate that long-term, arsenic in long tailings seepage may exceed both the freshwater aquatic guidelines after closure and arsenic, antimony, and lithium may exceed drinking water guidelines.

In 2020, Talison commissioned a pit lake water balance study (GHD, 2020) which evaluated a range of climate scenarios to assess post-closure pit lake conditions. The analysis indicated that in all scenarios the pit lake is predicted to remain a weak to moderate terminal sink and the pit is not predicted to discharge to surface water.

Department of Biodiversity Conservation and Attractions (DBCA) indicated clear objectives with regard to the post-mining landscape and the return of state forest values including biodiversity, conservation, forestry, water recreational and riverine elements. This objective does not necessarily exclude passive recreation or wetland activities. The closure concept for the mine is to rehabilitate the disturbed areas of the site to become unallocated crown land (UCL).

The mine is one of the largest employers in the region with a large percentage of mine employees and contractors residing in both the Bridgetown-Greenbushes and Donnybrook-Balingup Shire districts. Mine closure is likely to have a significant impact on the economies of both shires. Stakeholder consultation has been ongoing throughout the LoM with rural landholders with particular reference to downstream water usage, Post-Mining Land Uses (PMLU) and mine expansions.

The Broad Principal Closure Objectives are:

- Post-mining land use has been identified and is compatible with the surrounding land use
- Post-mining land use is achievable and acceptable to the future landowner/manager
- The Environment is safe, non-polluting, and stable, and will not be the cause of any environmental or public safety liability and has an acceptable contamination risk level for the intended land use
- Potential hazardous substances are removed from site and/or the location of buried or underground hazards is defined and adequately demarcated
- The Environment can be integrated into the post-closure management practices without the input of extraordinary resources above that which could reasonably and normally be expected, unless otherwise agreed by the future landowner
- The Environment is able to support functional landforms, soil profiles, ground and surface water systems, and ecological communities for the agreed post mining land-use
- Any built infrastructure is removed, unless otherwise agreed by the future landowner/manager and so long as the maintenance of the infrastructure is not inconsistent with all these objectives

The 2023 MCP delineates nine closure domains (Table 17-2), with Talison responsible to all facilities but two, with the responsibility falling on to Global Advanced Metals Greenbushes (GAMG) who have the rights to the non-lithium minerals and ownership of the Tantalum processing facilities.

Table 17-2: Reclamation and Closure Domains

Domain Features	Area (ha)	Domain Features	Area (ha)
Mine Void Waste Rock Landforms	**306.6**	**Waste Rock Landforms**	**539.6**
Central Lode Pit Kapanga Pit Underground Portal (Legacy) Cornwall North Cornwall		Floyds WRL Noise Bund RoM / TRP RoM MSA Stockpiles	
Water Circuit	**123.8**	**Tailings Storage Facilities**	**425**
Dams (CWD, Cowan Brook, Southampton and Austins) Drains		TSF1 / TSF2 / TSF3 / TSF4	
Infrastructure – Process	**123.8**	**Infrastructure – Other**	**27.9**
CGP1 / CGP2 / CGP3 TGP TRP WTP		Admin Area Explosives Batch Facility Magazine Southampton Pump Shed 132Kv Substation / Powerline Corridor Village	
Roads and Hardstand	**111.6**	**GAMG**	**27.6**
Roads (sealed) Tracks (unsealed) Laydowns and other hardstand Car parking		TaSP Tin Shed Dam Infrastructure-Other Roads and hardstand Vegetation-remnant Vegetation-rehabilitated	
Vegetation	**110.3**		
Vegetation-Remnant within disturbed area Vegetation-Rehabilitated within disturbed area			

Source: Greenbushes Lithium Mine 2022 Mine Closure Plan, Talison Lithium Pty Ltd, 04 January 2023

Ongoing progressive closure of inactive areas of the site has been ongoing for more than 10 years in some areas and continues to provide data that will be used to determine the effectiveness of some of the proposed closure activities included in the MCP.

Although the 2023 closure plan for the site states that monitoring will continue for 10 years post-closure, Talison is currently working towards accreditation under the Initiative for Responsible Mining (IRMA) standard, which requires a minimum of 25 years post-closure monitoring unless completion criteria have been achieved. Post-closure activities currently documented in the closure plan will comprise of a 10-year monitoring schedule for the following:

- Surface water flows
- Monthly water quality
- Ground water monitoring
- Dust monitoring
- Monthly TSF inspections and seepage checks
- Annual TSF geotechnical reviews
- Pit wall stability
- Pit void water levels
- Weed monitoring
- Flora and fauna assessments
- Monthly rehabilitation slope stability
- Feral animal monitoring
- Monthly water dam inspections

Proposed monitoring methods must be able to demonstrate trends towards the agreed site-specific completion criteria and environmental indicators for a sufficient timeframe.

17.5.2 Closure Cost Estimate

MCP financial provisions are required to be prepared with transparent and verifiable methodology with uncertainties and assumptions clearly documented (DMP and EPA, 2015). A cost estimate for immediate (unplanned) closure of Greenbushes has been prepared by Talison using the Victorian Government Rehabilitation bond calculator (dpi-bond-calculator-24-feb-2011) as a template to assist them in identifying and costing the rehabilitation, decommissioning, and monitoring requirements for the Greenbushes site. As stated within their closure plan, Talison's initial closure costs were calculated in 2013, with these costs escalated annually using Perth, Western Australia inflation rates. The Victorian Government bond calculator uses predefined third-party unit rates based on the typical current market 'third party rates' as of July 2010, which may overestimate or underestimate closure costs for Western Australia. Where more accurate costing information was available, that was used in lieu of the default third-party rate as prescribed in the Victorian bond calculator. A more accurate closure cost estimate should be prepared using Western Australian third-party rates or quoted estimates based on 'first principles.'

The September 2023 closure cost estimate totaled AU$62,434,282, of which AU $59,235,736.40 represents Talison's portion of the operation.

The closure cost estimate for Greenbushes only addresses immediate mine closure. SRK was not provided a Life-of-Mine (LoM) closure cost estimate, which, although not a regulatory requirement, is industry best practice and consistent with sustainable development goals (Department of Industry, Innovation and Science, 2016). The LoM closure costs include rehabilitation, closure, decommissioning, monitoring, and maintenance following closure at the end of the mine life and are typically much higher than the immediate closure due to a greater final footprint. Early recognition of mine closure costs aids financial planning, long-term budgeting, and mine plans, and promotes improved strategies for progressive rehabilitation. It provides a more accurate representation of the total closure liability for the Greenbushes operation.

17.5.3 Performance or Reclamation Bonding

Western Australia does not require a company to post performance or reclamation bonds. However, all relevant tenement holders in Western Australia are required to annually report surface disturbance and make contributions to a pooled mine rehabilitation fund (MRF) based on the type and extent of disturbance under the Mining Rehabilitation Fund Act 2012 (MRF Act). Each operator supplies the areas of disturbance for each facility type, and a standard rehabilitation cost is applied to each. Therefore, the cost used to estimate the annual contribution to the MRF may not reflect the actual cost to close the mine, as it does not use site-specific information, and is unlikely to include all of the activities that would be required to close the mine. The pooled fund can be used by DEMIRS to rehabilitate mines where the tenement holder/operator has failed to meet their rehabilitation obligations and finances have not been able to be recovered. The interest earned on the pooled fund is used for administration and to rehabilitate legacy abandoned mine sites.

However, the *Statutory Guidelines for Mine Closure Plans* (DEMIRS, March 2020) states that “DEMIRS may require a fully detailed closure costing report to be submitted for review, and/or an independent audit to be conducted on the report to certify that the company has adequate provision to finance closure. Where appropriate, the costing report should include a schedule for financial provision for closure over the life of the operation.” If requested by DEMIRS, tenement holders are required to provide financial assurance for mine closure to ensure that adequate funds are available and that the government and community are not left with unacceptable liabilities. The financial assurance process and methodology must be transparent and verifiable, with assumptions and uncertainties that are clearly documented, and based on reasonable, site-specific information. As of the preparation of this report, DEMIRS has not requested that Talison provide financial assurance for the Greenbushes operation; but Talison does submit annual payments to the MRF in accordance with the MRF Act.

17.5.4 Limitations on the Current Closure Plan and Cost Estimate

The latest closure cost estimate available for review was the September 2023 updated estimate. It includes the facilities that currently exist on site and expansion of Floyd’s Dump. The model used to prepare the closure cost estimate was developed in the State of Victoria. Its purpose is to provide the Victorian government with an assessment of the closure liabilities at the site and form the basis of financial assurance. However, because Western Australia does not require operators to post a financial assurance and, instead relies on a pooled fund, SRK believes this cost estimate may not have been reviewed in detail by the WA Government. Furthermore, this model was created in 2011, and uses fixed unit rates developed by a consultant to the government. These rates have been increased for inflation since that time using Perth CPI indices. However, the CPI increases reported in the model are for June 2022 and indicate a total 23.3% increase since 2013 when the cost model was created by the Victorian Government. This appears to be low considering the most recent global inflation numbers.

Talison used this model to prepare a cost estimate in the event that the government requires demonstration of adequate financial assurance for the site. This type of estimate typically reflects the cost that the government agency responsible for closing the site in the event that an operator fails to meet their obligation. If Talison, rather than the government, closes the site in accordance with their current mine plan and approved closure plan, the cost of closure is likely to be different from the financial assurance cost estimate approved by the government.

There are a number of costs that are typically included in the financial assurance estimates that would only be incurred by the government, such as government contract administration. Other costs, such as head office costs, a number of human resource costs, taxes, fees and other operator-specific costs that are not included in the financial assurance cost estimate would likely be incurred by Talison during closure of the site. Because Talison only provided a financial assurance estimate using the Victoria model, SRK was not able to prepare a comparison of the two types of closure cost estimates. The actual cost could be greater or less than the financial assurance estimate.

There is no documentation on the basis of the unit rates used in the Victoria model and the government of Victoria was unable to provide any information regarding the accuracy of the rates. Because of this, SRK cannot validate any of the unit rates used in the model or the overall cost estimate.

Furthermore, because closure of the site is not expected until 2042, the closure cost estimate represents future costs based on current site conditions. In all probability, site conditions at closure will be different than currently expected and, therefore, the current estimate of closure costs is unlikely to reflect the actual closure cost that will be incurred in the future.

17.5.5 Potential Material Omissions from the Closure Plan and Cost Estimate

As noted above, the closure plan and current cost estimate is based on the assumption that the mine site will be stable and non-polluting following completion of the closure measures included in the closure plan. However, there are several aspects of the project that may require additional measures to be implemented at the site to achieve this goal.

The site currently treats mine water collecting in the Southampton and Cowan Brook Dams prior to discharge due to elevated levels of arsenic and lithium in the water. The sources of elevated lithium and arsenic in the mine water circuit include dewatering water from the pit. Although some testing in early 2023 indicates that seepage from tailings solids will improve over time, the tests also indicate the potential for arsenic to remain above the freshwater aquatic and drinking water guidelines after closure. If perpetual, or even long-term, treatment of water is required to comply with discharge requirements, the closure cost estimate provided by Talison could be materially deficient.

7.6 Adequacy of Plans

In general, current plans are considered sufficient to address any significant issues related to environmental compliance, permitting, and local individuals or groups. Additional studies such as waste rock characterization, noise and dust monitoring, and mine closure are recommended for the proposed mine expansion.

7.7 Commitments to Ensure Local Procurement and Hiring

The mine has no formal commitments to ensure local procurement and hiring, although informal policies are in place for consideration of Aboriginal and Traditional Custodians with regards to employment and contracting.

The mine applies a fatigue management policy that requires staff to have a maximum workday of 13 hours that includes travel to and from home (Distance from Work ADM-ST-014, 2018). Staff operating on a 12-hour workday must live within a 30-minute drive of the mine (approximately 50 km), and those on an 8-hour workday must live within 1.5 hours of the mine site (approximately 120 km). This policy limits the radius of staff employment to the local region, with the majority of staff residing within 50 km.

18 Capital and Operating Costs

Estimation of capital and operating costs is inherently a forward-looking exercise. These estimates rely upon a range of assumptions and forecasts that are subject to change depending upon macroeconomic conditions, operating strategy and new data collected through future operations. For this report, capital and operating costs are estimated to a PFS-level with a targeted accuracy of +/- 25%. However, this accuracy level is only applicable to the base case operating scenario and forward-looking assumptions outlined in this report. Therefore, changes in these forward-looking assumptions can result in capital and operating costs that deviate more than 25% from the costs forecast herein.

Cost presented here are presented on a 100% basis with no adjustment for Albemarle's ownership in the operation.

8.1 Capital Cost Estimates

Summary LoM capital costs are shown in Table 18-1.

Table 18-1: Life-of-Mine Capital Costs

Category	LoM Cost (AU$ million)	Distribution (%)
Expansionary Development	319.7	11.9%
Plant & Equipment Expansion	1,586.1	59.0%
Tailings Addition	46.0	1.7%
Sustaining Development	106.9	4.0%
Leases	0.4	0.0%
Plant & Equipment Sustaining	567.7	21.1%
Closure	62.4	2.3%
Total	**2,689.3**	**100.0%**

Source: SRK, 2023

Total LoM capital expenditures are estimated at AU$2,689 million. Talison classifies capital expenditures as either expansionary or sustaining. A discussion of both types of capital expenditures is presented below.

18.1.1 Expansionary Capital Costs

Planned LoM capital expenditures that are characterized as expansionary are shown in Table 18-2.

Table 18-2: Life-of-Mine Expansionary Capital Costs

Category	LoM Cost (AU$ million)
Expansionary Development	
TSF4	227.6
New Water Storage Dam Construction	73.9
Other	18.2
Plant and Equipment Expansion	
CGP3	491.8
CGP4	721.6
Permanent Accommodation Village	107.1
Other	265.7
Tailings Addition – Expansion	
TSF 1 tailings lift	46.0
Total Expansionary Capital	**1,951.8**

Source: SRK, 2023

LoM expansionary capital expenditures are estimated at AU$1,952 million. The majority of the capital expenditure is related to the construction of the CGP 3 and CGP 4 processing facilities. CGP 3 is currently under construction and CGP 4 is scheduled to start construction in 2024. SRK's review of the Talison capital expenditure buildups confirmed that the estimates typically include contingency. The contingency is embedded within the line-item expenditures in Table 18-2. SRK review indicates that all contingency amounts were less than 15%.

18.1.2 Sustaining Capital Costs

Planned LoM capital expenditures that are characterized as sustaining are shown in Table 18-3.

Table 18-3: Life-of-Mine Sustaining Capital Costs

Category	LoM Cost (AU$ Million)
Sustaining Development	
Drilling & Exploration	65.6
TSF1	26.2
TSF2	4.2
Other	11.0
Leases	
Vehicles	0.4
Plant and Equipment	
CGP 1 Mag Separation	16.3
Other (General LoM Spend)	551.4
Closure	
Closure	62.4
Total Sustaining Capital	737.5

Source: SRK, 2023

LoM sustaining capital expenditures are estimated at AU$737 million, including estimated closure costs. The assumption is that Talison will continue to rely on a contractor for open pit mining and, accordingly, no mining equipment costs have been included in the sustaining capital cost estimate. No contingency is included in the sustaining capital shown in Table 18-4.

8.2 Operating Cost Estimate

The LoM operating costs are summarized in Table 18-4. No contingency is included in the operating cost estimates.

Table 18-4: Life-of-Mine Total Operating Cost Estimate

Category	LoM Total Cost (AU$ million)	LoM Unit Cost (AU$/t-processed)	Distribution (%)
Mining	7,035	47.44	33%
Processing	6,955	46.91	33%
G&A	1,777	11.99	8%
Water Treatment	237	1.60	1%
Market Development	8	0.05	0%
Concentrate Shipping	1,880	12.68	9%
Other Transport and Shipping Costs	60	0.40	0%
Government Royalty	3,165	21.34	15%
Total	**21,116**	**142.42**	**100%**

Source: SRK, 2023

The LoM total operating cost is AU$142.42 per tonne processed. On a combined basis, mining and processing make up approximately 66% of total LoM total operating cost.

A discussion of the cost categories comprising the total operating cost estimate is presented below.

18.2.1 Mine Operating

The LoM mine operating costs are summarized in Table 18-5.

Table 18-5: Mine Operating Costs

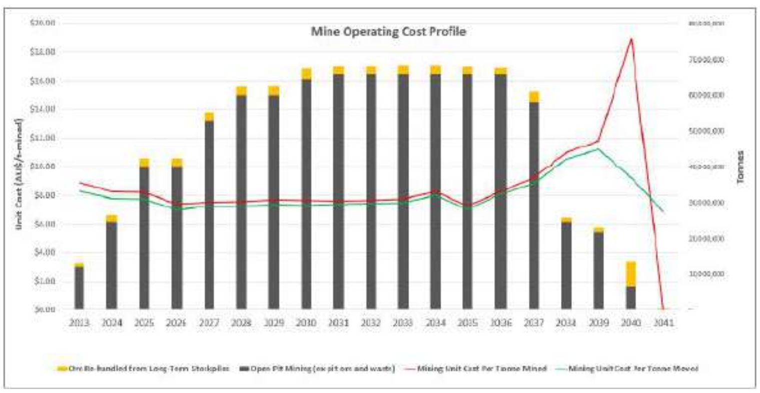
Category	LoM Total Cost (AU$ million)	LoM Unit Cost (AU$/t-mined)
Mining Overheads	422	0.49
Drill and Blast	1,440	1.67
Load and Haul	4,562	5.29
RoM Loader	373	0.43
Stockpile Rehandle	147	0.17
Grade Control Assays	8	0.01
Rockbreaking	82	0.10
Total	**7,035**	**8.16**

Source: SRK, 2023

The operating cost estimate is based on recent actual costs and the load and haul rates specified in the mining contract, which includes appropriate adjustments for rise and fall. Load and haul costs are variable depending on the pit bench from which the material is mined and whether the destination is the RoM pad, a long-term stockpile, or a waste dump.

The LoM unit operating cost is AU$8.16 per t mined from the open pit (AU$22.94 per bcm mined). On a total material movement basis (which includes tonnes of ore re-handled from long-term stockpiles), the LoM unit cost is AU$7.78 per t moved.

The mine operating cost profile over the life of the operation is shown in Figure 18-1.



LoM values are provided in Table 19-12

Source: SRK, 2023

Figure 18-1: Mine Operating Cost Profile

Mine operating costs remain in a relatively constant range until the final three years of open pit mining (2038 to 2041) when the annual mining rate decreases, and the deepest benches of the open pit are mined. The spike in the unit costs on a per tonne mined basis in 2040 is due to fewer in situ tonnes being mined from the pit and more tonnes being rehandled from long-term stockpiles.

18.2.2 Processing Operating Costs

The LoM processing costs are summarized in Table 18-6.

Table 18-6: Process Operating Costs

Category	LoM Total Cost (AU$ million)	LoM Unit Cost (AU$/t-processed)
Crushing		
Crushing Plant 1	649	17.50
Crushing Plant 2	553	13.29
Crushing Plant 3	490	13.29
Crushing Plant 4	435	13.29
Subtotal Crushing Plants	2,127	14.34
Technical Grade Plant		
Variable Costs	180	56.96
Chemical Grade Plant 1		
Variable Costs	1,121	33.03
Chemical Grade Plant 2		
Variable Costs	1,319	31.73
Chemical Grade Plant 3		
Variable Costs	1,170	31.73
Chemical Grade Plant 4		
Variable Costs	1,038	31.73
Subtotal All Plants	**4,829**	**32.57**

Source: SRK, 2023

The average LoM crushing cost is AU$14.34/t crushed. The average LoM processing cost for the Technical Grade Plant is AU$56.96/t processed. For Chemical Grade Plant 1, Chemical Grade Plant 2, Chemical Grade Plant 3, and Chemical Grade Plant 4 the LoM average processing costs are AU$33.03/t-processed, AU$31.73/t-processed, AU$31.73/t-processed, and AU$31.73/t-processed, respectively. The average LoM combined crushing and processing cost is AU$46.91/t processed. The estimate of processing costs is based on Talison's recent actual costs. The processing costs exclude the crusher feed loader and the mobile rockbreaker.

18.2.3 Other Operating Costs

Other operating costs consist of general and administrative costs (G&A), water treatment and marketing development as shown Table 18-7.

Table 18-7: Other Operating Costs

Category	LoM Total Cost (AU$ million)	LoM Unit Cost (AU$/t-processed)
G&A		
Site G&A	1,777	11.99
Water Treatment	237	1.60
Market Development	8	0.05
Total Other Operating Costs	**2,022**	**13.64**

Source: SRK,2023

The other operating costs (G&A, water treatment and market development) are generally fixed over the life of the project and average approximately AU$110 million per year over the life of the mine. The expenditure is expected to roughly double from current levels over the next 5 years as the processing capability as the site expands and requires additional management and infrastructure and the site management increases ESG-related spend. The estimate of other operating costs is based on Talison's recent forward-looking forecasts.

18.2.4 Shipping and Transportation Costs

Shipping and other transportation costs are shown Table 18-8.

Table 18-8: Shipping and Transportation Costs

Category	LoM Total Cost (AU$ million)	LoM Unit Cost (AU$/t-processed)
Shipping	1,880	12.68
Product Handling	60	0.40
Total Other Operating Costs	**1,940**	13.08

Source: SRK, 2023

Costs for shipping and transportation are estimated based on Talison's recent actual costs, near term budgets and rates from current contracts.

18.2.5 Royalties

LoM royalty payments are estimated at AU$3,165 million based on application of a 5% government royalty. The royalty is applicable to estimated LoM gross revenue from concentrate sales after deducting shipping costs to China.

19 Economic Analysis

9.1 General Description

SRK prepared a cash flow model to evaluate Greenbushes' ore reserves on a real basis. This model was prepared on an annual basis from the reserve effective date to the exhaustion of the reserves. This section presents the main assumptions used in the cash flow model and the resulting indicative economics. The model results are presented in U.S. dollars (US$), unless otherwise stated.

All results are presented in this section on a 49% basis reflective of Albemarle's ownership unless otherwise noted. Technical and cost information is presented on a 100% basis to assist the reader in developing a clear view of the fundamentals of the operation.

As with the capital and operating cost forecasts, the economic analysis is inherently a forward-looking exercise. These estimates rely upon a range of assumptions and forecasts that are subject to change depending upon macroeconomic conditions, operating strategy and new data collected through future operations.

19.1.1 Basic Model Parameters

Key criteria used in the analysis are presented throughout this section. Basic model parameters are summarized in Table 19-1.

Table 19-1: Basic Model Parameters

Description	Value
TEM Time Zero Start Date	July 1, 2023
Mine Life (years)	19
Discount Rate	10%

Source: SRK, Albemarle

All costs incurred prior to the model start date are considered sunk costs. The potential impact of these costs on the economics of the operation is not evaluated. This includes contributions to depreciation and working capital as these items are assumed to have a zero balance at model start.

The model continues one year beyond the mine life to incorporate closure costs in the cashflow analysis.

The selected discount rate is 10% as directed by Albemarle. Note that this discount rate is higher than the 8% utilized in pit optimization.

19.1.2 External Factors

Exchange Rates

As the operation is located in Australia, the operating and capital costs are modeled in AU$ and converted to US$ within the model. The foreign exchange rate for the model was provided by Albemarle, is held constant over the life of the model and is presented in Table 19-2.

Table 19-2: Modeled Exchange Rate

FX Rate	AU$:US$	0.68

Source: Albemarle

Pricing

Modeled prices are based on the prices developed in the Market Study section of this report. The prices are modeled as US$1,500/t concentrate over the life of the operation. This price is a CIF price and shipping costs are applied separately within the model.

All concentrate streams produced by the operation are modeled as being subject to the price presented above.

Taxes and Royalties

As modeled, the operation is subject to a 30% income tax. All expended capital is subject to depreciation over a 20 year period. Depreciation occurs via a reducing balance method with a 2x multiplier. No existing depreciation pools are accounted for in the model.

As the operation is located within Western Australia, the operation is subject to a royalty of 5%. The amount of revenue subject to the royalty is the project's gross revenue less deductions for shipping costs.

SRK notes that the project is being evaluated as a standalone entity for this exercise (without a corporate structure). As such, tax and royalty calculations presented here may differ significantly from actuals incurred by Albemarle.

Working Capital

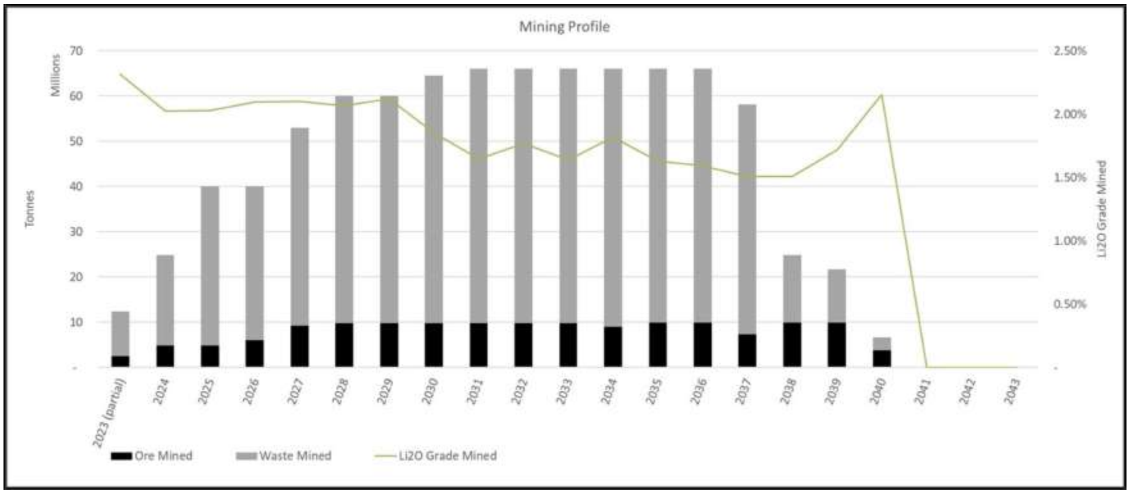
The assumptions used for working capital in this analysis are as follows:

- Accounts Receivable (A/R): 30 day delay
- Accounts Payable (A/P): 30 day delay
- Zero opening balance for A/R and A/P

19.1.3 Technical Factors

Mining Profile

The modeled mining profile was developed by SRK. The details of mining profile are presented previously in this report. No modifications were made to the profile for use in the economic model. The modeled profile is presented on a 100% basis in Figure 19-1.



Source: SRK

Figure 19-1: Greenbushes Mining Profile (Tabular Data in Table 19-12)

A summary of the modeled life of mine mining profile is presented in Table 19-3.

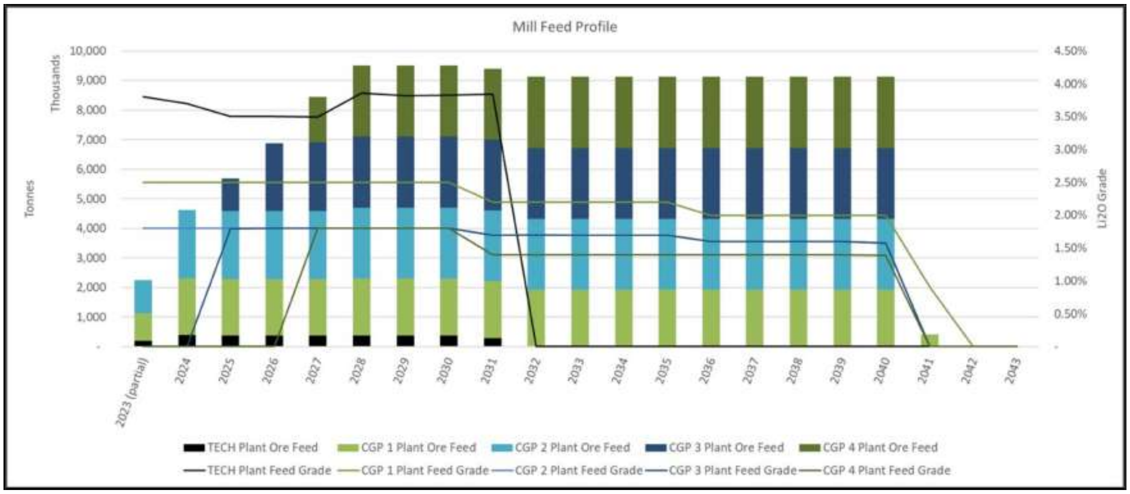
Table 19-3: Greenbushes Mining Summary

LoM Mining	Units	Value
Total Ore Mined	**Mt**	**145.4**
Total Waste Mined	**Mt**	**716.6**
Total Material Mined	**Mt**	**862.0**
Average Mined Li_2O Grade	%	1.82%
Contained Li_2O Metal Mined	Mt	2.6
LoM Strip Ratio	Num#	4.93x

Source: SRK

Processing Profile

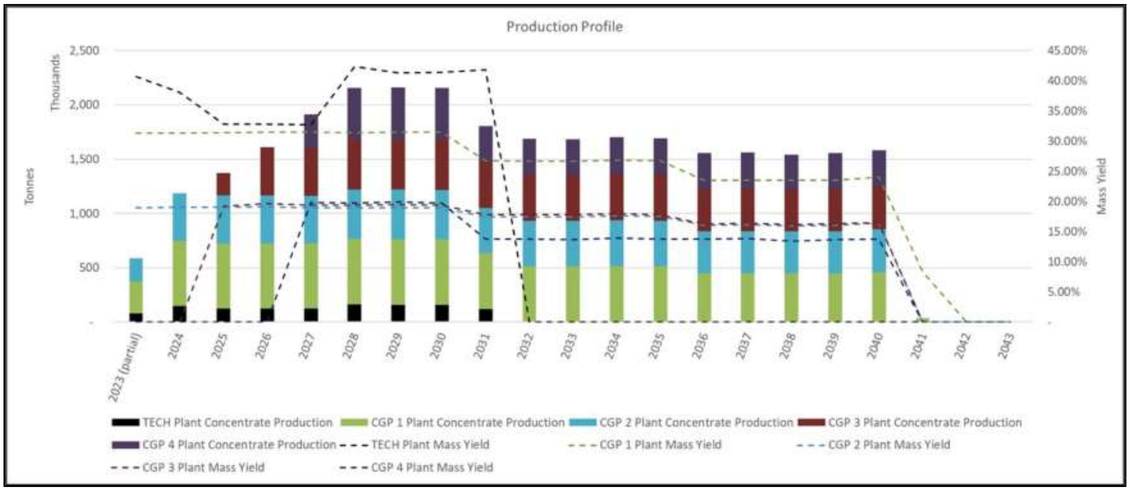
The processing profile was developed by SRK and results from the application of stockpile logic to the mining profile external to the economic model and includes some existing stockpile material. No modifications were made to the profile for use in the economic model. The modeled profile is presented on a 100% basis in Figure 19-2.



Source: SRK

Figure 19-2: Greenbushes Processing Profile (Tabular Data in Table 19-12)

The production profile was developed by SRK and results from the application of processing logic to the processing profile external to the economic model. No modifications were made to the profile for use in the economic model. The modeled profile is presented on a 100% basis in Figure 19-3.



Source: SRK

Figure 19-3: Greenbushes Production Profile (Tabular Data in Table 19-12)

A summary of the modeled life of mine processing profile is presented on a 100% basis in Table 19-4.

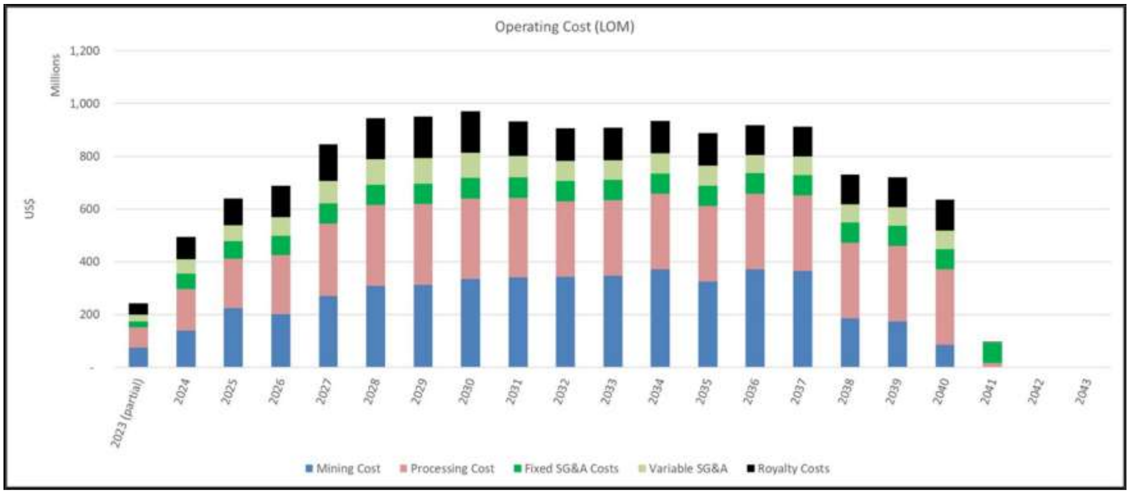
Table 19-4: Greenbushes Processing Summary

LoM Processing	Units	Value
TECH Plant		
Plant Feed (LoM)	Mt	3.2
Average Annual Feed Rate	kt/y	350.8
Average Feed Grade (Li_2O)	%	3.70%
Average Mass Yield	%	37.96%
CGP 1		
Plant Feed (LoM)	Mt	33.9
Average Annual Feed Rate	kt/y	1,786.1
Average Feed Grade (Li_2O)	%	2.25%
Average Mass Yield	%	27.61%
CGP 2		
Plant Feed (LoM)	Mt	41.6
Average Annual Feed Rate	kt/y	2,310.0
Average Feed Grade (Li_2O)	%	1.71%
Average Mass Yield	%	17.71%
CGP 3		
Plant Feed (LoM)	Mt	36.9
Average Annual Feed Rate	kt/y	2,304.4
Average Feed Grade (Li_2O)	%	1.70%
Average Mass Yield	%	17.88%
CGP 4		
Plant Feed (LoM)	Mt	32.7
Average Annual Feed Rate	kt/y	2,337.5
Average Feed Grade (Li_2O)	%	1.51%
Average Mass Yield	%	15.34%

Source: SRK

Operating Costs

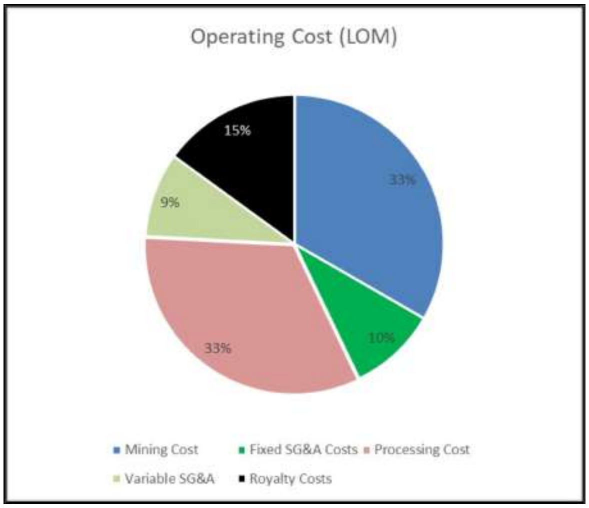
Operating costs modeled in Australian dollars and can be categorized as mining, processing and SG&A costs. No contingency amounts have been added to the operating costs within the model. All cost information in this section is presented on a 100% basis. A summary of the operating costs over the life of the operation is presented in Figure 19-4.



Source: SRK

Figure 19-4: Life of Mine Operating Cost Summary (Tabular Data in Table 19-12)

The contributions of the different operating cost segments over the life of the operation are presented in Figure 19-5.



Source: SRK

Figure 19-5: Life-of-Mine Operating Cost Contributions

Mining

The mining cost profile was developed external to the model and was imported into the model as a fixed cost on an annual basis in Australian dollars. Within the model, the cost was converted to US$ using the long term exchange rate of 0.68 AU$:1:00 US$. The result of this approach is presented in Table 19-5 on a 100% basis.

Table 19-5: Greenbushes Mining Cost Summary

LoM Mining Costs	Unit	Value
Mining Cost	US$ million	4,783
Mining Cost	US$/t mined	5.55

Source: SRK

Processing

Processing costs were incorporated into the model as variable costs. Variable costs are applied to the tonnage processed each processing plant. Table 19-6 presents the variable cost on a per tonne basis for each plant. The CR 1 crushing facility process ore for both the TECH plant and the CGP 1 plant.

Table 19-6: Variable Processing Costs

Processing Area	Unit	Value
Crushing (CR 1)	AU$/t	17.50
Crushing (CR 2)	AU$/t	13.29
Crushing (CR 3)	AU$/t	13.29
Crushing (CR 4)	AU$/t	13.29
TECH Plant	AU$/t	56.96
CGP 1	AU$/t	33.03
CGP 2	AU$/t	31.73
CGP 3	AU$/t	31.73
CGP 4	AU$/t	31.73

Source: SRK

Within the model, the cost was converted to US$ using the long term exchange rate of 0.68 US$:AU$ The result of this approach is presented in Table 19-7 on a 100% basis.

Table 19-7: Greenbushes Processing Cost Summary

LoM Processing Costs	Unit	Value
Processing Costs	US$ million	4,730
Processing Cost	US$/t processed	31.90

Source: SRK

<u>SG&A</u>

SG&A costs were incorporated into the model as annual fixed and variable costs. The fixed cost component is presented on a 100% basis in Table 19-8. Note that Year 1 is a partial year.

Table 19-8: SG&A Fixed Costs

Item	Unit	Value				
		Op Yr 1 (partial)	Op Yr 2	Op Yr 3	Op Yr 4	Op Yr 5+
G&A	AU$ million	30.7	76.1	82.8	92.3	99.7
Water Treatment	AU$ million	2.3	11.9	12.5	12.8	13.2
Market Development	AU$ million	0.4	0.4	0.4	0.4	0.4

Source: SRK

Variable SG&A costs consist of the transport and shipping costs associated with moving the operation's product to the selling point. These costs are presented on a 100% basis in Table 19-9.

Table 19-9: SG&A Variable Costs

Item	Unit	Value
Shipping	AU$/t concentrate	63.62
Other Transport and Shipping Costs	AU$/t concentrate	2.03

Source: SRK

Within the model, the cost was converted to US$ using the long-term exchange rate of 0.68 AU$:US$ The result of this approach is presented in Table 19-10 on a 100% basis.

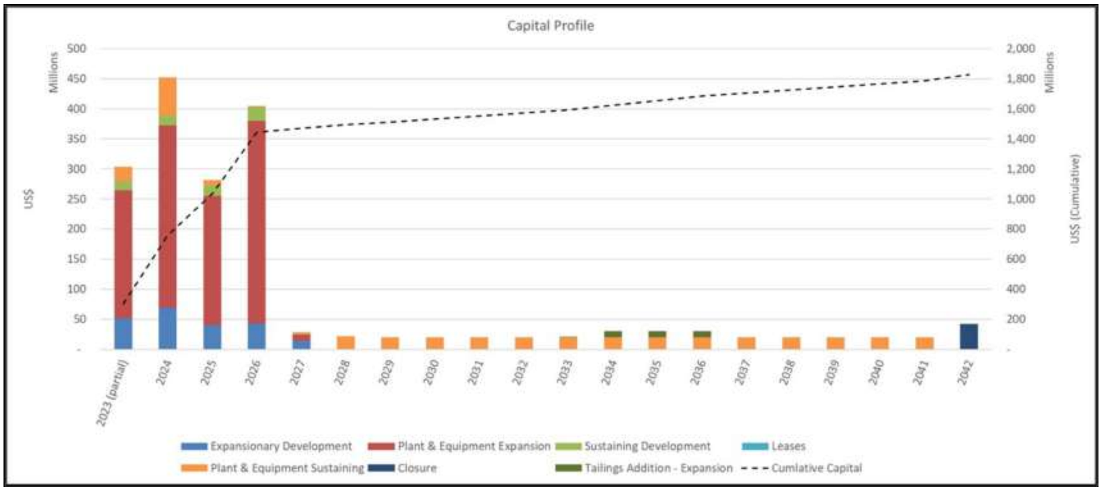
Table 19-10: Greenbushes SG&A Cost Summary

LoM SG&A Costs	Unit	Value
SG&A Costs	US$ million	2,694
SG&A Cost	US$/t concentrate	91.17

Source: SRK

Capital Costs

As the operation is an existing mine, no initial capital has been modeled. Sustaining capital is modeled on an annual basis and is used in the model as developed in previous sections. No contingency amounts have been added to the sustaining capital within the model. Closure costs are modeled as sustaining capital and are captured as a one-time payment the year following cessation of operations. The modeled sustaining capital profile is presented on a 100% basis in Figure 19-6. Note that the first modeled year is a partial year.



Source: SRK

Figure 19-6: Greenbushes Sustaining Capital Profile (Tabular Data in Table 19-12)

19.2 Results

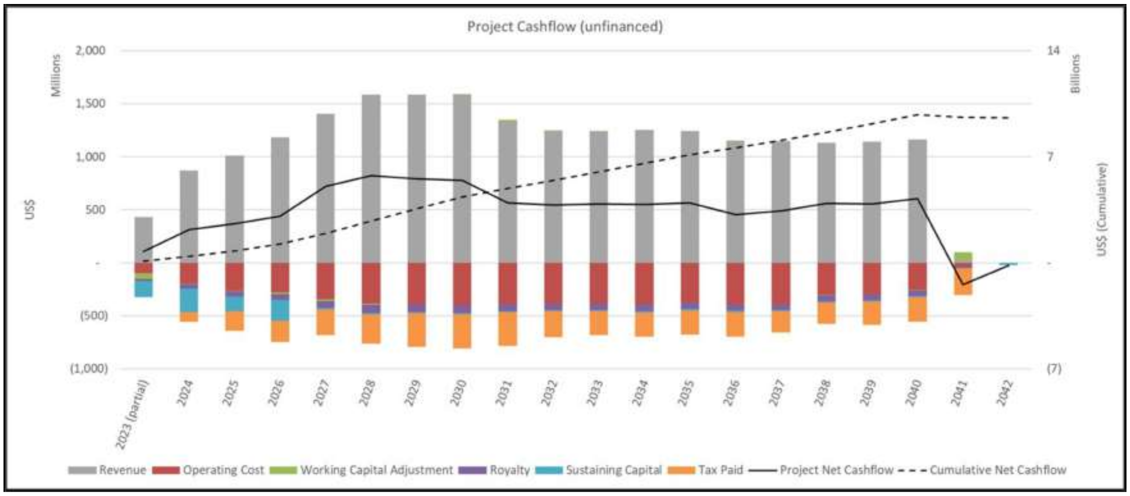
The economic analysis metrics are prepared on annual after-tax basis in US$. The results of the analysis are presented in Table 19-11. The results indicate that, at a concentrate price of US$1,500/t CIF China, the operation returns an after-tax NPV at 10% of US$8.86 billion (US$4.34 billion attributable to Albemarle). Note, that because the mine is in operation and is valued on a total project basis with prior costs treated as sunk, IRR and payback period analysis are not relevant metrics. Information about the economic result of the operation in this section is presented on a 49% basis (portion of the project attributable to Albemarle). Information about the technical aspects of the mining operation (tonnes, grade, costs, recoveries, etc.) is presented on a 100% basis to provide clear visibility into the underlying asset and aid the reader in resolving the information presented here to earlier sections in this report where the information is developed.

Table 19-11: Indicative Economic Results (Albemarle)

LoM Cash Flow (Unfinanced)	Units	Value
Total Revenue	**US$ million**	**21,716**
Total Opex	**US$ million**	**(5,981)**
Operating Margin	US$ million	15,735
Operating Margin Ratio	%	72%
Taxes Paid	US$ million	(4,219)
Free Cashflow	US$ million	9,565
Before Tax		
Free Cash Flow	US$ million	13,785
NPV at 10%	US$ million	6,120
After Tax		
Free Cash Flow	US$ million	9,565
NPV at 10%	US$ million	4,339

Source: SRK

The economic results and back-up chart information for charts within this section are presented on an annual basis in Table 19-12, Table 19-13, and Figure 19-7.



Source: SRK

Figure 19-7: Annual Cashflow Summary (Albemarle) (Tabular Data in Table 19-12)

Table 19-12: Greenbushes Annual Cashflow (on an attributable basis)

US$ in millions																							
Counters																							
Calendar Year			**2023 (partial)**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**
Days in Period			**184**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**
Escalation																							
Escalation Index			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Project Cashflow (unfinanced) – (Albemarle)																							
Revenue	US$ million	21,716.5	431.1	872.7	1,009.2	1,184.5	1,405.7	1,585.4	1,588.3	1,584.7	1,328.2	1,240.8	1,237.8	1,251.2	1,242.8	1,143.0	1,148.2	1,133.8	1,142.3	1,161.9	24.9	-	-
Operating Cost	US$ million	(5,981.4)	(98.2)	(200.4)	(264.0)	(279.4)	(346.3)	(386.2)	(388.4)	(398.7)	(392.1)	(383.4)	(385.0)	(397.4)	(374.7)	(394.5)	(391.6)	(302.6)	(297.5)	(254.6)	(46.3)	-	-
Working Capital Adjustment	US$ million	0.0	(54.3)	(0.8)	(6.1)	(13.1)	(12.7)	(11.2)	(0.3)	1.1	20.5	6.7	0.2	(0.1)	(1.2)	10.0	(0.8)	(6.1)	(1.1)	(4.9)	76.1	(1.8)	-
Royalty	US$ million	(1,054.5)	(20.9)	(42.4)	(49.0)	(57.5)	(68.3)	(77.0)	(77.1)	(76.9)	(64.5)	(60.3)	(60.1)	(60.8)	(60.3)	(55.5)	(55.8)	(55.1)	(55.5)	(56.4)	(1.2)	-	-
Sustaining Capital	US$ million	(896.1)	(148.9)	(221.5)	(138.1)	(198.3)	(14.1)	(10.7)	(9.9)	(9.9)	(9.9)	(9.9)	(10.2)	(14.9)	(14.9)	(14.9)	(9.9)	(9.9)	(9.9)	(9.9)	(9.9)	(20.8)	-
Other Government Levies	US$ million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax Paid	US$ million	(4,219.2)	-	(93.6)	(184.5)	(198.2)	(240.5)	(279.0)	(319.7)	(321.3)	(318.4)	(248.3)	(227.0)	(226.6)	(227.5)	(232.5)	(198.6)	(201.5)	(224.6)	(229.1)	(248.1)	-	-
Project Net Cashflow	US$ million	9,565.3	108.8	313.9	367.5	437.9	723.8	821.2	792.8	779.0	563.9	545.6	555.7	551.5	564.3	455.6	491.5	558.7	553.7	607.0	(204.4)	(22.6)	-
Cumulative Net Cashflow	US$ million		108.8	422.7	790.2	1,228.2	1,952.0	2,773.2	3,565.9	4,344.9	4,908.8	5,454.4	6,010.1	6,561.6	7,125.9	7,581.4	8,072.9	8,631.6	9,185.3	9,792.3	9,587.9	9,565.3	9,565.3

Source: SRK

Table 19-13: Greenbushes Key Project Data (100% basis)

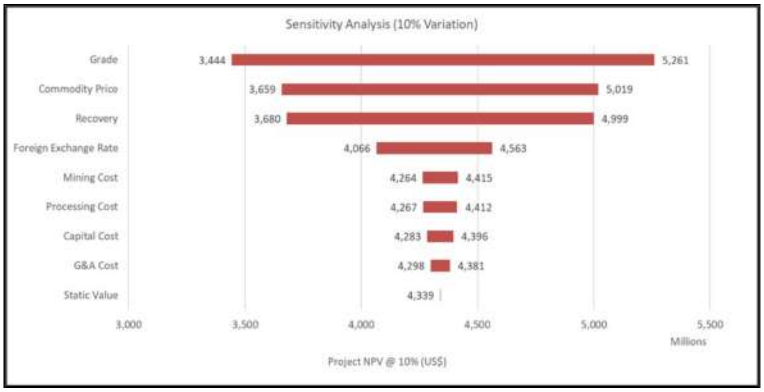
US$ in millions																							
Counters																							
Calendar Year			**2023 (partial)**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**
Days in Period			**184**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**	**366**	**365**	**365**	**365**
Escalation																							
Escalation Index			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Operating Cost (LoM) – (100% Basis)																							
Mining Cost	US$ million	4,783.5	75.0	139.7	223.6	201.3	271.3	309.1	313.5	334.8	341.7	343.7	347.2	371.6	325.7	372.2	366.1	185.2	174.4	85.6	1.9	-	-
Mining Cost	US$/t mined	5.55	6.0	5.6	5.6	5.0	5.1	5.2	5.2	5.2	5.2	5.2	5.3	5.6	4.9	5.6	6.3	7.5	8.0	12.9	-	-	-
Fixed SG&A Costs	US$ million	1,374.8	22.7	60.1	65.1	71.8	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	-	-
Processing Cost	US$ million	4,729.6	76.5	156.3	188.8	225.1	273.1	305.7	305.7	305.7	300.9	286.4	286.4	286.4	286.4	286.4	286.4	286.4	286.4	286.4	14.1	-	-
Variable SG&A	US$ million	1,319.1	26.2	53.0	61.3	71.9	85.4	96.3	96.5	96.3	80.7	75.4	75.2	76.0	75.5	69.4	69.7	68.9	69.4	70.6	1.5	-	-
Royalty Costs	US$ million	2,152.1	42.7	86.5	100.0	117.4	139.3	157.1	157.4	157.0	131.6	123.0	122.7	124.0	123.2	113.3	113.8	112.4	113.2	115.1	2.5	-	-
Mining Profile – (100% Basis)																							
Ore Mined	kt	145,391	2,450	4,900	4,900	6,000	9,150	9,750	9,750	9,750	9,750	9,750	9,807	8,980	9,850	9,850	7,305	9,850	9,850	3,748	-	-	-
Waste Mined	kt	716,632	9,950	19,900	35,100	34,000	43,850	50,250	50,250	54,750	56,250	56,250	56,193	57,020	56,150	56,150	50,825	14,973	11,867	2,905	-	-	-
Li_2O Grade Mined (%)	%	1.82%	2.32%	2.03%	2.03%	2.10%	2.10%	2.06%	2.12%	1.85%	1.65%	1.77%	1.64%	1.82%	1.63%	1.59%	1.51%	1.51%	1.72%	2.16%	-	-	-
Mill Feed Profile – (100% Basis)																							
TECH Plant Ore Feed	kt	3,158	191	388	382	382	382	382	382	382	286	-	-	-	-	-	-	-	-	-	-	-	-
TECH Plant Feed Grade	%	3.70%	3.80%	3.70%	3.50%	3.50%	3.50%	3.86%	3.82%	3.83%	3.84%	-	-	-	-	-	-	-	-	-	-	-	-
CGP1 Plant Ore Feed	kt	33,936	943	1,910	1,904	1,904	1,904	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	410	-	-
CGP1 Plant Feed Grade	%	2.25%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.20%	2.20%	2.20%	2.20%	2.20%	2.00%	2.00%	2.00%	2.00%	2.00%	0.91%	-	-
CGP2 Plant Ore Feed	kt	41,580	1,123	2,320	2,313	2,313	2,313	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	-	-	-
CGP2 Plant Feed Grade	%	1.71%	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%	1.70%	1.70%	1.70%	1.70%	1.70%	1.60%	1.60%	1.60%	1.60%	1.57%	-	-	-
CGP3 Plant Ore Feed	kt	36,871	-	-	1,087	2,272	2,313	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	-	-	-
CGP3 Plant Feed Grade	%	1.70%	-	-	1.80%	1.80%	1.80%	1.80%	1.80%	1.80%	1.70%	1.70%	1.70%	1.70%	1.70%	1.60%	1.60%	1.60%	1.60%	1.57%	-	-	-
CGP4 Plant Ore Feed	kt	32,725	-	-	-	-	1,525	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	-	-	-
CGP4 Plant Feed Grade	%	1.51%	-	-	-	-	1.80%	1.80%	1.80%	1.80%	1.40%	1.40%	1.40%	1.40%	1.40%	1.40%	1.40%	1.40%	1.40%	1.39%	-	-	-
Production Profile – (100% Basis)																							
TECH Plant Mass Yield	%		40.74%	38.07%	32.77%	32.78%	32.70%	42.35%	41.35%	41.40%	41.85%	-	-	-	-	-	-	-	-	-	-	-	-
TECH Plant Concentrate Production	kt	1,199	78	148	125	125	125	162	158	158	120	-	-	-	-	-	-	-	-	-	-	-	-
CGP1 Plant Mass Yield	%		31.35%	31.31%	31.41%	31.46%	31.44%	31.42%	31.51%	31.50%	26.74%	26.66%	26.65%	26.82%	26.74%	23.52%	23.50%	23.47%	23.51%	24.04%	8.27%	-	-
CGP1 Plant Concentrate Production	kt	9,368	296	598	598	599	599	603	605	605	513	512	512	515	513	452	451	451	451	462	34	-	-
CGP2 Plant Mass Yield	%		18.96%	19.03%	19.06%	19.07%	18.92%	18.91%	18.96%	18.93%	17.41%	17.45%	17.45%	17.59%	17.49%	16.00%	16.08%	15.95%	16.02%	16.39%	-	-	-
CGP2 Plant Concentrate Production	kt	7,365	213	441	441	441	437	454	455	454	418	419	419	422	420	384	386	383	384	393	-	-	-
CGP3 Plant Mass Yield	%		-	-	19.23%	19.64%	19.41%	19.33%	19.42%	19.36%	17.78%	17.76%	17.76%	17.98%	17.82%	16.22%	16.40%	16.10%	16.29%	16.48%	-	-	-
CGP3 Plant Concentrate Production	kt	6,593	-	-	209	446	449	464	466	465	427	426	426	431	428	389	394	386	391	396	-	-	-
CGP4 Plant Mass Yield	%		-	-	-	-	19.83%	19.76%	19.87%	19.76%	13.73%	13.80%	13.64%	13.91%	13.75%	13.76%	13.81%	13.45%	13.64%	13.76%	-	-	-
CGP4 Plant Concentrate Production	kt	5,021	-	-	-	-	302	474	477	474	330	331	327	334	330	330	331	323	327	330	-	-	-
Capital Profile – (100% Basis)																							
Expansionary Development	US$ million	217.4	51.2	68.8	40.0	43.4	13.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant & Equipment Expansion	US$ million	1,078.6	213.4	303.6	215.1	336.4	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tailings Addition - Expansion	US$ million	31.3	-	-	-	-	-	-	-	-	-	-	0.7	10.2	10.2	10.2	-	-	-	-	-	-	-
Sustaining Development	US$ million	72.7	15.3	15.9	17.1	22.9	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leases	US$ million	0.3	0.2	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant & Equipment Sustaining	US$ million	386.0	23.9	63.6	9.6	2.1	3.3	21.9	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	-	-
Closure	US$ million	42.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42.5	-
Total	**US$ million**	1,828.7	304.0	452.1	281.8	404.8	28.8	21.9	20.1	20.1	20.1	20.1	20.8	30.3	30.3	30.3	20.1	20.1	20.1	20.1	20.1	42.5	-

Source: SRK

19.3 Sensitivity Analysis

SRK performed a sensitivity analysis to determine the relative sensitivity of the operation's NPV to a number of key parameters. This is accomplished by flexing each parameter upwards and downwards by 10%. Within the constraints of this analysis, the operation appears to be most sensitive to mined lithium grades, commodity prices and recovery or mass yield assumptions within the processing plant.

SRK cautions that this sensitivity analysis is for information only and notes that these parameters were flexed in isolation within the model and are assumed to be uncorrelated with one another which may not be reflective of reality. Additionally, the amount of flex in the selected parameters may violate physical or environmental constraints present at the operation. Figure 19-8 illustrates the results of the analysis.



Source: SRK

Figure 19-8: Greenbushes NPV Sensitivity Analysis (Albemarle)

20 Adjacent Properties

SRK notes that no adjacent properties are relevant or material to the study or understanding of the Greenbushes property. Minor exploration areas exist on the same property discussed herein, and there is potential for disclosure of additional materials from these areas if they are developed.

21 Other Relevant Data and Information

SRK includes the following information as it involves future expansion options at the Greenbushes site and the reader should be aware that they could have an impact on the overall production, economics, and roll on impact of permitting.

1.1 Technical Grade Plant (TGP)

The TGP plant operation is discussed in detail in Section 14.1. The TGP has operated historically for many years. The material feeding the plant is identified in the geologic model, then detailed grade control drilling is conducted in the pit. The results of the grade control assays are then used by Talison to assign which material is processed through the TGP. Feed to TGP is defined primarily by Li_2O grade and the iron grade that will achieve the final product iron quality specification for SC7.2. The iron grade for the plant feed is governed by mineralogy and is modeled using oxides of manganese, calcium, potassium, sodium and lithium in plant feed.

1.2 Tailings Retreatment Plant (TRP)

Greenbushes has developed and installed a Tailings Reprocessing Plant (TRP) to reprocess tailings at a rate of 2 Mt per year from Tailings Storage Facility 1 (TSF1). The TRP is planned to process approximately 10 Mt of tailings. The TRP processing facilities include an oxide flotation plant capable of processing 2.0 Mt/y of reclaimed tailings, nominally grading 1.4% Li_2O at a design feed rate of 250 tph, to produce 285 kt/y of Spodumene concentrate grading 6.0% Li_2O. Feed to the TRP is by a dedicated mining fleet operated by a Mining Contractor with experience in tailings reclamation. Feed is directly loaded into the plant by a fleet of mining trucks or stored on a RoM stockpile adjacent to the feed bin. Mining is conducted on a day shift only basis, with the processing plant fed by front end loader from the RoM during night shift. The TRP is located adjacent to and west of the planned TSF4. Operation of the facility began in 2022 and continues today. As noted earlier in the report, the TRP production is not included in reserve cost model as the resource does in the QP's opinion meet the standards for inclusion in reserves.

22 Interpretation and Conclusions

2.1 Geology and Mineral Resources

Geology and mineralization on the Greenbushes property are well understood through decades of active mining and exploration. SRK has used relevant data to integrate into the modeling effort at the scale of LoM resources for public reporting.

The Greenbushes operation utilizes a 3D geological model informed by various data types (primarily drilling and pit mapping) to constrain and control the volume of the pegmatite bodies which host the spodumene-bearing Li_2O. SRK reviewed the historical geological interpretations and has made modifications focused on improving the modeling and definition of late-stage diorite dikes, which are considered waste and may potentially impact mining and processing. Additional refinement in the models has related to the definition of high-grade and low-grade internal domains with the Central Lode and Kapanga deposits. Previously, the modeling and grade interpolation did not consider a plunge to pegmatites and the Li_2O mineralization in Central Lode and Kapanga. Understanding this trend has the potential to improve exploration drilling success, delineate high-grade “shoots” within the pegmatites and properly represent the continuity of high-grade and low-grade domains.

Drilling data from the exploration drilling database were composited within relevant geological wireframes, and Li_2O grades were interpolated into a block model using ordinary kriging methods. Results were validated visually, via various statistical comparisons. The mineral resources are categorized in a manner consistent with industry standards, aligned with SEC definitions, and reviewed with Albemarle technical management personnel.

Mineral resources have been reported constrained within open pit optimization and above the effect CoG to demonstrate RPEE. A CoG has been assigned based on site practices (and compared to the theoretical economic cut-off), and the resource has been reported above this cut-off.

SRK is of the opinion that the mineral resources stated herein are appropriate for public disclosure and meet the definitions of Indicated and Inferred resources established by SEC guidelines and accepted industry practices.

2.2 Mineral Reserves and Mining Method

22.2.1 Reserves and Mine Planning

SRK has reported Mineral Reserves that, in our opinion as QP, are appropriate for public disclosure. The mine plan, which is based on the Mineral Reserves, spans approximately 18 years plus a final partial year with only stockpile rehandling to the plants occurring. Annual mining requirements are reasonable, with a peak ex-pit mining rate of approximately 66 Mt of combined ore and waste per year. SRK notes that a significant increase over the current mining rate will be required in future years. Accordingly, SRK recommends that Greenbushes make arrangements with the mining contractor to mobilize additional equipment to achieve increased mining rates starting in 2024.

Over the life of the project, approximately 717 Mt of waste will be mined from the open pit. A feasible waste dump design exists to accommodate the LoM waste quantity; however, a portion of the waste will need to be deposited (backfilled) into the Kapanga pit and the southern portion of the Central Lode pit after all ore has been extracted from those areas. SRK recommends that alternative waste dump locations be investigated so there is flexibility to expand the open pit operations and extend the mine life beyond what has been contemplated for the June 30, 2023 reserves discussed herein.

22.2.2 Geotechnical

The overall pit has been designed such that it meets the minimum acceptable stability criteria. Even under reduced strength conditions the slopes are predicted to remain stable. The 2023 pit has been adjusted to meet the revised pit sector geotechnical design parameters thereby enhancing stability. The sheared pegmatite zone is an area to watch for local stability issues, but it is not anticipated to present a major stability issues.

There remains uncertainty in hydrogeological conditions, particularly regarding bench face stability due to local pore pressures and the need to dewatering benches.

Uncertainty in the character and orientation of the interpreted geologic structures in the east wall of the Central Lode have recently been reduced using the 2023 investigation information. Given the conservative FoS of the east wall, any uncertainty is not expected to have significant impact of predicted stability unless geologic structures locally intersect such that local unstable wedges are formed. Collection of structural data should be collected on an ongoing basis to mitigate this potential ahead of any local instabilities.

The thickness and strength properties of the waste dump material at the crest of the west wall of the Central Lode are uncertain. Given the adequate stability analysis results this should not be a major stability issue unless the assumed properties are vastly different. This can be mitigated by conducting a geotechnical investigation of the waste dump nearest the pit crest.

Local bench-scale failures and rockfalls in the west wall of the Central Lode present a potential safety risk. Greenbushes is aware of this need and has been mitigated via the slope monitoring program and use of safety protocols when approaching the face, including annual/semiannual bench face scaling and real-time movement monitoring.

2.3 Metallurgy and Mineral Processing

CGP2 commissioning began during September 2019 and continued intermittently into 2021. During 2021 CGP2 recovered only 50.5% of the contained lithium versus a predicted recovery of 73.2%. In an effort to resolve the performance issues with CGP2, Greenbushes retained MinSol Engineering (MinSol) to undertake a performance assessment of CGP2 and identify areas where improvements in the plant could be made to increase lithium recovery. These optimization changes have resulted in increasing average lithium recovery from about 50.5% reported for 2021 to 67.9% reported for the first half of 2023. This represents an almost 18% increase in lithium recovery. However, overall lithium recovery remains about 8% less than the design recovery. MinSol has identified the following process areas that could be further optimized in an effort to further improve overall lithium recovery:

- Blending of ore on the ROM pad to decrease plant feed variability
- Redirecting fines flotation cleaner tailings to allow for additional reagent conditioning
- Improve reagent conditioning efficiency of the fines flotation conditioner
- Improve reagent conditioning in the Hydrofloat reagent conditioners
- Prescreening HPGR feed to reduce slimes generation

- Add a scavenger flotation circuit
- Add a scavenger WHIMS circuit

2.4 Processing and Recovery Methods

Greenbushes currently has two ore crushing facilities (CR1 and CR2) and three ore processing plants which includes the Technical Grade Plant (TGP), Chemical Grade Plant-1 (CGP1) and Chemical Grade Plant-2 (CGP2) with a nominal capacity of 4.5 Mt/y of pegmatite feed to produce a nominal 1.3 Mt/y of spodumene concentrates (chemical and technical grades).

The process flowsheets utilized by both CGP1 and CGP2 are similar, however, CGP2 was designed with a number of modifications based on HPGR comminution studies and CGP1 operational experience. The most notable modification included the replacement of the ball mill grinding circuit with HPGRs.

CGP2 commissioning began during September 2019 and continued through April 2020 and was then shut down and put on care and maintenance during the period of March 2020 to April 2021 due to market demand considerations. CGP2 was then put back into production during May 2021 and has operated continuously since then.

During 2023 (Jan-Jun) CGP2 processed 1,037,617 t of ore at an average grade of 2.18% Li_2O and recovered 67.9% of the lithium into 256,512 t of concentrate at an average grade of 6.00% Li_2O. The improved plant performance is attributed to improved operating availability, steady-state operation and ongoing efforts to improve performance of individual unit operations.

SRK notes that that CGP2 and CGP1 flowsheets are similar and both plants process ore from the same mining operation, as such, SRK believes that it is reasonable to expect that CGP2 will eventually achieve performance similar to CGP1.

Greenbushes is currently constructing Chemical Grade Plant-3 (CGP3), which will be identical to CGP2, and is scheduled to come on-line during Q1 2025. Greenbushes also has plans to construct Chemical Grade Plant-4 (CGP4), which will also be based CGP2. CGP4 is currently planned to commence production during Q1 2027

SRK recommends that Greenbushes' CGP1 yield model continue to be used for resource and reserve modeling for ore processed at CGP1, and for the current period recommends using the modified CGP2 yield model shown below for resource and reserve calculations for ore processed at CGP2, CGP3 and CGP4:

Modified CGP2 Yield % = (9.362 * (Plant Feed Li_2O%) 1.319) - 1.5

2.5 Infrastructure

The infrastructure at Greenbushes is installed and functional. Expansion projects have been identified and are at the appropriate level of design depending on their expected timing of the future expansion. Tailings and waste rock are flagged as risks due to the potential for future expansion and location of future resources that are in development. A detailed review of long-term storage options for both tailings and waste rock will allow timely planning and identification of alternative storage options for future accelerated expansion if needed.

2.6 Environmental, Permitting, Social and Closure

Environmental, Permitting, Social

The Project has been in operation as a hard rock mine since 1983 and is fully permitted for its current operations. The Project is in the process of obtaining further approvals for expansion.

During development and subsequent modifications to the mine, environmental studies and impact assessments have been completed to support project approval applications. Many of these studies are being updated as part of the current expansion efforts; as such, some of the most up-to-date information was not readily available. Some of the key findings from previous studies include:

- No Threatened Ecological Communities, Priority Ecological Communities or threatened flora have been reported in the vicinity of the mine site.
- There have been seven conservation significant fauna species recorded in the mine development area.
- Surface water drains through tributaries of the Blackwood River, which is registered as a significant Aboriginal site that must be protected under the State Aboriginal Heritage Act 1972.
- Groundwater is not a resource in the local area due to the low permeability of the basement rock.
- Earlier studies indicated that the pits would overflow approximately 300 years after mine closure. However, more recent modeling suggests that water levels will stabilize in approximately 500 to 900 years and remain 20 m below the pit rims (i.e., no overflow).
- Background groundwater quality data are limited due to a lack of monitoring wells upgradient of the mine, and as monitoring wells are located close to the TSFs and/or in the historically dredged channels; some of these wells have been impacted by seepage and is under investigation and remediation efforts.
- Waste rock is not typically acid generating, though some potentially acid generating (PAG) granofels (metasediments) do occur in the footwall of the orebody. Significant acid neutralizing capacity (ANC) has been shown to exist in waste rock and pit walls.
- Studies into the potential for radionuclides has consistently returned results that are below trigger values.
- There are no other cultural sites listed within the mining development area.

The Project operates under approvals that contain conditions for environmental management that include waste and tailings disposal, site monitoring, and water management. The Project has not incurred any significant environmental incidents.

There has been no predictive modeling of the pit lake quality as far as SRK is aware, and this is recommended to inform closure management strategies. There is potential for site water management to be required post-closure until seepage from TSF2 attenuates.

The Project has contaminated five sites listed which encompass the entire mine area due to known or suspected contaminated sites due to hydrocarbons and metals in soil, and elevated concentrations of metals in groundwater and surface water. These sites are classified as “Contaminated – Restricted use” and only permit commercial and industrial uses. This will need to be reviewed for final land use options for closure.

Talison has agreements in place with two local groups, and maintains working relationships with local Aboriginal people.

Closure

Although Greenbushes has a closure plan prepared in accordance with applicable regulations, documenting all proposed closure activities to close all of the existing project facilities, and future expansions and facilities planned for the next 10 years. A proper PFS-level closure cost estimate should be prepared using site specific conditions and rates. SRK cannot validate the current closure cost estimate because the model used is based on inflated 2010/2011 rates and there is no information on how the unit rates used in the model were derived.

2.7 Capital and Operating Costs

The Greenbushes cost forecasts are based on mature mine budgets that have historical accounting data to support the cost basis and forward looking mine plans as a basis for future operating costs as well as forward looking capital estimates based on engineered estimates for expansion capital and historically driven sustaining capital costs. SRK notes that the global economic environment continues to drive cost increases and that forward looking forecasting is inherently limited in its ability to predict macroeconomic variability. In SRK's opinion, the estimates are reasonable in the context of the current reserve and mine plan.

2.8 Economic Analysis

The Greenbushes operation consists of an open pit mine and several processing facilities fed primarily by the open pit mine. The operation is expected to have a 19 year life. Under the forward-looking assumptions modeled and documented in this report, the operation is forecast to generate positive cashflow.

As modeled for this analysis, the operation is forecast to produce 29.5 Mt of concentrate to be sold at a spodumene price of US$1,500/t CIF China. This results in a forecast after-tax project NPV at 10% of US$8.86 billion, of which, US$4.34 billion is attributable to Albemarle.

The analysis performed for this report indicates that the operation's NPV is most sensitive to variations in the grade of ore mined, the commodity price received and processing plant performance.

23 Recommendations

3.1 Recommended Work Programs

23.1.1 Geology and Mineral Resources

SRK recommends the following work programs as opportunities for improvement to geology and Mineral Resources:

- Continue to utilize the property-wide geologic and resource block model that aligns the Central Lode and Kapanga deposits for use in mine planning.
- Continue to optimize orientations and trends of the Central Lode and Kapanga pegmatites and Li_2O mineralization for future estimates.
- SRK has completed simple estimates for the deleterious elements as part of the current update and for internal use for Talison tracking. Further review of the parameters and development of recovery models to predict future performance should be considered.
- Conduct a full data validation and review of QA/QC of Central Lode and Kapanga data during the next resource model update.
- Consider alternative modeling methods to improve the geologic model specifically for the Kapanga pegmatite and dolerite dikes.
- Construct a detailed 3D wireframe structural model across the property to support the geological model and provide aid to geotechnical design assumptions.
- Continue exploration drilling across the property for condemnation and deposit definition purposes, including chemical, mineralogical, and bulk density analyses.

23.1.2 Mining and Mineral Reserves

SRK recommends that alternative waste dump locations be investigated so there is flexibility to expand the open pit operations and extend the mine life beyond what has been contemplated for the June 30, 2023 reserves discussed herein.

SRK also recommends that Greenbushes closely monitor the mining sequence as mining progresses to ensure timely availability of in-pit dumps.

With regard to forecast increases in the annual mining rate, SRK recommends that Greenbushes make arrangements with the mining contractor to mobilize additional equipment to achieve the increased mining rate starting in 2024.

23.1.3 Processing and Recovery Methods

SRK recommends that Greenbushes continue with the optimization programs identified by Minsol for CGP2, which includes the following:

- Blending of ore on the ROM pad to decrease plant feed variability
- Redirecting fines flotation cleaner tailings to allow for additional reagent conditioning
- Improve reagent conditioning efficiency of the fines flotation conditioner
- Improve reagent conditioning in the Hydrofloat reagent conditioners
- Prescreening HPGR feed to reduce slimes generation
- Add a scavenger flotation circuit
- Add a scavenger WHIMS circuit

23.1.4 Geotechnical Program

Recommendations for future geotechnical work includes the following:

- Field mapping to ground truth interpreted geologic structures and update structural model should be continued on an ongoing basis.
- Conduct numerical modeling of the shared pegmatite zone wall to check for interaction with the Kapanga pit
- Update the hydrogeological conceptual model considering VWP data and asses the benefits of dewatering on bench stability

23.1.5 Groundwater

Transient calibration of the regional groundwater modeling recommended to increase predictability and reliability of the model. To achieve this:

- Water level data collected from the last modeling update should be added to calibration data set
- Transient recharge should be considered as stress to numerical model.
- Calibration should be enhanced to produce history matching of available underground mine working inflow records

23.1.6 Environmental and Closure

There is potential for site water management to be required post-closure until seepage from TSF2 attenuates. This could result in a significant increase in the closure costs. The closure cost estimate should be updated to reflect current industry best practice.

3.2 Recommended Work Program Costs

Table 23-1 summarizes the costs for recommended work programs.

Table 23-1: Summary of Costs for Recommended Work

Discipline	Program Description	Cost (1000's US$)
Geology and Mineralization	Detailed 3D structural model development	50
Mineral Resource Estimates	Continue to refine property scale geological and resource model by incorporating new data.	100
Deposit definition drilling	Continued exploration and condemnation drilling across the deposit to define extents of pegmatites on the Greenbushes property.	500 to 1,000 per year
Mineral Reserves and Mining	Investigate alternative waste dump locations to determine if there is flexibility to expand the open pit operations and extend the mine life.	100
Geotechnical	Hydrogeological model update, pit phase stability assessments, rock fall assessment	40
Process	Continue ongoing performance assessment on CGP2 to determine modifications/adjustments to the flow sheet to improve the performance to design levels.	2,000
Infrastructure	Life of Mine Tailings Disposal study, Studies required for further characterization of TSF1 and advancement of the expansion design, Comprehensive 3rd party dam safety review.	2,500
Environmental Studies, Permitting, and Plans, Negotiations, or Agreements with Local Individuals or Groups	Conduct comprehensive geochemical predictive modeling of the post-closure pit lakes, as this could have significant bearing on possible long-term water treatment requirements. A site-wide assessment of water quality should be completed including diffuse and point sources, and predictions of long-term water quality. This would inform closure planning and determine if long-term, post-closure water management or treatment is required.	375
Groundwater	Transient calibration of the groundwater numerical model to reduce uncertainty on mine inflows, cone of drawdown impacts , and baseflow impact assessment	150
Closure Costs	The closure cost estimate should be updated to reflect current industry best practice. The update should use standard calculating methods, site specific data, and include all costs that could be reasonably incurred. It is possible that the closure plan may require additional modification, such as predicting the need for long-term water treatment.	75
Total US$		**$5,890 to $6,390**

Source: SRK, 2023

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25 Reliance on Information Provided by the Registrant

The Consultant's opinion contained herein is based on information provided to the Consultants by Albemarle throughout the course of the investigations. Table 25-1 of this section of the Technical Report Summary will:

(i) Identify the categories of information provided by the registrant;

(ii) Identify the particular portions of the Technical Report Summary that were prepared in reliance on information provided by the registrant pursuant to Subpart 1302 (f)(1), and the extent of that reliance; and

(iii) Disclose why the qualified person considers it reasonable to rely upon the registrant for any of the information specified in Subpart 1302 (f)(1).

Table 25-1: Reliance on Information Provided by the Registrant

Category	Report Item/ Portion	Portion of Technical Report Summary	Disclose why the Qualified Person considers it reasonable to rely upon the registrant
Discount Rates	19	19 Economic Analysis	Albemarle provided discount rates based on a benchmarking of publicly available information for 54 lithium mining project studies. The median value of the benchmarking dataset is 10%. SRK typically applies discount rates to mining projects ranging from 5% to 12% dependent upon commodity. SRK views the selected 10% discount rate as appropriate for this analysis.
Foreign Exchange Rates	19	19 Economic Analysis	SRK was provided with an exchange rate comparison of a forward-looking consensus average and spot rates and a 3-year trailing average. The selected FX rate is slight lower than the consensus and 3-year trailing averages. The selected rate is higher than the spot FX rate. As such, it is SRK's opinion that the rates provided strike a balance between spot and forward looking rates are appropriate for a long term analysis such as reserves.
Tax rates and government royalties	19	19 Economic Analysis	SRK was provided with tax rates and government royalties for application within the model. These rates are in line with SRK's understanding of the tax regime at the project location.
Environmental Studies	17	17.1 Environmental Studies	SRK was provided various environmental studies conducted on site. These studies were of a vintage that independent validation could not be completed.

Environmental Compliance	17	17.3.4 Environmental Compliance	Registrant provided regulatory compliance audit results. SRK did not conduct an independent regulatory compliance audit as part of the scope.
Local Agreements	17	17.4 Local Individuals and Groups	Registrant provided agreements with local stakeholders. SRK was unable to query all project stakeholders on issue of agreements.

Signature Page

Sections 1.9 and 16 of this report titled “SEC Technical Report Summary, Pre-Feasibility Study, Greenbushes Mine, Western Australia” with an effective date of June 30, 2023, was prepared and signed by:

Fastmarkets ***/s/*** **Fastmarkets**
Dated at London, UK
February 9, 2024

All sections other than Sections 1.9 and 16 of this report titled, “SEC Technical Report Summary, Pre-Feasibility Study, Greenbushes Mine, Western Australia” with an effective date of June 30, 2023, was prepared and signed by:

SRK Consulting (U.S.) Inc. ***/s/*** **SRK Consulting (U.S.) Inc.**

Dated at Denver, Colorado
February 9, 2024

Exhibit 96.2

SEC Technical Report Summary
Initial Assessment
Wodgina
Western Australia

Effective Date: December 31, 2022
Report Date: February 14, 2023

Report Prepared for

Albemarle Corporation

4250 Congress Street
Suite 700
Charlotte, North Carolina 28209

Report Prepared by

SRK Consulting (U.S.), Inc.
999 Seventeenth Street, Suite 400
Denver, CO 80202

SRK Project Number: USPR000574

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List of Abbreviations

The metric system has been used throughout this report. Tonnes are metric of 1,000 kg, or 2,204.6 lb. All currency is in U.S. dollars (US$) unless otherwise stated.

Abbreviation	Unit or Term
A	ampere
AA	atomic absorption
A/m^2	amperes per square meter
°C	degrees Celsius
CoG	cut-off grade
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
cfm	cubic feet per minute
ConfC	confidence code
CRec	core recovery
°	degree (degrees)
dia.	diameter
g	gram
g/t	grams per tonne
ha	hectares
ICP	induced couple plasma
IDW2	inverse-distance squared
IDW3	inverse-distance cubed
kg	kilograms
km	kilometer
km^2	square kilometer
kt	thousand tonnes
kt/d	thousand tonnes per day
kt/y	thousand tonnes per year
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
kWh/t	kilowatt-hour per metric tonne
L	liter
L/sec	liters per second
L/sec/m	liters per second per meter
LOI	Loss On Ignition
LoM	Life-of-Mine
m	meter
m^2	square meter
m^3	cubic meter
mamsl	meters above mean sea level
mg/L	milligrams/liter
mm	millimeter
mm^2	square millimeter
mm^3	cubic millimeter
Mt	million tonnes
Mt/y	million tonnes per year
MTW	measured true width

MW	million watts
m.y.	million years
%	percent
ppm	parts per million
QA/QC	Quality Assurance and Quality Control
RC	rotary circulation drilling
RoM	Run-of-Mine
RQD	Rock Quality Description
SEC	U.S. Securities and Exchange Commission
sec	second
SG	specific gravity
t	tonne (metric ton) (2,204.6 pounds)
t/h	tonnes per hour
t/d	tonnes per day
t/y	tonnes per year
TSF	tailings storage facility
V	volts
VFD	variable frequency drive
W	watt
XRD	x-ray diffraction
y	year

1 Executive Summary

This report was prepared as an Initial Assessment-level (IA) Technical Report Summary (TRS) in accordance with the Securities and Exchange Commission (SEC) S-K regulations (Title 17, Part 229, Items 601 and 1300 until 1305) for Albemarle Corporation (Albemarle) by SRK Consulting (U.S.), Inc. (SRK) on the Wodgina Mine asset (Wodgina).

This TRS represents an update from the previous TRS with changes due to mining depletion. The resource block model, mineral resource economic pit, and cut-off grade economic assumptions remain unchanged from December 2021. SRK chose a conservative approach using previous cost and commodity prices. The previous report was "SEC Technical Report Summary, Initial Assessment, Wodgina Western Australia. Amended Date December 16, 2022". The operation re-started mining activities in mid-2022 with continued ramp up in operational capacity. The basis of the report is unchanged, though the Qualified Person (QP) notes on-going technical work programs remain in-progress. A summary of the changes is provided in Chapter 2.2.

1.1 Property Description (Including Mineral Rights) and Ownership

The Wodgina property lies approximately 110 kilometers (km) south-southeast (S-SE) of Port Hedland, Western Australia between the Turner and Yule Rivers. The area includes multiple prominent ridges up to 180 m above mean sea level (mamsl) surrounded by plains and lowlands. The center of the property is located at Mount Cassiterite - 21° 11' 25"S, 118° 40' 25"E (World Geodetic System [WGS] 1984).

The property tenure is held under the joint venture of Albemarle Wodgina Pty Ltd. and Wodgina Lithium Pty Ltd. with ownership structure of 60% Albemarle Corporation and 40% Mineral Resources Ltd. (MRL). The operating joint venture entity is known as MARBL.

1.2 Geology and Mineralization

The Wodgina pegmatite deposits (including the historical Wodgina, Mount Cassiterite (Cassiterite), and Mount Tinstone (Tinstone) pits) are hosted within the Paleoarchean East Strelley Greenstone Belt in the Pilbara Craton of Western Australia, Australia.

The property is located within the Wodgina Pegmatite District. This pegmatite district is entirely hosted in the eastern limb of the Wodgina greenstone belt along the southern portion of the Wodgina-Strelley lineament. This greenstone belt is a north-northeast (N-NE) plunging synform separating the Yule and Carlindi granitoid complexes within the Central zone of the Pilbara Craton.

The Cassiterite pegmatite group is classified as a rare element albite-spodumene type pegmatite. Spodumene ($LiAlSi_2O_6$) is the primary lithium-bearing mineral. It is a massive to weakly layered pegmatite with comb-textured megacrystic microcline and spodumene with aplitic layers often displaying pseudo-gneissic banding. Unlike many other Pilbara Craton pegmatite bodies, the Cassiterite pegmatites tend not to display internal structure such as mineralogical layering or banding. Lithium-bearing minerals are predominantly spodumene and lepidolite. Prior to focusing on lithium production, the Cassiterite deposit was exploited for tantalum-bearing wodginite and cassiterite with subordinate maganocolumbite and manganotantalite with associated microcline alteration (Huston, et al., 2001). Other significant minerals include spessartine (Mn aluminosilicate garnet), elbaite (Na-Li alumino-boro-silicate tourmaline), and native Bi.

1.3 Status of Exploration, Development and Operations

During May 2022, MARBL re-started operations at Wodgina. In addition to mining and processing ore from the Cassiterite pit, additional technical work programs have been initiated onsite. These include resource drilling, analyses, and updated geological modeling. Work is on-going at Wodgina to address the technical confidence in the Cassiterite lithium deposit.

For the purposes of this TRS, historical resource data, including the 2020 resource block model, is used to support the Mineral Resource statement with resource depletion calculated based on December 31, 2022 site topography. The resource block model, mineral resource economic pit, and cut-off grade economic assumptions remain unchanged from the previous TRS.

1.4 Mineral Resource Estimates

Mineral resources are updated as of December 31, 2022 by SRK, as summarized in Table 1-1. Differences between the previous Mineral Resource statement are due to mining depletion during the second half of 2022.

As the project-level is currently considered at an Initial Assessment-level, the property contains no mineral reserves.

Table 1-1: Wodgina Summary Mineral Resources as of December 31, 2022 by SRK Consulting (U.S.), Inc.

Category	100% Tonnes (Mt)	Attributable Tonnes (Mt)	Li_2O (%)	Cut-Off (% Li_2O)	Mass Yield	100% Concentrate Tonnes at 6.0% Li_2O (Mt)	Attributable Concentrate Tonnes at 6% Li_2O (Mt)	100% Li Metal in Concentrate (Kt)	Attributable Li Metal in Concentrate (Kt)
Indicated	21.0	12.6	1.36	0.5	14.7%	3.1	1.9	86.2	51.7
Inferred	163.9	98.3	1.12	0.5	12.1%	19.9	11.9	554.3	332.6

Source: SRK, 2023
Notes:
• The Summary mineral resources attributable tonnes reflect Albemarle's 60% ownership percentage in the Wodgina project.
• The effective date for this mineral resource is December 31, 2022. All significant figures are rounded to reflect the relative accuracy of the estimates.
• Tonnages are presented as million metric tonnes (Mt) with lithium oxide (Li_2O) grades presented as percentages.
• The mineral resource estimate has been classified in accordance with SEC S-K 1300 guidelines and definitions.
• Mineral resources on the Wodgina property are contained within the Cassiterite Deposit which comprises the historically mined Cassiterite pit and undeveloped North Hill area.
• Mineral resources are not Mineral Reserves and do not have demonstrated economic viability. Inferred mineral resources have a high degree of uncertainty as to their economic and technical feasibility. It cannot be assumed that all or any part of an Inferred mineral resources can be upgraded to Measured or Indicated mineral resources.
• Metallurgical recovery of lithium has been estimated on a block basis at a consistent 65% based on documentation from historical plant production.
• To demonstrate reasonable prospects for economic extraction of mineral resources, a cut-off grade of 0.5% Li_2O is applied to material contained within an economic pit shell based on 65% recoverability assumption, long-term price assumptions of US$584 per tonne (t) at mine gate, variable mining costs averaging US$3.40/t, processing costs and G&A costs totaling US$23/t.
• The mineral resources are constrained by an economic pit shell using an overall 43° pit slope angle, 0% mining dilution, and 100% mining recovery.
• There are no known legal, political, environmental, or other risks that could materially affect the potential development of the mineral resources based on the level of study completed for this property.

1.5 Conclusions and Recommendations

Wodgina is a large spodumene pegmatite deposit which is currently in the process of ramping up production after several years on care and maintenance. The geology of the site is relatively complex and features a number of challenges due to variations in structure, morphology, and mineralogy of the pegmatites. Such variability is common in spodumene pegmatites and is generally related to inherent structural complexity of host rocks, rheology of pegmatite intrusions, and the characteristics of various phases of pegmatite which commonly accompany lithium mineralization. SRK has considered all provided and validated data in developing a robust structural and lithological interpretation to best inform the mineral resources. The lack of sufficient foundation data to adequately characterize these aspects in certain portions of the project has been incorporated in the mineral resource classification. It is expected that risks in the geological interpretation and resources are likely to remain until extensive geological, mineralogical, and structural work has been finalized across the deposit, and that ongoing de-risking through closely spaced diamond core drilling is expected to be on-going as part of mining development.

The Wodgina property has an extensive operational history in products other than lithium. Despite this, lithium production is a relatively recent addition to Wodgina (effectively post-2016), with the majority of the lithium analytical data being generated or characterized from remnant historical tin/tantalum drilling samples. All data supporting the mineral resources was provided to SRK by MARBL, and exploration and development of Wodgina continues, with on-going work programs during 2022.

While Wodgina features extensive drilling and a long history of intermittent production, significant uncertainty associated with the deposit remains. SRK reflects these risks in the resource classification, and notes that the following additional work is recommended for the project going forward:

- Characterize the mineralogy and process recoverability of both the. Cassiterite and North Hill areas of Wodgina. SRK understands this to be ongoing in new drilling on the project at this time.
- Refine the 3D structural model for Wodgina pegmatite mineralization utilizing core drilling to collect accurate structural measurements and provide influence in updated geological modeling and resources.
- Characterize the recoverability and process for the existing tin/tantalum operation tailings, which have been noted to contain significant quantities of lithium.
- Robust ore control including closely spaced blasthole drilling and short-term planning should be considered to de-risk mining areas.
- The project should advance to pre-feasibility study (PFS) levels of development with the completion of additional technical study and re-interpretation for relevant modifying factors of the mineral resource.

2 Introduction

2.1 Registrant for Whom the Technical Report Summary was Prepared

This Technical Report Summary was prepared in accordance with the SEC S-K regulations (Title 17, Part 229, Items 601 and 1300 through 1305) for Albemarle by SRK on the Wodgina property located in Western Australia, Australia. Albemarle has a 60% ownership in Wodgina with MRL retaining the remaining 40%. The joint venture operating entity is titled MARBL.

2.2 Terms of Reference and Purpose of the Report

The quality of information, conclusions, and estimates contained herein are consistent with the level of effort involved in SRK's services, based on i) information available at the time of preparation and ii) the assumptions, conditions, and qualifications set forth in this report. This report is intended for use by Albemarle and is subject to the terms and conditions of its contract with SRK and relevant securities legislation. The contract permits Albemarle to file this report as a Technical Report Summary with American securities regulatory authorities pursuant to the SEC S-K regulations, more specifically Title 17, Subpart 229.600, item 601(b)(96) - Technical Report Summary and Title 17, Subpart 229.1300 - Disclosure by Registrants Engaged in Mining Operations. Except for the purposes legislated under securities law, any other uses of this report by any third party are at that party's sole risk. The responsibility for this disclosure remains with Albemarle.

The purpose of this Technical Report Summary is to report mineral resources as part of an initial assessment (IA). The IA is preliminary in nature, it includes Inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the IA will be realized. Mineral resources that are not mineral reserves do not have demonstrated economic viability.

The effective date of this report is December 31, 2022. This date corresponds with the latest topography and available validated drilling information incorporated into the technical work supporting the disclosure. This TRS represents an update from the previous years' TRS. The previous report was "SEC Technical Report Summary, Initial Assessment, Wodgina Western Australia, Amended Date December 16, 2022". The update includes mining depletion calculated from differences in digital topographic surveys of the property between end-of-year 2021 and end-of-year 2022. Differences in topographic volumes are due to mining activities onsite which commenced in May 2022.

2.3 Sources of Information

This report is based, in part on internal company technical reports, previous studies, maps, published government reports, company letters and memoranda, and public information as cited throughout this report and listed in the References Section 24.

Reliance upon information provided by the registrant is listed in the Section 25, when applicable.

2.4 Details of Inspection

Due to the global pandemic, no site inspection has been conducted on the property by Qualified Persons (QP). Future site visits are planned by QPs.

2.5 Qualified Person

This report was prepared by SRK Consulting (U.S.), Inc., a third-party firm comprising mining experts in accordance with § 229.1302(b)(1). Albemarle has determined that SRK meets the qualifications specified under the definition of qualified person in § 229.1300. References to the Qualified Person or QP in this report are references to SRK Consulting (U.S.), Inc. and not to any individual employed at SRK.

2.6 Report Version Update

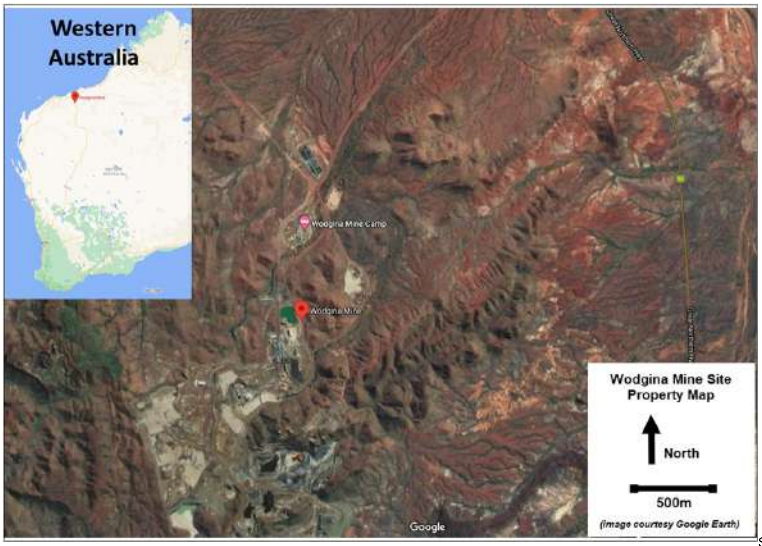
This Technical Report Summary is an update of a previously filed Technical Report Summary. The previous report was "SEC Technical Report Summary, Initial Assessment, Wodgina Western Australia. Amended Date December 16, 2022", with the exception of the amendments noted in section 2.2. This report represents an IA as defined by SEC S-K 1300 definitions.

3 Property Description

3.1 Property Location

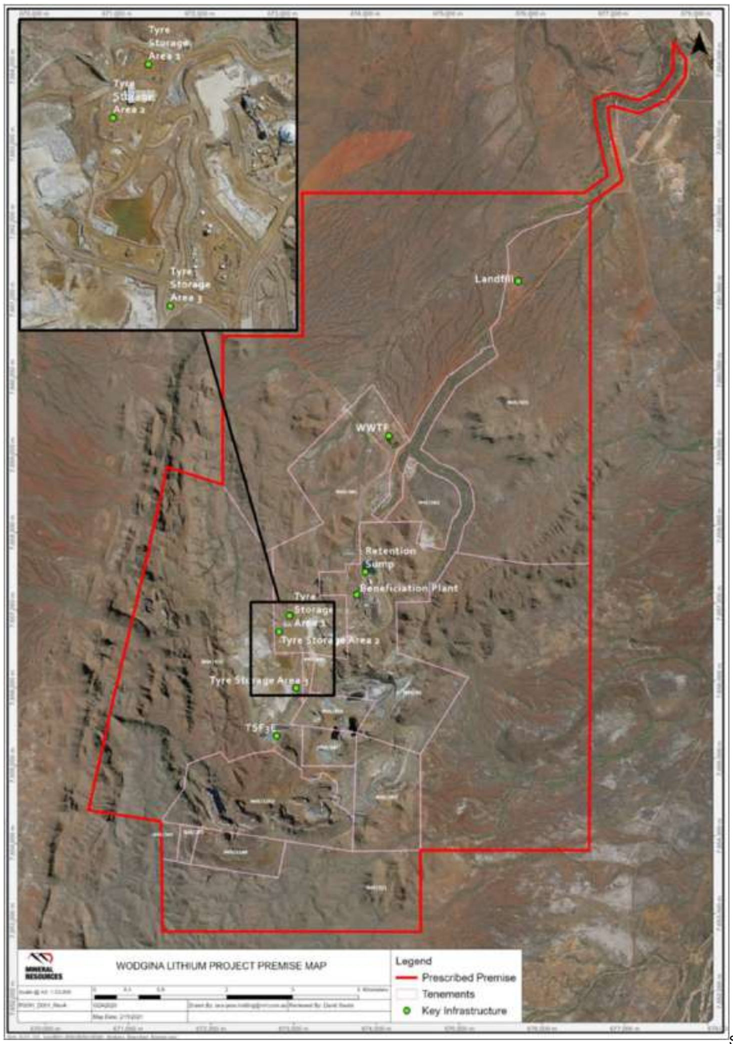
The Wodgina property lies approximately 110 km S-SE of Port Hedland, Western Australia between the Turner and Yule Rivers. The area includes multiple prominent greenstone ridges up to 180 mamsl surrounded by granitic plains and lowlands. The center of the property is located at Mount Cassiterite - 21° 11' 25"S, 118° 40' 25"E (WGS, 1984).

The property tenure is held under the joint venture of Albemarle Wodgina Pty Ltd. and Wodgina Lithium Pty Ltd. with ownership structure of 60% Albemarle and 40% MRL. The joint company is known as MARBL. A location map of the Wodgina property is shown in Figure 3-1 and Figure 3-2.



Source: Modified after Google

Figure 3-1: Location Map of the Wodgina Property, Western Australia, Australia



Source: MARBL, 2021

Figure 3-2: Wodgina Property Tenure Map

3.2 Property Area

The leases covering the Wodgina property cover a total of 111.4 square kilometers (km^2) (43 square miles) (DMP, 2021). This includes various tenement types of general purpose and mining leases, along with retention and miscellaneous licenses.

3.3 Mineral Title, Claim, Mineral Right, Lease or Option Disclosure

The Wodgina property is located on Mining Lease M45/50, M45/353, and M45/887. These tenements are located within the Kariyarra native title claim and are subject to the Land Use Agreement dated March 2001 between the Kariyarra People and Gwalia Tantalum Ltd. (now the joint venture partners of Albemarle and MRL). All tenements are in good standing with the State government with no known impediments as of the effective date of this report (DMP, 2021). A list of the land tenure is available in Table 3-1.

Payment associated with tenement renewal to the State of Western Australia are:

- Mining Lease – AU$100 per hectare (ha), minimum AU$5,000
- General Purpose Lease – AU$17.90 per ha rent payment per annum
- Miscellaneous License – AU$17.90 per ha rent payment per annum

Table 3-1: Land Tenure Table

Tenement ID	Tenement Type	Survey status	Status	Holders	Grant Date (DD/MM/YYYY)	End Date (DD/MM/YYYY)	TENID	Area (ha)	Extract Date
G 4500269	General purpose lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	27/01/2005	28/01/2026	G 45/269	9.612	15/02/2023 12:00:00 AM
G 4500271	General purpose lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	27/01/2005	28/01/2026	G 45/271	9.3595	15/02/2023 12:00:00 AM
G 4500029	General purpose lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	18/07/1990	25/07/2032	G 45/29	9.6505	15/02/2023 12:00:00 AM
L 4500009	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	19/10/1984	03/07/2026	L 45/9	12.5	15/02/2023 12:00:00 AM
L 4500108	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	29/06/2001	28/06/2043	L 45/108	1560	15/02/2023 12:00:00 AM
L 4500093	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	25/03/1998	24/03/2028	L 45/93	134.9	15/02/2023 12:00:00 AM
L 4500105	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	01/06/2001	31/05/2043	L 45/105	1682	15/02/2023 12:00:00 AM
L 4500058	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	09/12/1988	08/12/2023	L 45/58	95	15/02/2023 12:00:00 AM
L 4500064	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	18/05/1990	17/05/2025	L 45/64	1	15/02/2023 12:00:00 AM
M 4500365	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	02/10/1988	09/10/2030	M 45/365-I	206.6	15/02/2023 12:00:00 AM
M 4500254	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	19/10/1987	28/10/2029	M 45/254	77.97	15/02/2023 12:00:00 AM
M 4500353	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	15/05/1988	18/05/2030	M 45/353	35.395	15/02/2023 12:00:00 AM
M 4500888	Mining Lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	22/03/2001	21/03/2043	M 45/888	12.755	15/02/2023 12:00:00 AM
M 4500049	Mining Lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	28/06/1984	03/07/2026	M 45/49	85.95	15/02/2023 12:00:00 AM
M 4500886	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	22/03/2001	21/03/2043	M 45/886	6.81	15/02/2023 12:00:00 AM
M 4500887	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	22/03/2001	21/03/2043	M 45/887-I	30.575	15/02/2023 12:00:00 AM
M 4500383	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	05/07/1988	11/07/2030	M 45/383-I	110.6	15/02/2023 12:00:00 AM
M 4500925	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	26/03/2001	25/03/2043	M 45/925-I	612.55	15/02/2023 12:00:00 AM
M 4500950	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	11/07/2001	10/07/2043	M 45/950-I	677.8	15/02/2023 12:00:00 AM
M 4500381	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	05/07/1988	11/07/2030	M 45/381	287.65	15/02/2023 12:00:00 AM
G 4500290	General purpose lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	22/01/2010	21/01/2031	G 45/290	9.945	15/02/2023 12:00:00 AM
G 4500270	General purpose lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	27/01/2005	28/01/2026	G 45/270	9.043	15/02/2023 12:00:00 AM
L 4500441	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	21/11/2018	20/11/2039	L 45/441	0.82	15/02/2023 12:00:00 AM
L 4500443	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	05/11/2018	04/11/2039	L 45/443	196.405	15/02/2023 12:00:00 AM
L 4500451	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	05/02/2019	04/02/2040	L 45/451	1.674	15/02/2023 12:00:00 AM
L 4500437	Miscellaneous license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	11/04/2018	10/04/2039	L 45/437	733.23	15/02/2023 12:00:00 AM
				Albemarle					

L 4500452	Miscellaneous license	Unsurveyed	Live	Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	05/02/2019	04/02/2040	L 45/452	5.992	15/02/2023 12:00:00 AM
M 4500050	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	28/06/1984	03/07/2026	M 45/50-I	364.5	15/02/2023 12:00:00 AM
M 4500382	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	05/07/1988	11/07/2030	M 45/382	58.24	15/02/2023 12:00:00 AM
M 4500924	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	26/03/2001	25/03/2043	M 45/924-I	520.1	15/02/2023 12:00:00 AM
M 4500949	Mining lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	11/07/2001	10/07/2043	M 45/949	804.15	15/02/2023 12:00:00 AM
G 4500291	General purpose lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	22/01/2010	21/01/2031	G 45/291	9.677	15/02/2023 12:00:00 AM
G 4500321	General purpose lease	Surveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	05/10/2011	04/10/2032	G 45/321	296.55	15/02/2023 12:00:00 AM
R 4500004	Retention license	Unsurveyed	Live	Albemarle Wodgina Pty Ltd; Wodgina Lithium Pty Ltd	21/07/2017	20/07/2027	R 45/4	2469	15/02/2023 12:00:00 AM

Source: DMP, 2023

3.4 Mineral Rights Description and How They Were Obtained

Mineral rights were obtained by the registrant through a joint venture agreement (JV) in 2018 between Albemarle Corporation and Mineral Resources Ltd when the registrant acquired a 60% interest in the Wodgina property to form the JV MARBL.

The mining lease tenements are retained through meeting the requirements set forth by the State of Western Australia, Department of Mines and Petroleum (DMP). Renewal applications are met for 12-month periods by providing justification to the DMP for reasons of renewal with accompanying rent payments.

3.5 Encumbrances

SRK has relied upon the legal information regarding title provided by Albemarle, as noted in section 25, and is unaware of any encumbrances upon the Wodgina property.

3.6 Other Significant Factors and Risks

SRK is unaware of any significant factors or risks that may affect property access, title, or the right to perform work on the Wodgina property.

3.7 Royalties or Similar Interest

Table 3-2 represents the royalty and liabilities in-place for the Wodgina property.

Table 3-2: Summary Royalty and Liabilities.

Royalties/Liability	Details of Amounts Payable
Mine Rehabilitation Fund (MRF) Funding for Closure including payment offset obligations	Annual MRF levy US$157,093.76 (1% of the liability according to the MRF) Based on 653.46 ha disturbance and 242.32 ha rehabbed
Royalties payable under Pastoral and Native Title Agreements	US$450,000 per annum payment owed to the Kariyarra People's Trust (pursuant to Land Use Agreement for Wodgina Mine between the Kariyarra People and Gwalia Tantalum Pty Ltd dated 8 March 2001) We did not identify a royalty fee for the Wallareenya pastoral lease.
Royalties payable under Global Advanced Metals (GAM) Agreement	Royalties owed by Wodgina Lithium Pty Ltd (WLPL) to GAM: M 45/381 (WLPL to pay 1.75% royalty to GAM). M 45/382 M 45/383 M 45/886 (WLPL to pay 1.75% royalty to GAMG). Clause 2 of the Lithium Royalty Deed dated 8 September 2016 between Global Advanced Metals Wodgina Pty Ltd (GAMW), GAMG and Global Advanced Metals (GAM) provides that the Royalty payable by the Grantor (GAMW) to the Grantee (GAMG) will be 1.75% on Gross Revenue (in relation to lithium extracted and recovered from processing the tailings extracted from the tailings dam situated on the dam or reservoir situated on the area the subject of the tenements) in respect of each Royalty Period (30/6, 30/9, 31/12, 31/3).

Source: Personal Communication – MRL, 2021

4 Accessibility, Climate, Local Resources, Infrastructure and Physiography

The Wodgina property lies approximately 110 km south-southeast of Port Hedland, Western Australia between the Turner and Yule Rivers. The area includes multiple prominent greenstone ridges up to 180 mamsl surrounded by granitic plains and lowlands. The center of the open cut mine at Mount Cassiterite is located at the latitude and longitude of -21° 11' 25"S, 118° 40' 25"E.

4.1 Topography, Elevation and Vegetation

The topography onsite varies between 150 mamsl and 330 mamsl (500 ft and 1,100 ft) and is described as rolling hills and valleys. The vegetation onsite is considered a combination of grassland with spare shrubs with predominant species being *Triodia basedowii* and *Triodia schinzii*. The general topography and site elevation is illustrated in Figure 4-1.

Source: Atlas Iron Ore, 2021

Figure 4-1: Oblique Aerial View of the Wodgina Camp Looking South to the Minesite

4.2 Means of Access

The property is accessible via National Highway 95 to the Wodgina camp road. All roads to site are sealed bitumen. The nearest large regional airport is in Port Hedland which also hosts an international deep-water port facility. A site dedicated all-weather airstrip is located onsite capable of landing A320 jet aircrafts. Regional infrastructure is shown in the map presented as Figure 4-2.

Source: Modified after MRL, 2018

Figure 4-2: Regional Road and Rail Infrastructure

4.3 Climate and Length of Operating Season

The climate of the Wodgina property is categorized as a hot desert climate characterized by hot summers (average 40º to 45º Celsius (ºC) and mild winters (average 20ºC). The majority of precipitation occurs during the summer months, with annual averages around 300 millimeters (mm) per year (DPIRG, 2021).

Due to the hot to mild climate of the area, the Wodgina property maintains a year-round operating season.

4.4 Infrastructure Availability and Sources

The Wodgina property has year-round availability of infrastructure; a water bore field, a natural gas pipeline, an accommodation camp, sealed road access, and a dedicated airstrip able to service A320 jets.

The property is in operation as of May 2022, with on-going ramp up of mining and processing activities. Equipment, infrastructure, and assets at the Wodgina property including the following:

- Three stage crushing plant capable of sustaining 5.65 million tonnes per annum (Mt/y) of ore feed to the Spodumene concentration plant

- Administrative and office buildings
- 750-room accommodation camp on the property
- 81 km long, 10-inch gas pipeline to site
- 32 each 2-megawatt (MW) gas gensets for a total power station size of 64 MW
- Three mature and reliable water bore fields with minimal contaminant removal required
- All weather airstrip capable of landing A320 jet aircraft
- Extension of TSF3 for future tailing storage

4.4.1 Water

Water is obtained from three dedicated water bore fields located on the property.

A series of monitoring bores are installed around the toe of the Eastern Waste Landform (EWL). These monitoring bores require monthly reporting on water levels and quarterly reporting on ambient groundwater quality and will continue to be monitored for any analytical signs that acid production is occurring within the waste landform.

Groundwater data for the EWL monitoring bores is only in its infancy for WLPL, monitoring was conducted from September 2017 through closure of the operation in November 2019. Data collected from these monitoring bores in the last year of the operation has been compared against Australian and New Zealand Environment and Conservation Council's (ANZECC) livestock drinking water guidelines. The only exceedance reported with respect to these guidelines was for total dissolved solids (TDS), which is consistent with the natural variation in the area.

4.4.2 Electricity

The Wodgina property has a dedicated 10-inch natural gas pipeline which runs from the Pilbara Energy pipeline to the property. The pipeline feeds the site power station which consists of 32 generator sets sized at 2 MW each with a total capacity of 64 MW. The natural gas pipeline was upgraded from 4-inch to 10-inch pipe in 2019.

4.4.3 Personnel

The Wodgina property maintains a 750-room accommodation camp located on-site. Personnel access the camp via sealed highway or the on-site airstrip servicing a fly-in fly-out (FIFO) workforce based in a larger population area such as Perth.

4.4.4 Supplies

The Wodgina property is supplied via road access on well-maintained roadways or via the on-site airstrip.

5 History

The Wodgina pegmatite deposits were discovered in 1902. Since then, the pegmatite-hosted deposits have been mined for tin, tantalum, beryl, and lithium. Tantalum production began in 1905, with most early production sourced from alluvial and eluvial deposits.

Tantalite was discovered on the property in 1901 by Francis and William Michell, who subsequently mined 70 t of ore between 1905 and 1909. In the early part of the twentieth century, tantalite was a rare commodity, and despite its remoteness, Wodgina supplied most of the world's tantalite. In the early years of mining, the ore was carted by camel to the coast for export. Tantalite Ltd was formed by Lady Deborah V. Hackett-Moulden and N.S. Young. Tantalite Ltd mined the site between 1925 to 1943, exporting tantalite ore concentrate mainly to the United States.

In 1943, the mine was taken over by the Australian Government as part of its wartime effort. Tantalite concentrate continued to be exported to the United States, and in addition, during this period beryl was exported. In 1927, geologist E.S Simpson had identified large masses of cesium bearing white beryl at the northern end of the pegmatite.

After World War II, Tantalite Ltd continued to operate the mine; however, by 1953, it had run out of funds, and the mine was sold to Northwest Tantalum Ltd. This company found the property to be uneconomic and relinquished the lease by 1957. Between 1957 and 1963, the mine was operated by prospector L.J. Wilson. In 1963, the mine was purchased by J.A. Johnson and Sons Pty Ltd, by Avela in 1967, and by Goldrim Mining in 1968. Goldrim formed a partnership with Goldfield Corp (New York) and Chemalloy Minerals Ltd (Toronto).

The investigations into the pegmatite by this last JV discovered the new species Wodginite. Mining occurred sporadically until Goldrim formed a new partnership with Pan West Tantalum Pty Ltd, who began open pit mining at the site in 1989. By 1994, most of the pegmatite had been removed and mining ceased from the Wodgina pit.

The Mount Cassiterite pit operations were established in 1989 and progressively expanded during the 1990s. A major expansion in 2002 increased the mine's capacity to 635 t of tantalum pentoxide (Ta_2O_5) per annum. The mining operation extracted tantalum bearing pegmatite ores from the Mount Cassiterite and Tinstone open pits. The ores were crushed, milled, and fed into the Wodgina plant's advanced gravity separation. A primary tantalum concentrate was produced at Wodgina, and then sent to the Greenbushes mining operation for secondary processing to produce on-specification, saleable tantalum products. The mine re-started operations in May 2022 after being on care and maintenance since 2019. The current owners of the Wodgina property are the JV MARBL.

5.1 Previous Operations

The ownership of the Wodgina property has changed multiple time since initial mineralization discovery in 1902. Details of past owners have been compiled from various sources but remain incomplete and vague in terms of the details around ownership (Table 5-1).

Table 5-1: Ownership History of the Wodgina Property

Years	Owners
1901 - 1909	Francis and William Michell
1925 - 1943	Tantalite Ltd.
1943 - 1945	Australian Commonwealth government
1945 - 1953	Tantalite Ltd.
1953 - 1957	Northwest Tantalum Ltd.
1957 - 1963	L. J. Wilson
1963 - 1967	J.A. Johnson and Sons Pty Ltd.
1967	Avela
1968 - 1989	Goldrim Mining/Goldfield Corp
1989 - 2001	Goldrim and Pan West Tantalum Pty Ltd. JV
2001 - 2005	Sons of Gwalia
2005 - 2009	Talison Minerals
2009 - 2016	Global Advanced Metals (previously known as Talison Tantalum)
2016 - 2019	Mineral Resource Ltd.
2019 - present	MARBL (JV between Mineral Resource Ltd. and Albemarle Corp.)

Source: SRK, 2020 compiled from multiple publications.

5.2 Exploration and Development of Previous Owners or Operators

There is no known documentation available related to historical exploration work on the property. There have been numerous governmental and academic studies on the occurrences of pegmatite, variable mineralogy, and mineralization in the Wodgina pegmatite district. Work has included regional scale mapping by the Geological Survey of Western Australia (GSWA, 2001), scientific publications from Geoscience Australia, and various technical studies by the multitude of operating companies.

Exploration and development history for the property includes a variety of owners with sporadic production of multiple products over the life of the Wodgina property. Due to the complex nature of production and limited historic data available, the following represents a high-level account of production history on the property:

- Pre-1945: Various Producers: The Wodgina main load produced 85 t of beryl
- Pre-1984: Various Producers: The Wodgina main load produced 269 t of tantalum and an inferred 44 t of niobium
- Global Advanced Metals (GAM)/Talison: Mining was focused on the Cassiterite pit area
  - Prior to 1988: The Cassiterite pit area produced an estimated 308 t of tantalum, 193 t of tin, and 39 t of niobium
  - 1988 to 1994: Wodgina main load pit ceased operation
  - Late 1990s into early 2000s: The Tinstone pit commenced production
  - 2001 to 2002: production of 442 t of Ta_2O_5 concentrate
  - 2008: Mine placed in care and maintenance
  - 2010 to 2011: Mining restarted
  - 2012: Mine placed in care and maintenance
- Mineral Resources Ltd. (MRL) operated the Cassiterite pit from April 2017 until November 2019
- MARBL was formed in late 2019, immediately placed on placed in care and maintenance then re-started production in mid-2022.

6 Geological Setting, Mineralization, and Deposit

6.1 Regional, Local and Property Geology

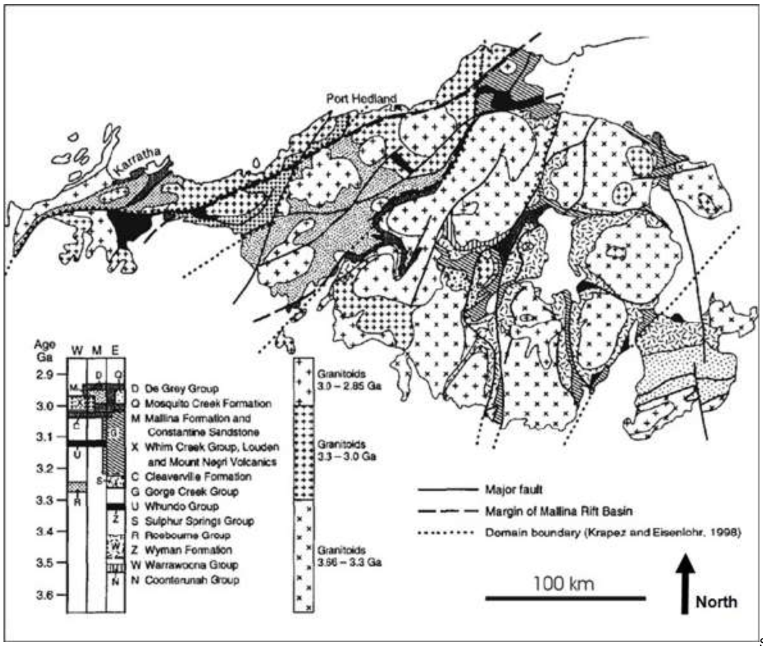
6.1.1 Regional Geology

The Wodgina pegmatite deposits (including the historical Wodgina main lode, Cassiterite, and Tinstone pits) are hosted within the Paleoarchean East Strelley Greenstone Belt in the Pilbara Craton of Western Australia, located approximately 100 km S-SE of Port Hedland (Cassiterite pit at 21° 11' 25"S, 118° 40' 25"E). The following summary of property regional geology is summarized below from Huston, et al., 2001, Sweetapple, 2000, Sweetapple & Collins, 2002, and Widenbar & Associates, 2018.

The Archean Pilbara Craton consists of large, domal, multiphase granitoid-gneiss complexes bordered by sinuous synformal to monoclinal greenstone belts. The greenstone belts range in age from approximately 3.56 to approximately 2.94 billion years (Ga), with the granitoids emplaced over a similar but slightly younger time span. Although, the supracrustal rocks are structurally complex, the primary stratigraphic units may be correlated between greenstone belts. The granitoid-greenstone terrane of the Pilbara Craton has been subdivided into tectonostratigraphic domains with boundaries defined by north northeast, south southwest (NNE-SSW) to northeast southwest (NE-SW) trending structural lineaments that regionally have a sinistral shear sense. The following lithotectonic units have been identified:

- East Pilbara granite-greenstone terrane
- Central Pilbara tectonic zone
- West Pilbara granite-greenstone terrane

At least seven episodes of granitic magmatism have been identified between 3.47 and 2.80 Ga. During this period, granitic magmatism became increasingly potassic and large ion lithophile element enriched, with increased compositional variability from tonalite-trondhjemite granodiorite to calc-alkaline and alkaline granite compositions due to cyclic crustal reworking and growth. Most of the granitoid-gneiss complexes have tectonic margins, with little evidence of contact metamorphism of adjacent supracrustal sequences. Granitic magmatism culminated with emplacement of a suite of 2.89 to 2.83 Ga granite plutons and a 2.76 Ga suite of small A-type granites and stocks of tourmaline rich S-type peraluminous granites. There is good spatial, geochemical, and geochronological evidence to link rare metal pegmatites in the Pilbara Craton with emplacement of the younger granite suite Sweetapple, et al., 2000. Figure 6-1 shows the regional geology map.



Source: Sweetapple, 2000

Figure 6-1: Regional Geology Map

6.1.2 Local Geology

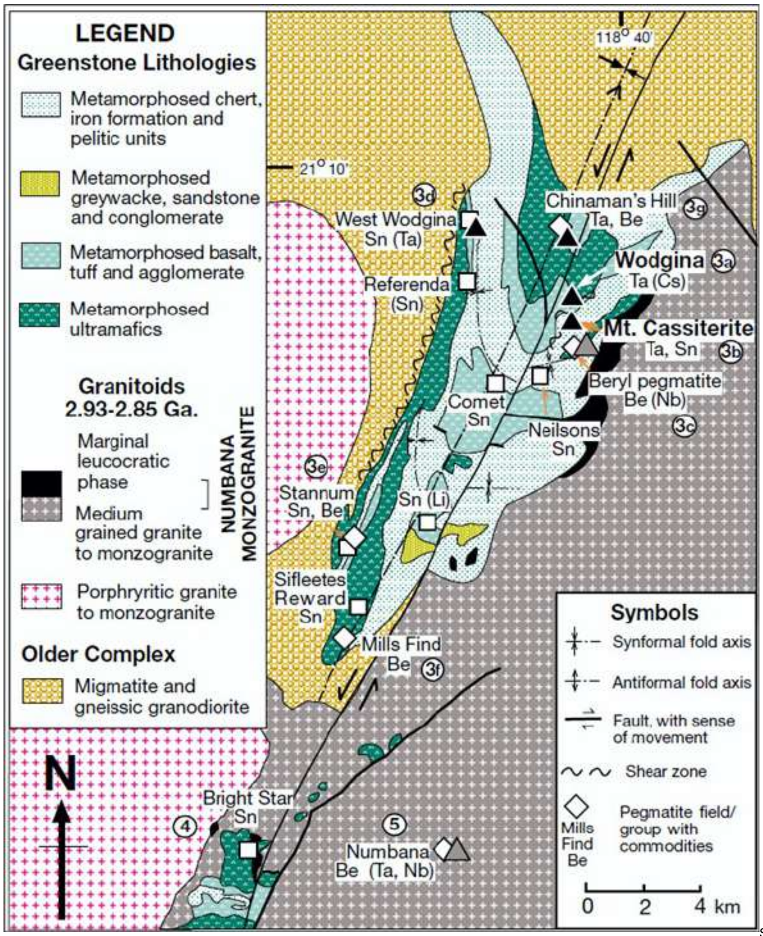
The property is located within the Wodgina Pegmatite District. This pegmatite district is entirely hosted in the eastern limb of the Wodgina greenstone belt along the southern portion of the Wodgina-Strelly lineament. This greenstone belt is a north-northeast plunging synform separating the Yule and Carlindi granitoid complexes within Central zone of the Pilbara Craton (Figure 6-2).

The Wodgina greenstone belt consists of mafic-ultramafic volcanics, sedimentary, and intrusive rocks, including ultramafic komatiites, mafic basalt, clastic sedimentary rocks, banded iron formation (BIF), and cherts. All rocks within the belt have undergone greenschist to lower amphibolite facies metamorphism at relatively low pressures (Sweetapple and Collins, 2002). A younger leucocratic granitoid of the Numbana Monzogranite is present on the eastern margins of the Wodgina greenstone belt.

Structurally, the Wodgina greenstone belt forms the core of a north-plunging synform. The Wodgina property is located near the axis of the synform and near a left-lateral (sinistral) shear zone adjacent to the marginal leucocratic phase of the Numbana Monzogranite. It is composed principally of interlayered mafic and ultramafic schists and amphibolite, with subordinate komatiite, clastic sediments, BIF, and chert. The komatiitic and metasedimentary units within the Wodgina area are tentatively correlated to the Kunagunarrina and Leilira Formations respectively.

Archean volcanic activity and sedimentation was followed by the intrusion of Archean granitic batholiths with consequent deformation and metamorphism of the sequence. Late-stage granitic intrusions resulted in the emplacement of simple and complex pegmatite sills and barren quartz veins.

A major regional shear zone separates the two main pegmatite groups of Wodgina main lode and Cassiterite. Both pegmatite groups have been emplaced syntectonically into fault/shear zones, with a predominantly reverse sense of movement. This emplacement has been related to a semi-concordant control of pegmatite distribution in both areas by F2 fold hinges and limbs. The Wodgina main lode pegmatite appears to be related to a major inclined fold hinge, while the pegmatites of the Cassiterite group appear to be sheets joined by a number of parasitic fold hinges. The pegmatites identified under the North Hill area are not yet characterized but may represent a transition between the two types observed on the property.



Source: Sweetapple and Collins, 2002

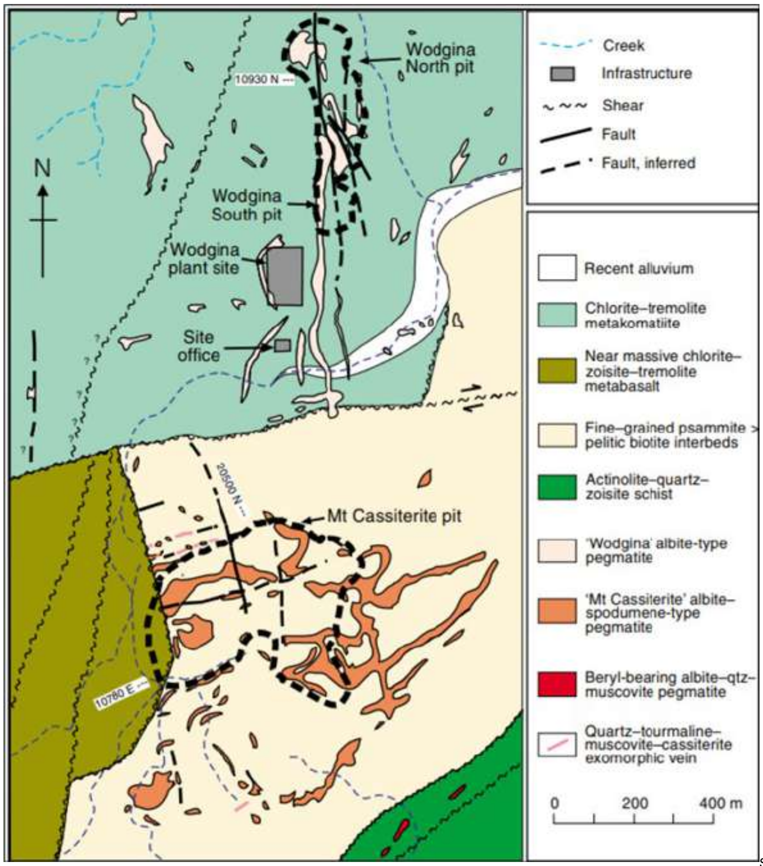
Figure 6-2: Local Geology Map of the Wodgina Pegmatite District

6.1.3 Property Geology

The property geology has been broken into two primary areas:

- The Cassiterite area containing the mineral resources of the Cassiterite pit and the North Hill area. The current focus of mining activities.
- The historical production area of the Wodgina main lode pit located in the northern portion of the property.

There are distinct differences in whole rock geochemistry between the two different pegmatite suites (Sweetapple and Collins, 1998) (Figure 6-3). The Wodgina pegmatite has a higher niobium to tantalum ratio than Cassiterite, which has a higher tin to tantalum ratio. These differences are reflected in the two different tantalum mineral suites in each pegmatite group. Significant differences were also noted in the gallium and beryllium contents, which were enriched and depleted respectively, in the Wodgina main lode pegmatite relative to the Cassiterite pegmatite group. The mineral assemblages in both pegmatite groups have undergone a significant degree of subsolidus recrystallization (Sweetapple and Collins, 1998).



Source: Sweetapple, 2001

Figure 6-3: Wodgina Property Geology Map

Cassiterite Pegmatite Group

The Cassiterite pegmatites lie directly to the south of the Wodgina pegmatite group and cover an area of approximately 1.1 km x 0.8 km (Figure 6-3). They comprise a series of interlinked pegmatite sheets, dikes, and irregular offshoot structures, and in contrast to the Wodgina pegmatite group, have been emplaced within a thick formation of metasedimentary rocks, mostly composed of fine-grained psammite and thinly interbedded pelite with minor quartzite and chert (Sweetapple et al., 2001). Immediately north of the Cassiterite pit, pegmatites have been intercepted from drilling hosted in amphibolite schist and generally display thicker individual pegmatite dikes with different chemistries than those observed and previously mined in the metasediments-hosted pegmatite sheets of the Cassiterite pit.

Within the Cassiterite pit, multiple sets of stacked pegmatite sheets occur, mostly 5 to 12 m thick, but ranging from 2 to 100 m and generally dipping 20 to 25°SE with localized 'roll-overs' dipping at 15 to 20°W to SW. These sheets are interconnected by near-vertical dikes that trend NW-SE and NE-SW, by irregular keel-like structures, and by thin stringers of pegmatite, all of which were emplaced at the same time. These pegmatite sheets were apparently syntectonically emplaced into a series of thrust faults that postdate at least two earlier deformation events identified by prominent cleavages and folding in the host metasedimentary rocks (Sweetapple and Collins, 2002).

Cassiterite pegmatite appear to have a primary mineralogy and texture characteristic of albite-spodumene-type pegmatites, including an abundance of albite and primary spodumene with subordinate K feldspar and minor muscovite in near homogeneous sheeted bodies. The pegmatite sheets display a massive to comb-textured internal structure which Sweetapple and Collins (2002) regard as also being characteristic of albite-spodumene type pegmatites (Ginzburg and Lugovski, 1977; Cerny, 1992), with minor aplitic and K feldspar-rich layering.

These sheets are mostly not zoned, with a mineralogy dominated by megacrystic spodumene and perthitic microcline in a matrix of fine- to medium-grained quartz, albite, and muscovite. Spodumene crystals are mostly aligned nearly perpendicular to the pegmatite contacts, typically exhibiting distinctive 'pull apart' structures. A weak zonation is evident as the development of finer grained border units, and occasional areas rich in microcline crystals.

Secondary assemblages, predominantly composed of fine-grained albite, variably overprint the assemblage outlined above in most areas of the pegmatite sheets. This alteration developed an accompanying pseudo-gneissic textured banding and syn-tectonic deformational textures. Cataclastic and proto-mylonitic textures are evident in places in the pegmatites. However, the micaceous minerals of the banding do not display a true schistosity, suggesting final crystallization of the pegmatite took place under hydrostatic stress conditions, after the termination of deformation association with emplacement (Sweetapple, 2000).

North Hill Pegmatite Group

The North Hill pegmatite group lies directly to the north of the Cassiterite group under the area known locally as North Hill. Details on the mineralogy, chemistry, and association of these pegmatites is largely unknown but may represent a continuum of pegmatite emplacement between Cassiterite and the Wodgina pegmatite group to the north. This group has been identified through drilling in the North Hill area with various interpretations of the geometry and continuity over the years. Because no structural data has been collected in the area, the orientation and thicknesses are largely speculative.

The North Hill pegmatite group is hosted in a primary schist lithology, though logging varies greatly in the area. It is unknown whether the host lithology is complex, or the historical data are merely unreliable. This pegmatite group generally exhibits lower Li_2O grades than the Cassiterite group, along with displaying materially thicker drill intercepts than observed in the Cassiterite pit. Internal pegmatite banding and mineralogy is largely unknown as evaluation and exploration activities in this group have been conducted by reverse circulation (RC) drilling methods with analyses focused on chemistry and not mineralogy. Trace geochemistry of the North Hill pegmatite group varies from the Cassiterite deposit located immediately to the south. It is inferred by MARBL that the primary Li mineralogy is spodumene. Although the general geochemistry of the area can be characterized by the current RC dominant drilling, deficiencies in the mineralogical characterization, metallurgical testwork, and other factors relevant to economic evaluations remain risks to the understanding of the viability of the pegmatites to support mining and processing in the North Hill area.

Wodgina Pegmatite Group

The Wodgina pegmatite group includes the Wodgina main lode pegmatite, plus several smaller pegmatites that are mostly subparallel to the main structure (Figure 6-3). They are characterized by an abundance of cleavelandite and/or sugary albite and are almost entirely hosted by variably foliated metakomatite. The Wodgina pit has historically exploited the Wodgina main lode pegmatite and associated secondary pegmatites for tantalum. The current economic focus on the property is for Li resources, whereas the Wodgina pegmatite group hosted Li as minor lepidolite and associated Li-bearing micaceous minerals.

The Wodgina main lode pegmatite is a sheeted dike that trends north-south, dips at 20 to 50° east (E), and cuts across the foliation of the host rock, which strikes north-south to NE-SW, and dips to the west. This pegmatite has a total strike length of approximately 1 km and varies from 5 to 40 m in thickness. However, most mining has been confined to the northern 500 m, where the pegmatite segments are thickest. Small offshoots of the pegmatite are subparallel to the foliation of the metakomatite host rocks.

The pegmatite postdates most of the deformation of the Wodgina greenstone belt and was apparently partially controlled by pre-existing folding and faulting. It is cut by late steeply dipping normal faults, while the northern end was disaggregated by later dip-slip faulting and late strike-slip shearing (Sweetapple et al., 2001). The northern portion of the pegmatite body has also been observed to be intruded around the hinge zone of an asymmetric fold, and its associated long limb (Sweetapple, 2000). While the pegmatite has a general easterly dip, it varies from a dike in the south, to a large bulbous mass with a saddle shape that pinches out rapidly into thin angular sheets in the north.

Although pegmatite zonation typical of highly fractionated pegmatites is not well developed in the Wodgina main lode, the zonation that is developed, takes the form of two main compositional assemblages in primary layers that subparallel contacts, as: 1) layers of massive cleavelandite (a variety of albite) with rare quartz, spessartine, and muscovite on both the footwall and hanging wall of the dike, and 2) a broad central unit of banded aplitic to granitic-textured medium to coarse grained albite-quartz-muscovite ± megacrystic perthitic microcline.

These assemblages are less regularly distributed on the northern end of the dike. The central bulbous section of the main dike contained a large irregular segregation of massive quartz up to 50 m wide and 60 m long. Ellis (1950) noted that the cleavelandite units appear to locally intrude the aplitic/granitic textured unit.

The marginal cleavelandite assemblage zones in the hanging wall and footwall are partially overprinted by a secondary fine-grained sugar-textured albite ± muscovite assemblage, and by lepidolite ± albite alteration of the micaceous aplitic-granitic textured unit. An intense 5 to 30 centimeter (cm) thick concentration of exomorphic mica was developed on the contacts with the wall rocks (Sweetapple, 2000). Hall (1988) notes discrete units rich in beryl, spodumene, and fluorite associated with these secondary overprints.

This tantalum mineralization is almost always within the massive cleavelandite units, commonly occurring in the core of radial aggregates of cleavelandite, and frequently as coarse skeletal-textured manganotantalite crystals clustered at the base of the hanging wall massive cleavelandite unit, suggesting precipitation and gravitational settling from that massive unit (Sweetapple, 2000).

The Wodgina main lode pegmatite is characterized by high-grade tantalum mineralization, and the presence of secondary lepidolite, or lithian muscovite, is consistent with it being an extremely fractionated pegmatite (Sweetapple et al., 2001). The primary cleavelandite and secondary albite units constitute approximately 78 volume percent of the pegmatite. The bulk composition of the pegmatite is more sodic and less silicic than most other rare metal pegmatites, consistent with the albite type of Cerny (1993). Other albite-enriched pegmatites close to the Wodgina main lode pegmatite are also considered to be of the albite type, as they have similar internal structure and modal mineralogy. Sweetapple and Collins (2002) suggest the low contents of rare alkali elements and volatile elements such as boron (B), phosphorus (P), fluorine (F), and higher magnesium (Mg) and iron (Fe) values than other rare metal pegmatites are most likely to be the result of extensive ion exchange with the metakomatite wall rock. The same authors suggest this and provide field evidence for the separation of a residual sodic melt enriched in lithophile elements escaping from crystallizing semi-consolidated albite-spodumene pegmatite sheets at Mount Cassiterite (Cassiterite) and appear to represent a regional zonation relationship.

6.2 Mineral Deposit

The Cassiterite is the primary focus of this TRS and contains mineral resources. This pegmatite group is classified as a rare element albite-spodumene type pegmatite. Spodumene ($LiAlSi_2O_6$) is the primary lithium-bearing mineral. It is massive to weakly layered pegmatite with comb-textured megacrystic microcline and spodumene with aplitic layers often displaying pseudo gneissic banding. Unlike many other Pilbara Craton pegmatite bodies, the Wodgina and Cassiterite pegmatites tend not to display internal structure such as mineralogical layering or banding. Lithium minerals are predominantly spodumene and lepidolite with secondary tin (Sn) in microlite, and manganese (Mn) in tantalite and columbite calciotantite. Other significant minerals include spessartine (Mn aluminosilicate garnet), elbaite (Na-Li alumino-boro-silicate tourmaline), and native Bi.

Geochronological work at the Wodgina deposit using various dating techniques (Rb-Sr, K-Ar, and Pb/Pb SHRIMP) provide pegmatite emplacement dates around 2,800 mega annum (Ma). This timing and other relationships suggest the likely source for the Wodgina pegmatites to be the Numbana Monzogranite.

The pegmatites on the property have a semi concordant relationship to regional-scale parasitic folding (Sweetapple and Collins, 2002). Differences between the emplacement nature of the Wodgina and Cassiterite dikes appear to be controlled largely by the host rocks. The large discrete Wodgina main lode pegmatite is hosted in mafic-ultramafic sequence (metakomatite) compared to the smaller dike swarm at Cassiterite which is hosted within a metasedimentary (meta-arenite/psammite) sequence (Sweetapple, 2000). In addition to the main spodumene pegmatite dikes, smaller (less than 0.5 m thickness) veins and/or alternation of wall rock contain pegmatite-related mineralogy of quartz-tourmaline-mica-albite-cassiterite. These secondary features often occupy parallel fractures adjacent to the main dike swarms.

At this time, individual pegmatites vary in strike length from approximately 200 to 400 m. The thinner near surface pegmatites vary from 10 to 30 m in thickness but vary locally from less than 2 m up to 35 m thick. The massive basal pegmatite varies from 120 to 200 m thick. The pegmatites intrude the mafic volcanic and meta-sedimentary host rocks of the surrounding greenstone belt.

The lithium in the Cassiterite pegmatites occur as 10 to 30 cm long grey, white spodumene crystals within medium grained pegmatites comprising primarily of quartz, feldspar, spodumene, and muscovite (Figure 6-4 and Figure 6-5). Typically, the spodumene crystals are oriented orthogonal to the pegmatite contacts. Some zoning of the pegmatites parallel to the contacts is observed, with higher concentrations of spodumene occurring close to the upper contact. In the massive basal pegmatite, the spodumene is distributed within fine-grained quartz, feldspar, spodumene, and muscovite matrix.

Source: MRL, 2018

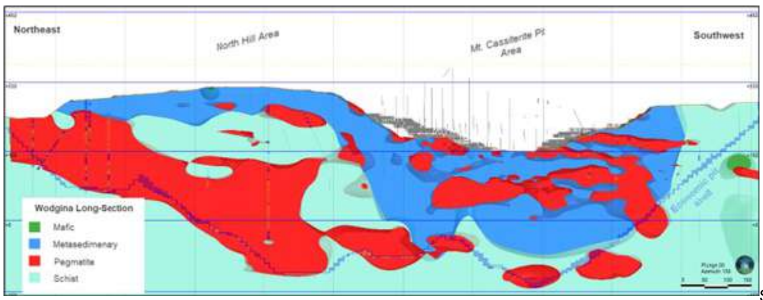
Figure 6-4: Wodgina Outcropping Pegmatite Example, Visible Spodumene Crystals

Source: MRL, 2018

Figure 6-5: Wodgina Pegmatite Grey White Spodumene Crystals (Specimen Around 30 cm Long)

6.3 Stratigraphic Column and Local Geology Cross-Section

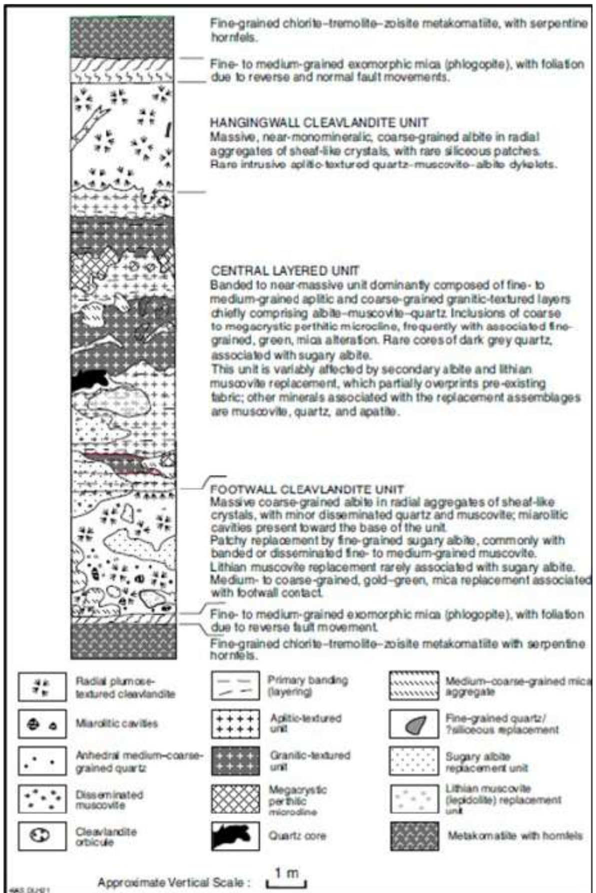
Figure 6-6 shows a generalized long-section of the North Hill - Cassiterite area containing the extents of mineral resources on the property. The long section shows the transition from amphibolite schist-hosted Li-pegmatites to metasedimentary-hosted Li-pegmatites in the Cassiterite pit area.



Source: SRK, 2020

Figure 6-6: Long-Section from Northeast to Southwest across the Main Portion of the Deposit

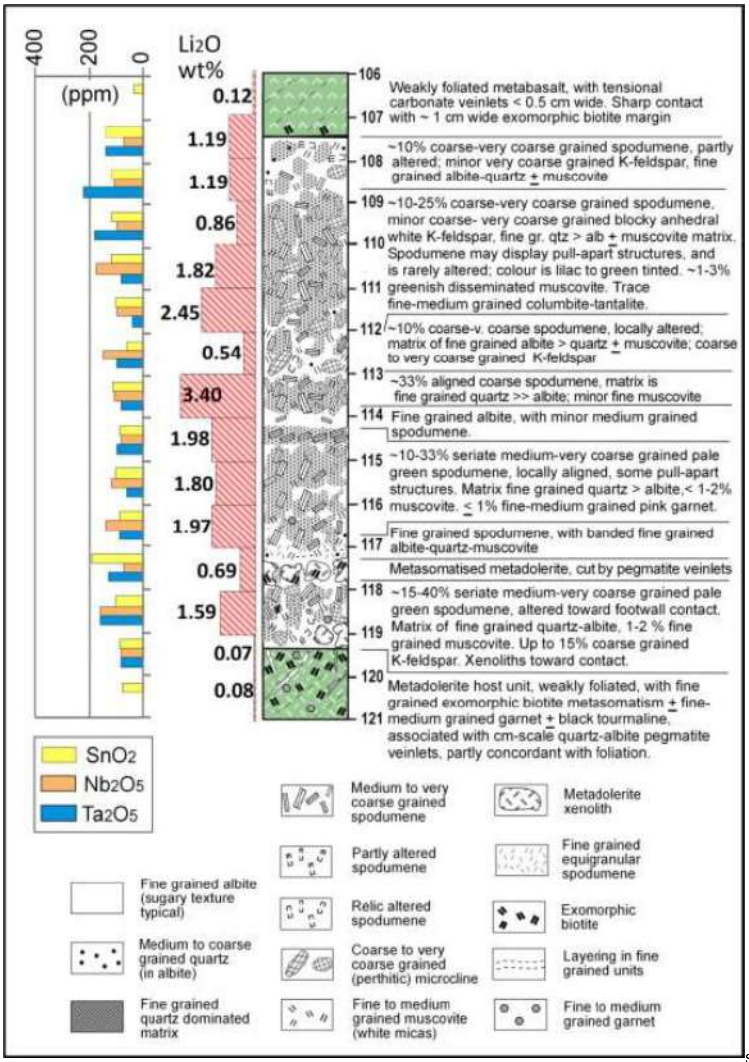
Figure 6-7 and Figure 6-8 illustrate a typical stratigraphic column through a Wodgina main lode and Cassiterite pegmatite dike respectively.



Representative stratigraphic column of rocks exposed in the Wodgina South pit, showing location of visible tantalum mineralization. The pattern of regular layering seen in the south pit progressivel decreases northwards within the Wodgina North pit

Source: Sweetapple, 2001

Figure 6-7: Generalized Stratigraphic Column from the Cassiterite Pit



Source: Sweetapple, et al., 2017

Figure 6-8: Generalized Stratigraphic Column Through Cassiterite Pegmatite Dike

7 Exploration

7.1 Exploration Work (Other Than Drilling)

All exploration work is currently performed via drilling. SRK is not aware of additional surveys (geochemical, geophysical, etc.) which have been performed over the Wodgina site by or on behalf of the registrant.

7.2 Exploration Drilling

Exploration drilling which is utilized in the geological interpretation and resources is summarized in the sub-sections below. There are numerous drillholes pre-1990 that are not utilized as part of any mineral resource determination and lack detailed descriptions or documentation. During SRK's review, these drillholes were excluded due to lack of confidence, therefore these historical holes have been excluded from this report.

7.2.1 Drilling Type and Extent

Drilling at the Wodgina property has historically been dominated by RC drilling methods. In addition to RC, both diamond drilling (DDH) and rotary air-blast (RAB) methods have been utilized in a limited capacity for specific purposes such as preliminary exploration, metallurgical, or geotechnical data collections. A summary of recently completed drilling campaigns on the Wodgina property is presented in Table 7-1.

Drilling in the Cassiterite area has been carried out by a number of drilling contractors and by a variety of different methods over the years. Drilling carried out by the Pan West JV included 3,825 m of air track: 1,145 m of RC drilling and 204 m of DDH.

Under GAM, who operated the property in the late 1990's, six development-drilling programs have been completed at the Cassiterite pit. The first, in 1996, involved a track mounted RC rig completing a 3,464 m drilling program, a resource extension program during 1998 to 99 comprised 17,586 m of RC drilling and 2,225 m of DDH, a further resource extension program in 2001 comprised 18,694 m of RC drilling, A RC infill-drilling program in the Tinstone area commenced in February 2002 and totaled 5,432 m, further resource drilling was conducted in 2002/03 consisting of 12,805 m of RC drilling. As a result of this program, an infill-drilling program was carried out which targeted the East Ridge mining area, totaling 2,948 m.

Additional resource drilling, completed in March 2004, consisted of 3,866 m of RC drilling and later infill drilling for a total of 12,930 m. The 2004 drill campaign was designed to extend the resource to the south of Tinstone, as well as determine the extent of the pegmatite sheets adjacent to the old Wodgina pit, north of the Cassiterite mining area. This drilling was conducted by a track-mounted RC drill rig and consisted of 3,866 m. The drilling to the south of Tinstone highlighted a significant extension of the Tinstone pegmatite sheets and was subsequently infill-drilled by two drill rigs (wheel and track-mounted) for a total of 12,930 m.

Concurrent with this drilling, an infill-drilling program was also being carried out in the Cassiterite area aimed at better defining the nature of the pegmatite sheets. This drilling consisted of 8,984 m.

In 2005, further RC drilling was undertaken to determine the limits of the South Tinstone pegmatite to the south, as well as systematically infill the main Cassiterite area to achieve at least a 25 m x 25 m pattern. Selected areas within the Cassiterite area were drilled to 25 m x 12.5 m to provide data for an assessment of the effects of closer spaced drilling. This drilling included 8,458 m of wheel-mounted RC drilling in Cassiterite and 2,220 m in South Tinstone. In addition to this, 1,017.5 m and 382.7 m of DDH was conducted in the Cassiterite and Tinstone areas respectively. The drilling allowed further detail to be placed on the pegmatite physical geology model. The resultant model was used as the basis of an optimization study to allow a revised pit design and schedule to be produced.

A two-staged RC drilling program was undertaken between July and October of 2006. The first stage was aimed at completing the 25 m x 25 m grid-based grade control drilling, targeting the deeper portions of the resources that lay within the pit designs associated with the 2006 optimization study. The second stage involved scout resource evaluation of the known extensions to resources outside and down dip of the resources inside the pit design. A total of 7,898 m was drilled from 86 holes. The drilling allowed for the updating and refinement of the 2006 physical geology model of the deposit, as well as further spatial grade definition within the pegmatite sequence. The refinement was the basis of the 2007 MRE. The second stage exploratory RC drilling program consisted of 1,138 m drilled from five holes.

A small metallurgical and geotechnical focused DDH program was completed in 2006 in the Cassiterite and Mount Tinstone (Tinstone) pits and totaled 1,518.7 m of HQ3 core.

In 2008, an infill RC drilling program was carried out in the Tinstone and Cassiterite pits (Figure 7-1). The total program involved 1,914 m of drilling for 47 holes and was planned to target gaps in geological understanding at relatively shallow depths (less than 80 m) relevant to the pit floor level development at the time. The program was based within the resource models of the Tinstone and Cassiterite areas.

Source: GAM, 2010

Figure 7-1: Magnet Drilling Hydro 150 Drilling RC in the Cassiterite Pit (During 2008)

August and September of 2010 saw the completion of a further RC infill drilling program, with the intent of improving the understanding of the spatial dispersion and grades of the pegmatites in the resource model between the mine grid sections 20400N to 20800N of the Cassiterite pit. The general strategy of the program was to provide an improved reconciliation of tonnes and grade for future mining in this area. In all, 27 RC holes were drilled for a total of 2,024 m.

After the property was acquired by MARBL, a RC drilling program of 245 holes was conducted between September 2016 and July 2017 for a total of 61,825 m. MRL directed RC drilling was carried out using a face sampling hammer and a 142 mm diameter bit. Blasthole drilling was carried out with Atlas Copco BH rigs using a 140 mm diameter bit. No additional resource drilling has been completed on the property since 2018.

During 2018, MRL conducted a shallow drill program to assess potential resources in the tailings storage facilities (TSF). The TSF's have been drilled on a nominal 50 m x 50 m pattern with an Open Hole Percussion Atlas Copco D65 drill rig (Figure 7-2). Hole diameter is nominally 165 mm. While this program has previously been utilized in disclosing mineral resources in the TSF (MRL, 2019), SRK notes that the lack of metallurgical testwork provided precludes definition of this material as a Mineral Resource herein.

Source: Widenbar and Associates, 2018

Figure 7-2: Atlas Copco D65 Drill Rig

Table 7-1: Recent Drilling Campaigns on the Wodgina Property

Year	Type	Length (m)	Areas
1996	RC	3,464	Cassiterite
1998	RC	17,586	Cassiterite
1998	DDH	2,225	Cassiterite
2002	RC	5,432	Tinstone
2002	RC	12,805	Tinstone and Cassiterite
2002	RC	2,948	Cassiterite
2004	RC	3,866	Cassiterite
2006	RC	7,898	Cassiterite
2008	RC	1,914	Tinstone and Cassiterite
2010	RC	2,024	Cassiterite
2016	RC	61,825	Cassiterite
2018	RC	6,197	TSF

Source: SRK, 2023 (modified after Widenbar, 2018)

Collar and Downhole Survey

Historic collar locations were surveyed by a differential global positioning system (dGPS) which achieves an accuracy of ± 0.01 m. All downhole survey data was converted to Wodgina Mine Grid and corrected for magnetic declination. The grid system is MGA Zone 51 (GDA94) for horizontal data and AHD (based on AusGeoid09) for vertical data.

For pre-2008 RC drilling programs, downhole surveying was conducted using a single shot Eastman downhole camera, equipped with a high-dip compass for all vertical holes. For diamond holes, survey shots were taken every 20 m and at the end of hole. The RC holes had camera shots taken at either 40 m or 50 m intervals, as well as at the end of hole. All camera shots were taken inside the 6 m stainless steel starter rod.

For the 2010 and 2012 RC drilling, all except for a few collapsed holes were gyro surveyed to compare the data. Gyro-derived data was recorded at the surface and 5 m intervals downhole to the end of the hole. Ultimately, the gyro-surveyed data was accepted as the most-accurate of the downhole surveys and was adopted into the database to project the drillhole strings.

During the 2017 and 2018 drilling program, all except for a few collapsed holes were surveyed using a north-seeking gyro survey tool. Gyro-derived data was recorded at the surface and random intervals downhole to the end of the hole. Reflex North seeking (NS) gyros were used to survey both vertical and inclined drillholes. Ultimately, the NS gyro-surveyed data was accepted as the most-accurate of the downhole surveys and this data was adopted into the database. Drillhole collars were surveyed by MRL Wodgina mine surveyor on a campaign basis using RTK dGPS.

7.2.2 Drilling, Sampling, or Recovery Factors

Pre-2016, Li_2O data on the Wodgina property was obtained from re-analysis of historical samples and rejects stored onsite. Drilling, sampling, and analyses were originally focused on tantalum resources prior to 2016.

Prior to 2008, RC chip samples were collected at 1 m intervals and split with a riffle splitter. RC samples were split with a cone splitter after 2008, to produce a sub-sample of 3 to 5 kilograms (kg) for analysis. Sieved chips from the RC drilling were logged geologically at 1 m intervals, with information recorded including lithology, color, mineralogy, grain size, texture, alteration, structure, weathering, and hardness. Sample condition and recovery also were noted for each meter. Chips were collected in pre-numbered chip trays and after logging, stored in an exploration sea container at the Wodgina mine site.

Similar to RC chips, diamond core was logged geologically at 1 m intervals except at lithological boundaries. Lithology, color, mineralogy, grain size, texture, alteration, structure, weathering, and hardness were noted, furthermore diamond core was orientated and logged for geotechnical qualities, core recovery, rock quality designation (RQD), fractures count per m, and structures were recorded. Sampled core was photographed (dry and wet) and weighted for density calculation.

Samples have also been collected from the MRL drilling campaign conducted between July 2016 and August 2018. An RC rig-mounted cone splitter was used, with samples falling through an inverted cone splitter, splitting the sample into a 90/10 ratio. A 10% off-split is retained in a calico bag. The 90% split residue is stored on the ground. All pegmatite intercepts were sampled at 1 m intervals plus 2 m of adjacent waste was sent for laboratory analysis (discussed in Section 8 of this report).

Historical sample recoveries are near 100% in the pegmatite, sample loss occurs in shear zones and occasionally on contacts. Most loss is recorded at the start of holes, near collars. MRL noted recoveries consistently at 80%. There is a low probability of preferential loss of sample having an effect on the grade of pegmatites. RC recoveries are recorded as a percentage based on visual and weight estimates of the sample.

When moist or wet ground conditions were experienced in historical drilling, the cyclone was washed out between each sample and run further to ensure no inter-sample contamination. The drill rig had a dust collection system that involved the injection of water into the sample pipe before the sample reached the cyclone. This water injection prevented fines from being lost out of the top of the cyclone. This system was employed to minimize dust fines being released into the atmosphere in the work area and to minimize the possibility of the sample being biased by the loss of the lighter minerals such as quartz, feldspar, and mica, thus potentially concentrating the heavier minerals such as tantalite.

RC chips were dried at 100°C. All samples below approximately 4 kg were pulverized in LM5's to nominally 85% passing a 75-micron (μm) screen. The few samples generated above 4 kg were crushed to less than 6 mm and riffle split first prior to pulverization.

Drill core samples are also collected sequentially in pre-numbered sample bags after cutting with a diamond saw. The integrity and continuity of the core string is maintained by reassembling the core in the tray. If any apparent geological discontinuities are noted within or at the end of core runs these are resolved by the logging geologist.

All HQ3 core pegmatite intercepts were quartered lengthwise using a diamond core-saw, with one quarter of the core for the pegmatite intercepts sent for X-ray fusion (XRF) analysis. Selected intervals of most of the pegmatite intercepts (in the HQ3 core) were then sampled as half-core for metallurgical analysis.

All NQ2 core was geologically logged and split lengthwise into half core using a diamond core-saw, with half core samples sent for XRF analysis.

All diamond drill core assay samples were taken at regular 1 m intervals or at smaller intervals to conform to logged pegmatite contacts.

Commercially prepared certified reference materials (CRM) were inserted amongst the drill samples.

MRL 2018 Drill report:

A nominal 2 to 3 kg RC sample was collected for each meter. Samples were collected using a static cone splitter mounted below the cyclone; the material falling through the cone splitter was split in 90/10 ratio. A 10% off-split was retained in a pre-numbered calico bag with the remaining residue collected in buckets and dumped on the ground in sequence adjacent to the hole for logging.

All pegmatite intercepts were sampled at 1 m intervals along with 2 m into the footwall and hangingwall of adjacent waste and delivered to the Nagrom Laboratory of 49 Owen Road, Kelmscott, WA (Nagrom) for analysis. Samples outside the pegmatite except adjacent waste were not assayed.

After geological logging of NQ core, a sample spreadsheet was created with the sample intervals at 1 m in pegmatite zones adjusted by lithological contacts on footwall and hanging wall plus approximately 2 m of waste on each side were sampled. The core was cut in half, put in pre-numbered calico bags, and delivered to the Nagrom for analysis. Samples outside the pegmatite except adjacent waste were not assayed.

Widenbar 2017

In March-April 2016, a program was instituted to retrieve as many RC pulp samples as possible from storage on the Wodgina property and re-assay the pegmatite zones for Li_2O. Li_2O has been assayed by ICP at Nagrom.

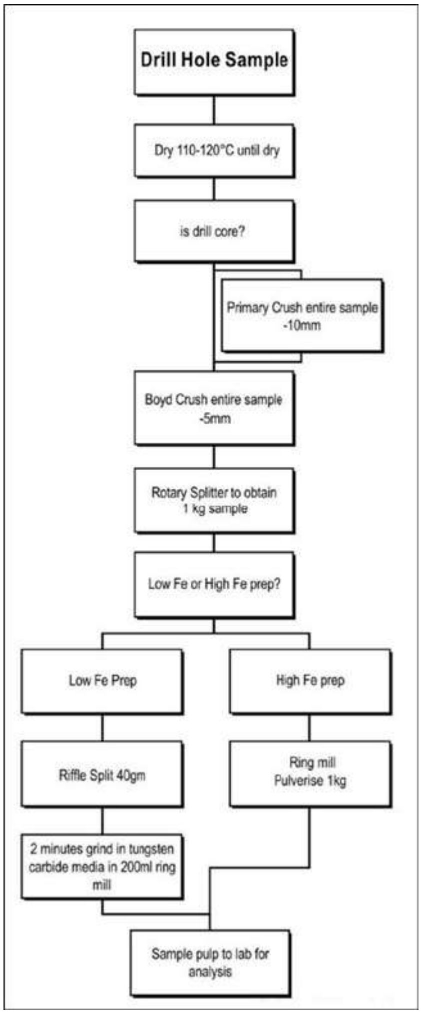
GAM 2013

Sample preparation is routinely undertaken at the internal Wodgina site laboratory.

Received samples less than 2 kg are rejected and extra sample material (if available) is routinely requested. Samples are oven dried, weighed, crushed to -5 mm, with a rotary split 1 kg then pulverized to minus 100 micron and a final 100 g split passed to assay preparation (Figure 7-3).

A 3 g sample measured by electronic scale is submitted using LODIL protocol with high grade samples (0.75 g) rerun using PEAKA protocol.

As far as can be determined since 2006, all samples have been assayed by XRF for a consistent 36 elements at either the Wodgina or Greenbushes laboratory. During this time period, Li_2O was not analyzed. No documentation is available for accreditation of either the Wodgina or Greenbushes site laboratories during 2013.



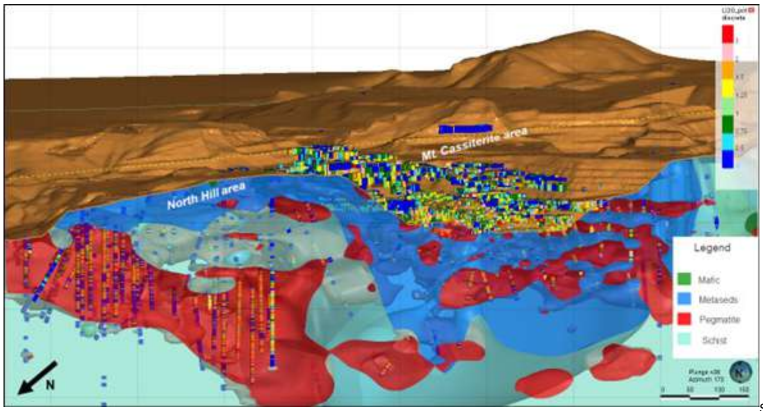
Source: Dolbear, 2012

Figure 7-3: GAM Sample Preparation Flow Sheet

7.2.3 Drilling Results and Interpretation

Drill results are presented in this TRS as summary data used in support of the declared mineral resources. As the property contains mineral resources at IA study level, individual drillhole results are not considered material in nature and thus not presented in this section.

An interpretation via cross section is shown in Figure 7-4. This southeast-looking section shows drilling, topography, and major lithology types.



Source: SRK, 2021

Figure 7-4: Southeast Looking Oblique Section showing Drilling Colored by Li_2O Grade and Geological Model on the Wodgina Property.

7.3 Hydrogeology

SRK has summarized the current perspective on hydrogeology from MRL-provided reports on the Wodgina property.

The Wodgina area is a fractured rock environment, with groundwater resources being associated with bedrock aquifers including major fault systems, fractured rocks, and well-developed weathering profiles (Burton, 2018).

Zones of brittle deformation develop enhanced porosity and permeability, and can receive, store, and transmit water. Areas of relatively unfractured bedrock dominate the sub-surface and form boundaries to the water resources stored in fractured zones.

Minor aquifers also occur in localized alluvium and colluvium in drainage lines and, in some areas, may support groundwater dependent vegetation (e.g., along the Turner River). These aquifers are thin, readily drained, and have limited storage capacity. They host the water table near the drainage lines and drain vertically into underlying fractured rock aquifers.

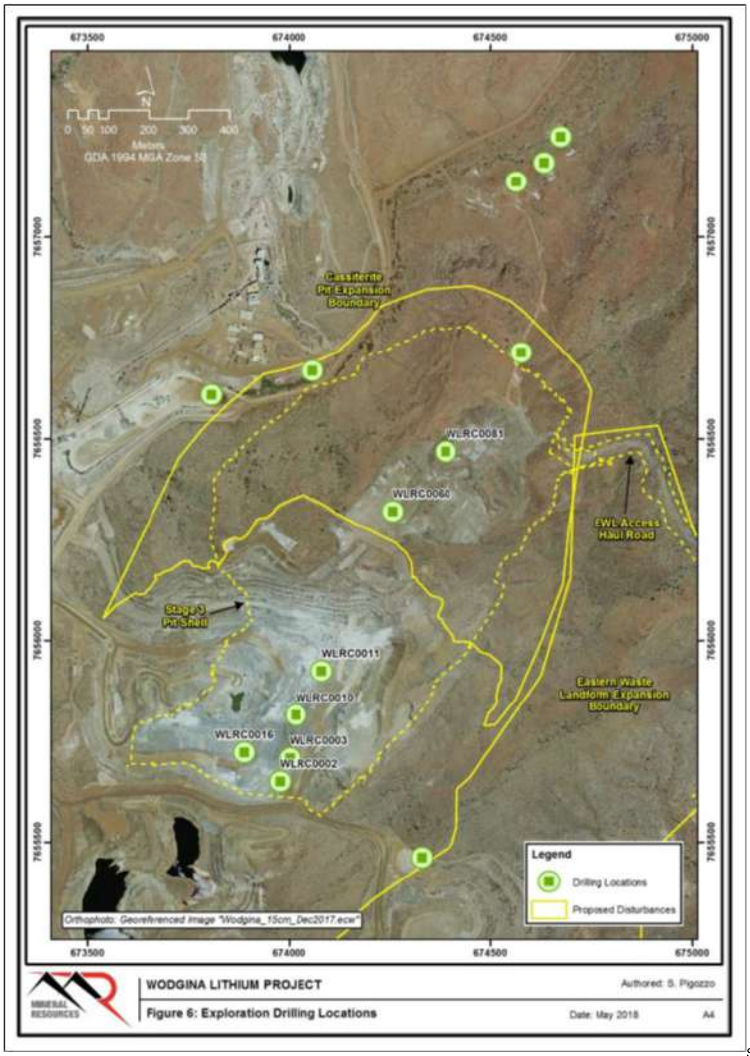
The retention of runoff water in the alluvial aquifers from intense rainfall events forms an important recharge mechanism for the fractured rock aquifers as the hydroperiod (i.e., the period of saturation) for the streams and alluvial aquifers is likely to directly affect the quantity of recharge available to the fractured rock aquifer (Burton, 2018).

Borefields used for water supply at Wodgina target fractured quartz veins (Old and North borefields) and contact zones between ultramafics, quartzites, and conglomerate (Breccia borefield) (Burton, 2018). All three borefields develop fractured rock aquifers and the most reliably and higher yielding bores are associated with deeper fractured zone intersections (Burton, 2018).

Various hydrogeological studies and groundwater monitoring have been undertaken in the Wodgina area over the past two decades. Hydrogeological studies to date have focused on the identification and management of either: (a) groundwater resources to support mining operations; or (b) groundwater levels to inform decisions on potential dewatering of iron ore deposits.

Groundwater monitoring has been undertaken in accordance with Western Australian Department of Water and Environmental Regulation (DWER) license conditions e.g., TSFs (most recently TSF3), the eastern waste landform (EWL), borefields (Old, North and Breccia), and the wastewater treatment plant.

Depth to groundwater varies considerably across the Wodgina area as a result of major faulting and fractured rock aquifers being interspersed with impermeable bedrock. This is evidenced by recent exploration drilling undertaken by MARBL within and adjacent to the Cassiterite pit. The locations of holes where water was recorded during recent drilling activities are shown in Figure 7-5.



Source: MRL, 2018

Figure 7-5: Drillhole Locations of Noted Groundwater

Five of these holes (WLRC0002, WLRC0003, WLRC00010, WLRC00011, WLRC00016) shown in Figure 7-5, are located within the active mining area, and the recorded depth to water varies from 3 to 142 m below ground level (mBGL). This places the water table elevation between 197 m AHD and 93.5 m AHD.

Two of these holes (WRLC0081, WRLC0060) are located to the northeast of the active mining area, and the recorded depths of water in these holes are 70 mBGL and 254 mBGL, respectively. These holes are 200 m apart with water table elevations varying between 200 m AHD and 35 m AHD.

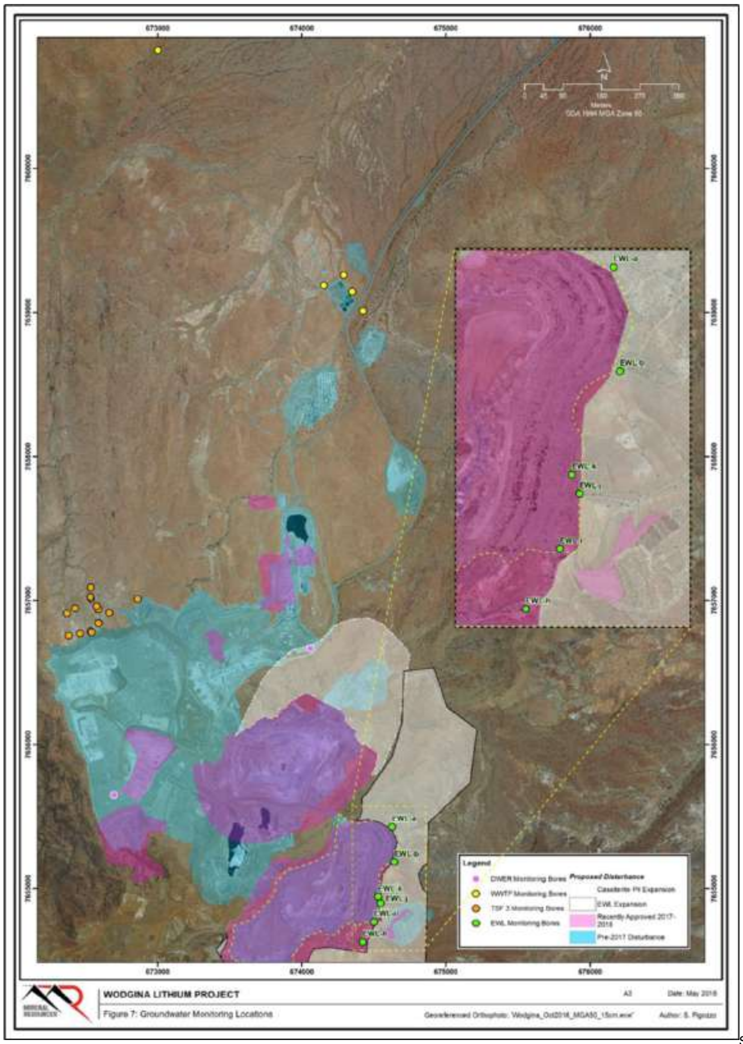
The current pit floor elevation of the Cassiterite pit is 140 m AHD. The pit floor is dry except for a small area of water accumulation at the eastern end of the pit floor. Where groundwater has been found in the pit, the relatively minor quantities of water are easily removed by the installation of a sump and pumping of water ex-pit. Currently, this water is stored in the Tinstone pit where it is evaporated.

To the southwest of the Cassiterite pit, Tinstone and South Tinstone pits contain pit lakes that are understood to be associated with interflow rather than groundwater inflow (AECOM, 2011). The bases of these two pits are both approximately 210 m AHD.

To the north of TSF3, data from monitoring bores indicates that the water table occurs at approximately 13 m below ground level. The corresponding water table elevation in this area is approximately 217 m AHD.

Groundwater monitoring is undertaken at Wodgina in association with the borefields, TSFs, EWL, and wastewater treatment plant (WWTP). A series of monitoring bores were previously installed around the toe of the Eastern Waste Landform. These monitoring bores, similarly, to the TSF bores, require monthly reporting on water levels and quarterly reporting on ambient groundwater quality, and will continue to be monitored for any analytical signs that acid production is occurring within the waste landform.

Groundwater data for the EWL monitoring bores is only in its infancy for WLPL, monitoring has only taken place since September 2017. Locations of groundwater monitoring bores are shown in Figure 7-6.



Source: MRL, 2018

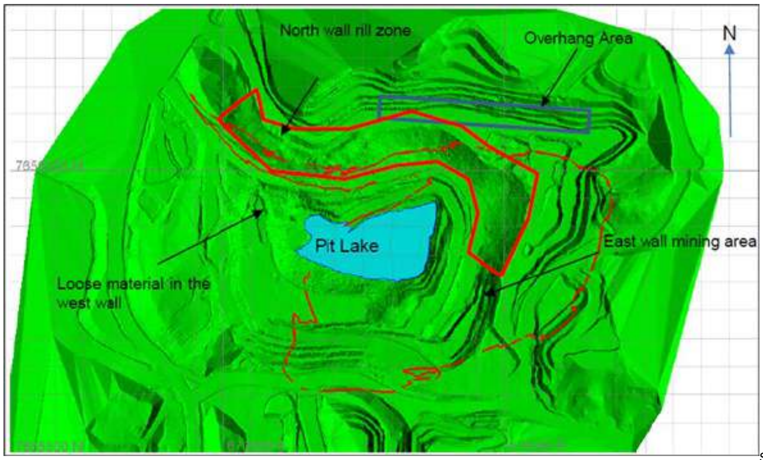
Figure 7-6: Groundwater Monitoring Locations

7.4 Geotechnical Data, Testing and Analysis

As the majority of drilling at Wodgina is conducted using RC methods, geotechnical data and analyses have been primarily conducted based on the existing open pit via pit mapping and observations by third party consultants. Two geotechnical drillholes have been completed: DGET-0604 and -0605 in the Cassiterite pit though their positions are considered sub-optimal for rock mass conditions and intersecting major structures. Numerous geotechnical mapping and structural data collection campaigns haven been completed in the 2000s. Data collected and utilized in pit design analyses include stereo plot and pit structural data.

Pells Sullivan Meynink (PSM), engineering consultants out of West Perth, WA have provided a recent geotechnical review which is summarized in this section. The PSM report summarized observations from pit inspections including key pit hazards as illustrated in Figure 7-7.

SRK notes all geotechnical data are based on pit mapping with no drilling, analytical or laboratory tests due to the general use of RC drilling methods on the property.

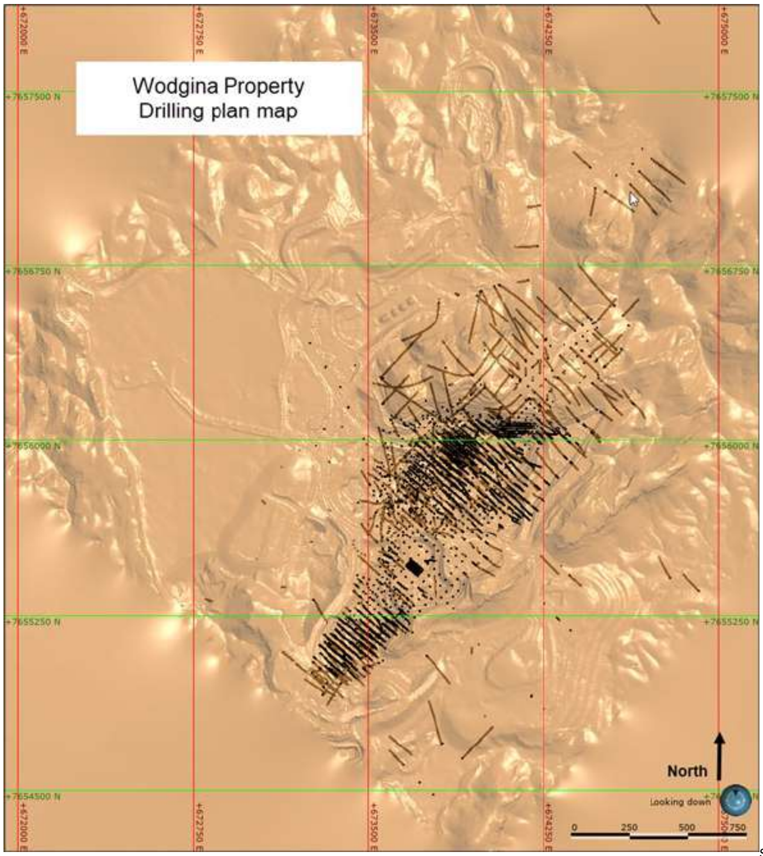


Source: PSM, 2017

Figure 7-7: Pit Geotechnical Hazards

7.5 Property Plan View

The plan view of the property is presented in Figure 7-8. This figure illustrates the Property topography and locations of drillholes.



Source: SRK, 2020

Figure 7-8: Plan Map of the Wodgina Property Showing All Drillhole Traces

7.6 Exploration Target

Exploration potential exists within the Wodgina property for additional pegmatites with the majority of these area having been drill-tested as previously described. SRK is not aware of additional exploration targets that are relevant to the Wodgina property.

8 Sample Preparation, Analysis and Security

8.1 Sample Preparation, Assaying and Analytical Procedures

Sample preparation is completed at the Wodgina site. RC drill chips were dried at 100°C. All samples below approximately 4 kg were pulverized in LM5's to nominally 85% passing a 75 µm screen. Samples generated above 4 kg were crushed to less than 6 mm and riffle split first prior to pulverization. Samples are then crushed and split through a riffle splitter for samples greater than 2.5 kg. In this case, samples are all approximately 200 g, so samples are simply sorted, dried, and pulverized to P80 at 75 µm.

Analytical testing is performed using a combination of inductively coupled plasma (ICP) and X-ray fluorescence (XRF) by Nagrom. Nagrom is an independent laboratory with no affiliation with the Wodgina property or MARBL and is ISO9001:2008 accredited. Table 8-1 below presents analyzed elements, units, and detection limits.

Table 8-1: Elements, Units and Detection Limits for Analyses Conducted by Nagrom Laboratory

Element	Method	Units	Detection Limit
Li_2O	ICP005	ppm	10
Al_2O_3	XRF007	%	0.001
CaO	XRF007	%	0.001
Cr_2O_3	XRF007	%	0.001
Fe	XRF007	%	0.001
K_2O	XRF007	%	0.001
MgO	XRF007	%	0.001
MnO	XRF007	%	0.001
Na_2O	XRF007	%	0.001
P	XRF007	%	0.001
S	XRF007	%	0.001
SiO_2	XRF007	%	0.001
TiO_2	XRF007	%	0.001
V_2O_5	XRF007	%	0.001
Ta_2O_5	XRF007	%	0.001
Nb_2O_5	XRF007	%	0.001
Sn	XRF007	%	0.001
LOI1000	TGA002	%	0.01
Rb	ICP005	ppm	1
Cs	ICP005	ppm	1

Source: MRL, 2018

Lithium had not been analyzed for the Wodgina site prior to 2016, as the operation was previously focused on the production of tantalum. The majority of Li_2O data that is used in the mineral resource calculation has been obtained from the re-assay of historical pulps supplemented with RC and DDH drilling in 2018. SRK notes the potential for sample degradation of historical pulps. Despite this risk, any hydration or alteration of pulps is considered minimal due to the pulps being stored in watertight sea containers onsite. SRK has not inspected the sample storage or monitored the sample submission process.

The site is security-controlled by MRL with all samples stored on-site. Digital data are maintained by MRL.

8.2 Quality Control Procedures/Quality Assurance

Field duplicates from RC drilling were collected from the second sample port of the cone splitter, for diamond tails another half of the sampled core was used, at a rate of 1:20; (sample numbers ending in 00, 20, 40, 60, and 80 were assigned as duplicates) however, only field duplicates within the interval determined to be sampled at 1 m intervals (nominally the pegmatite intersection plus 2 m either side) were submitted for assaying. The majority of field duplicates, which were assayed, are from within the pegmatite intervals. Certified standard samples were inserted for RC/DDH by the supervising geologist at the rate of two standards per 100 samples (2%). SRK notes duplicates are inserted at a frequency consistent with industry standards while insertion of CRMs is considered well below acceptable QC standards along with no blanks used as part of the overall QA/QC program.

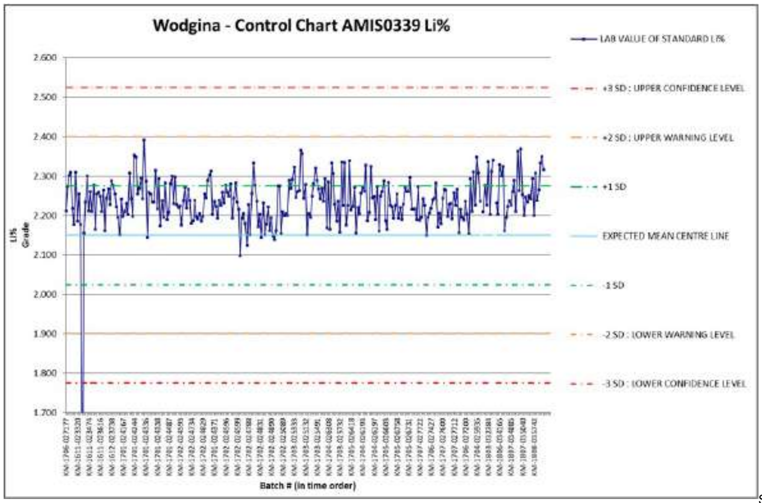
Widenbar (2018) described the QA/QC program as follows:

The original RC pulps were subject to stringent QA/QC and laboratory preparation procedures and are considered reliable for the purposes for which they are being used.

Two standards were initially submitted at the rate of approximately 1 in 11 samples, and internal laboratory repeats, and splits have been assayed at a rate of 1 in 10. Recent MRL QA/QC protocols used for the RC drill samples included the insertion of one of three types of CRMs at an incidence of 1 in 36, and the repeat analysis of field duplicate samples at an incidence of 1 in 20. Lab protocols included duplicate analysis at an incidence of 1 in 20 and pulp repeat analysis at an incidence of 1 in 20.

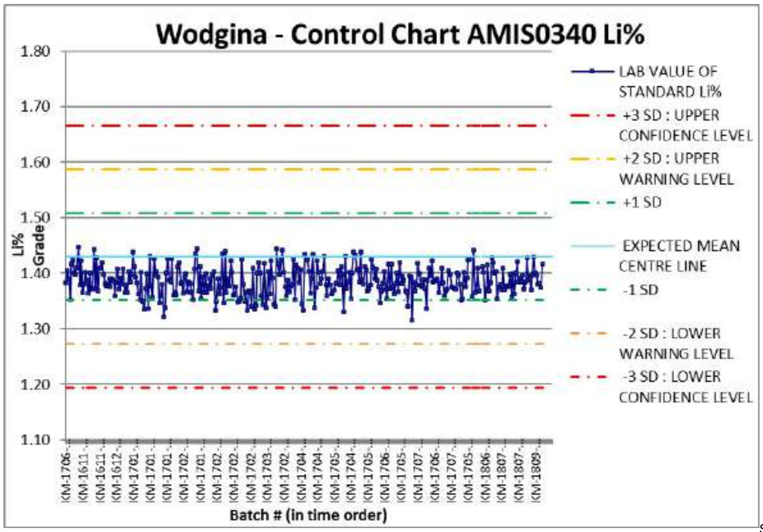
Five CRM standards were utilized as part of the QC program in 2018. Performance charts are provided for key elements. CRM performance varied summarized at:

- High grade AMISO339 showed a high bias for Li_2O (%) and minor increasing trend for Fe_2O_3 from analyses (Figure 8-1)
- Moderate grade AMISO340 showed a low bias for Li_2O (%) and high bias for Fe_2O_3 (%) from analyses (Figure 8-2)
- Lower grade AMISO343 showed a minor high bias for Li_2O (%) from analyses (Figure 8-3)



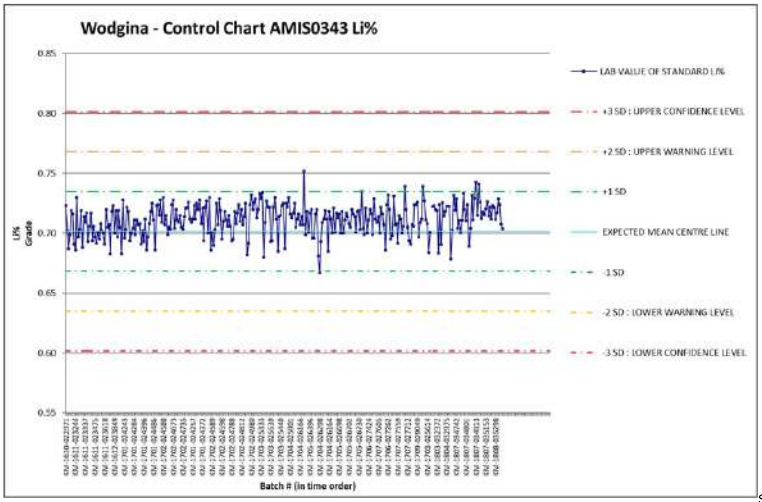
Source: MRL, 2021

Figure 8-1: CRM AMISO339 Control Performance Chart - Li_2O (%)



Source: MRL, 2021

Figure 8-2: CRM AMISO340 Control Performance Chart - Li2O (%)



Source: MRL, 2021

Figure 8-3: CRM AMISO343 Control Performance Chart - Li_2O (%)

Prior to MARBL taking ownership of the property in 2016, all analyses and QC were conducted using a combination of the Wodgina and Greenbushes laboratories with QC samples incorporating standards, repeats, duplicates, and split samples but no blanks. One in twenty samples are riffle split in the laboratory and a split created which is analyzed along with the original sample.

As an extension of the quality control procedures, when operational, the Wodgina laboratory periodically participate in round-robin exercises whereby samples are randomly selected and assayed by the Wodgina laboratory, Greenbushes laboratory, and one or two other commercial laboratories. The results from each laboratory are compiled and compared.

SRK notes that QA/QC documentation does not exist prior to 2013. Therefore, all analytical data obtained prior to 2013 is considered to have a lower confidence due to the inability to track, manage, and mitigate potential issues and errors associated with preparation and analysis. SRK has incorporated the lack of QA/QC in pre-2013 drilling data into consideration in the classification of mineral resources.

8.3 Opinion on Adequacy

It is the opinion of SRK that, based on documentation, the original sampling, preparation, and analyses were performed in a reasonable manner consistent with industry standards. The majority of historical drilling lack industry standard QA/QC. The analytical data that forms the basis of the mineral resource was primarily sourced from RC sample rejects collected during tin/tantalum exploration drilling across the property, further supported by focused lithium drilling in 2018. Based on a review of the data and historical documentation, it is the opinion of SRK that the fundamental data are adequate for the reporting of mineral resources with the various factors related to data confidence being considered during classification.

It is SRK's opinion that utilizing historical metallurgical recovery data (as discussed in Section 10) from production is adequate for the disclosure of mineral resources in the Cassiterite area. However, the lack of metallurgical testing, mineralogy, and analyses on the property increases the risk of predictive recovery which is key for mineral reserve estimation. Further work is required before confidence in this modifying factor is adequate for disclosure of mineral reserves.

8.4 Non-Conventional Industry Practice

The analytical data for the assessment of the Wodgina property's mineral resources does not include any non-conventional testing. All analyses were performed using industry standard procedures and testing by a combination of independent laboratory for Li_2O and both internal and external labs for historical data.

9 Data Verification

9.1 Data Verification Procedures

SRK performed a variety of data validation and verification procedures to assess the quality of underlying data associated with the Wodgina property. Procedures include:

- Check of database against assay certificates.
- Visual validation of logging and analytical data in relation to historical models.
- Statistical validation of analytical data.

9.2 Limitations

SRK reviewed 37,534 unique samples from laboratory assay certificates from MARBL during August 2020 for comparison to the drillhole database. The following items represent findings from the validation of all received assay certificates.

- There are 34,552 unique samples in the drillhole assay database compared to 37,534 in the laboratory certificates. The discrepancy is due to drilling data outside the Cassiterite block model area of interest.
- SRK was able to successfully match 28,640 assay certificates to the drillhole assay database.
- 5,912 samples in the drillhole assay database do not have certificates.
- Each sample in the assay database has 18 values (columns or elements) resulting in a total of 515,520 (18 x 28,640) possible value matches between the certificate files and the assay database. SRK was able to match 513,363 values between the certificate files representing an error rate of 0.4%.
- No collar or downhole survey verification was conducted.
- No independent duplicate analytical work was conducted.

SRK notes use of historical drilling data in the mineral resource calculation which contain a variety of uncertainties. These relate to a lack of QA/QC on historical analytical data, lack of collar and downhole survey on historical drilling, a variety of logging, and a historical lack of focus on Li_2O utilizing pulp re-assay for a portion of the database.

9.3 Opinion on Data Adequacy

It is SRK's opinion that the database is acceptable for use in determining mineral resources with the variety of identified potential concerns being accounted for in resource classification. Further recommendations on future drilling and analyses are presented in section 23 under Recommendations.

10 Mineral Processing and Metallurgical Testing

There are limited metallurgical analyses from drilling in the Cassiterite pit and there is no data in the North Hill area of the Wodgina property. SRK notes that MARBL operated the Cassiterite pit for lithium production from 2016 through 2019 thus demonstrating metallurgical recovery from mining areas. For the purposes of this report, a 65% metallurgical recovery has been applied based on historic processing averages from mining in the Cassiterite pit (pers. comm, MRL, 2020).

The lack of mineral processing and metallurgical testing in the North Hill area is accounted for in Mineral Resource classification. There is no metallurgical testing from samples obtained from the TSF, and SRK has not conducted a MRE for this disclosure. MRL has previously disclosed mineral resources for the TSF in their JORC code disclosure.

It is SRK's opinion that utilizing historic metallurgical recovery data from production is adequate for the disclosure of mineral resources in the Cassiterite area. However, the lack of metallurgical testing, mineralogy, and analyses on the property increases the risk of predictive recovery, which is key for Mineral Reserve estimation. It is the QP's opinion that further work is required before confidence in this modifying factor is adequate for disclosure of Mineral Reserves.

11 Mineral Resource Estimates

The basis for the mineral resource estimate is unchanged from the previous TRS. The mineral resource statement disclosed in this section has been updated from the prior year based on site topography as of 31 December 2022, with differences due to mining depletion only.

The following subsections summarize the key assumptions from the 2020 resource model which forms the basis of the mineral resource statement.

11.1 Geological Modeling

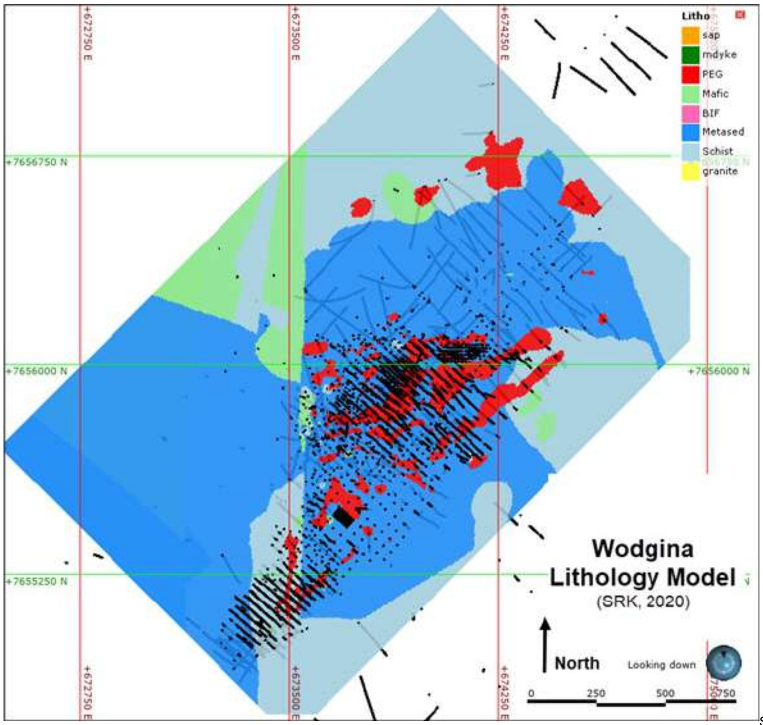
SRK constructed a geological model based on general lithology and structural data obtained from MARBL in September 2020, supplemented with publicly available reports and maps. The previous geological model was completed by Widenbar and Associates in October 2018 (Widenbar, 2018) and included 3D wireframe modeling of pegmatite based on drilling interpretation and historical sheet-like dike assumptions.

The 2020 SRK geological model incorporated regional and local lithology with historical structural mapping to provide an updated interpretation of the pegmatite geometry and include pegmatite dike host lithology which is believed to materially affect the mineralogy, chemistry, and rheology of the dikes. The MARBL-provided drilling database was reviewed with logging codes grouped into broad lithotypes for modeling purposes. The large variety of recent and historical drilling was grouped into the following lithology codes:

- Overburden and fill material
- TSF – tailings storage facility fills from historic processing
- Saprolite
- Mafic dikes
- Pegmatite dikes
- Metasedimentary units
- Schist
- Mafic volcanics
- Banded iron formation (BIF)
- Granitoid intrusives

SRK noted that historical drilling and logging showed inconsistency in both codes and interpretation requiring the broad grouping of lithotypes. SRK grouped logging codes based on documentation to provide a reasonable basis for 3D modeling, but it is possible that these groupings could be refined or reinterpreted with additional supporting data. It is SRK's opinion that additional work should be performed to improve the lithotype grouping and domaining that may require re-interpretation of historical logging.

Using Leapfrog Geo software, the grouped lithologies were modeled in 3D accounting for mapped regional faulting and folding. The interpretation is primarily based on regional and local geological mapping by the GSWA and internal documents of previous operators. Multiple fault-bound geological sub-models were generated incorporating the Tinstone pit, Cassiterite pit, and North Hill area due to the distinct individual nature of rock types and structural boundaries. A plan view of the lithostratigraphic model is shown in Figure 11-1.

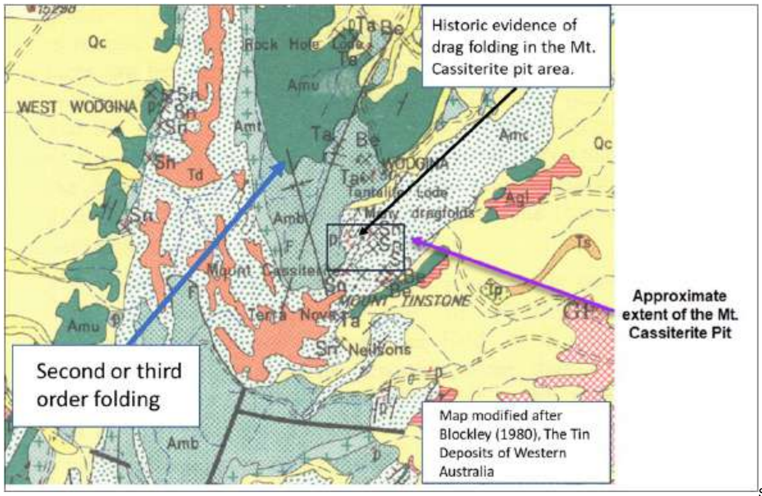


Source: SRK, 2020

Figure 11-1: Plan View Map of the Wodgina Lithology Model (Overburden and Fill Removed)

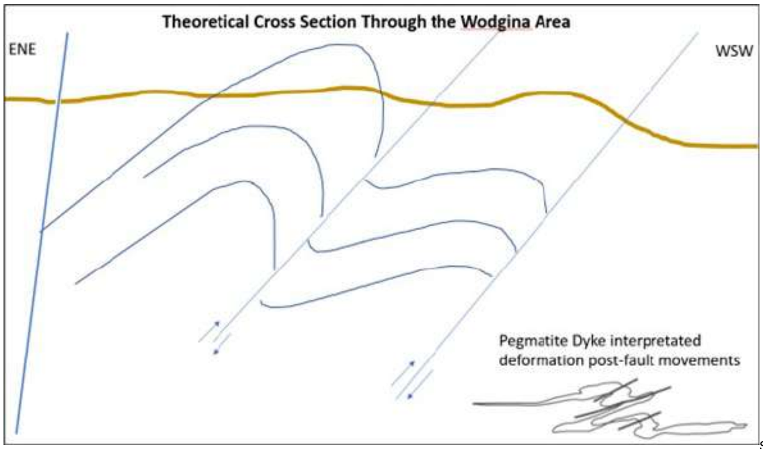
11.2 Structural Interpretation and Modeling

The structural interpretation of the Wodgina property was updated as part of the 2020 modeling process due to a general lack of structural modeling in previous work. Historically, a shallowly dipping pegmatite swarm was interpreted in the Cassiterite area based on limited historical pit mapping. Reviewing historical GSWA mapping (Figure 11-2), the presence of drag folding, thrust faulting, and the regional synclinal form was largely ignored in the prior interpretation. Therefore, an updated conceptual structural model (Figure 11-3) was required to account for local in-pit complexity, offsetting mapped dikes, and the changing geometry of dikes hosted within the schist domain of North Hill compared to the metasedimentary-hosted pegmatites observed in the Cassiterite pit. Based on the various data provided by MARBL supplemented with publicly available information, SRK generated an updated structural interpretation (Figure 11-4) for use in the 2020 geological model update. A simplified cross section from NNE to SSW (Figure 11-5) shows how the nature of pegmatite emplacement and geometry is affected based on host lithology between the North Hill area and the Cassiterite pit.



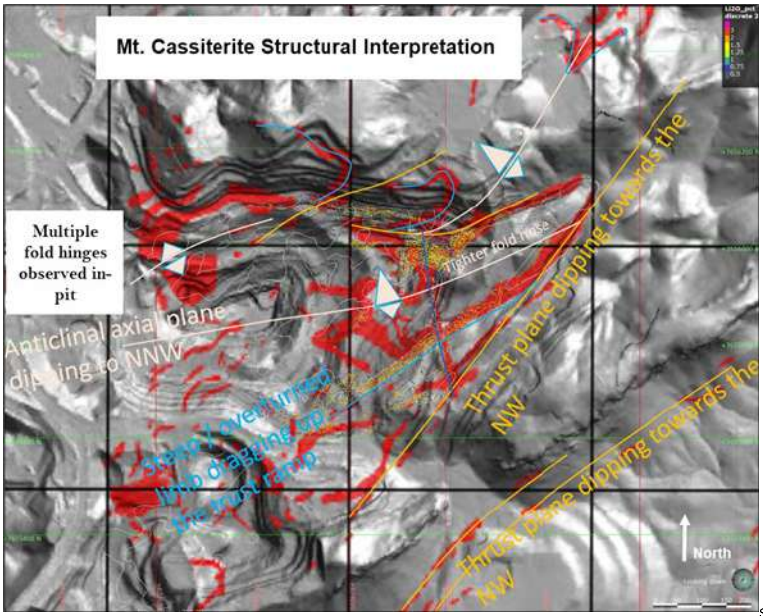
Source: Blockely, 1980 – annotated by SRK, 2020

Figure 11-2: Regional Structural Geology Interpretation



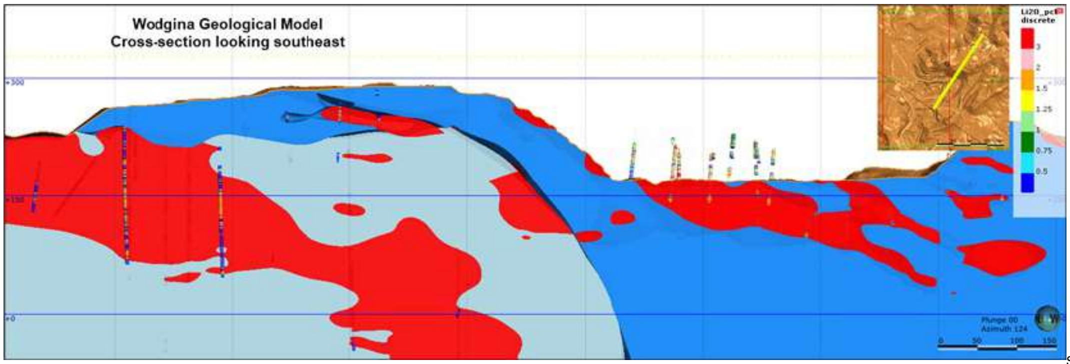
Source: SRK, 2020

Figure 11-3: Schematic Structural Cross Section in the Wodgina Area



Source: SRK, 2020

Figure 11-4: Cassiterite Pit Structural Interpretation



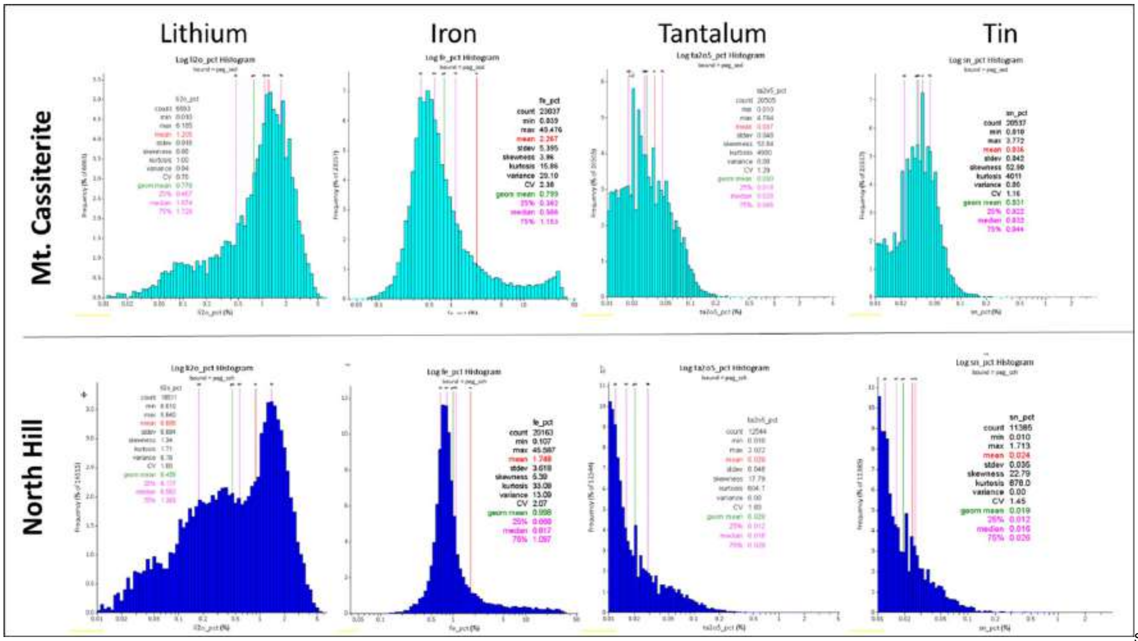
Source: SRK, 2020

Figure 11-5: Cross Section of Wodgina Geological Model

SRK modeled the pegmatite dike domains as separate volumes based on geological interpretations and the differing nature of the pegmatite geometry between the metasedimentary and schist-hosted dikes. The differences between the metasedimentary and schist-hosted dikes includes the following observations:

- Thin and consistently high Li_2O grades within metasedimentary hosted dikes compared to thicker and more variable Li_2O grades in schist-hosted dikes.
- Different trace chemistries noted in the pegmatites between the two host rocks.

The differences in chemical variability are illustrated in Figure 11-6. Reviewing key elements of Li, Fe, Ta, and Sn show material differences in mean and population distributions suggesting chemical interaction and influence of the host rocks in relation to the pegmatite dike chemistry. SRK notes that traditional trace chemistry used for pegmatite characterization include Be, Cs, and Rb are absent from the MARBL database.



Source: SRK, 2020

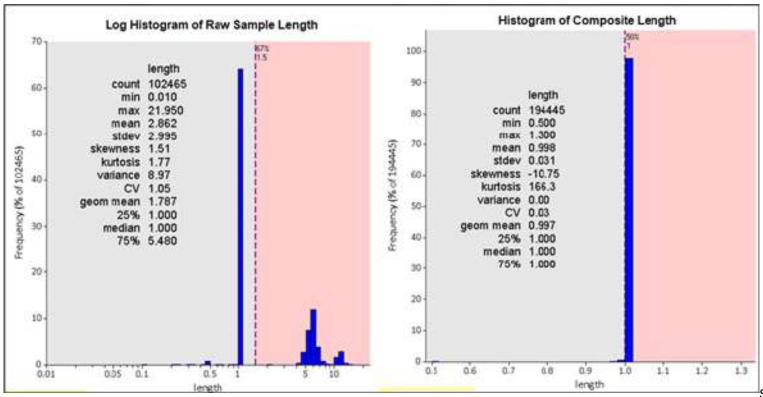
Figure 11-6: Differing Elemental Behavior between the Cassiterite and North Hill Areas

11.3 Key Assumptions, Parameters, and Methods Used

The key assumptions, parameters, and methods used to estimate the quality and quantity of mineral resources are outlined in the following sections. SRK utilized industry standard techniques including data compositing, reviewed the potential for capping of high yield samples, performed exploratory data analysis (EDA) including determining spatial continuity of key economic variables to provide insight into search and estimation parameters.

11.3.1 Compositing

A composite length analysis (CLA) was performed to evaluate implications for various compositing methods and lengths. Due to the mean and median sample length for RC and DDH being approximately 1 m, a 1 m composite using run-length methodology was selected. Composited samples were broken by major lithology including the two dominant pegmatite-hosted domains of PEG_schist and PEG_metased. Figure 11-7 shows original and composited data lengths.



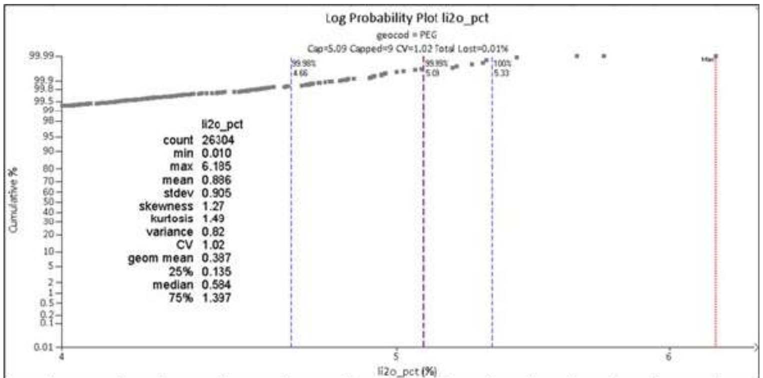
Source: SRK, 2020

Figure 11-7: Histograms of (L) Log Raw Sample Length and (R) Composite Length

11.3.2 Capping

A high yield capping analysis was performed on Li_2O values within intervals logged as pegmatite. The capping analysis involved calculating a log probability chart and assessing the statistical impact of upper caps at various values (Figure 11-8). Though minor lithium-bearing minerals are known to be present in the host rock as an alteration halo associated with the emplaced pegmatite dikes, the mineralogy is unknown, and from personal communications with Albemarle staff familiar with the deposit, these altered zones do not contain mineralization of interest. Therefore, no other domains of potential lithium-bearing minerals were analyzed for capping.

With the logged pegmatite units, SRK reviewed potential capping in both the PEG_metased and PEG_schist domains to understand potential differences in high-yield or outlier values. Both domains appear equivalent in regard to potential outliers with the highest composited pegmatite lithium values being 6.19%. The highest yield values between 5.10 and 6.19% Li_2O have been capped at 5.10% Li_2O to reduce the influence for these high-yield samples. High yield caps applied by domain are shown in Table 11-1.



Column	_Filter	Cap	Capped	Percentile	Capped%	Lost Total%	Lost CV%	Count	Min	Max	Mean	Total	Variance	CV
li2o_pct	geocod = PEG							26304	0.01	6.185	0.886	23311	0.82	1.02
li2o_pct	geocod = PEG	5.33	4	100%	0.02%	0.01%	0.03%	26304	0.01	5.33	0.886	23309	0.82	1.02
li2o_pct	geocod = PEG	5.09	9	99.99%	0.03%	0.01%	0.06%	26304	0.01	5.09	0.886	23307	0.82	1.02
li2o_pct	geocod = PEG	4.66	40	99.98%	0.20%	0.06%	0.20%	26304	0.01	4.66	0.886	23297	0.81	1.02
li2o_pct	geocod = PEG - li2o_pct > 5.09							9	5.193	6.185	5.472	49.25	0.11	0.06
li2o_pct	geocod = PEG - li2o_pct <= 5.09							26295	0.01	5.083	0.885	23261	0.81	1.02

Source: SRK, 2020

Figure 11-8: Log Probability for Li_2O in Pegmatites

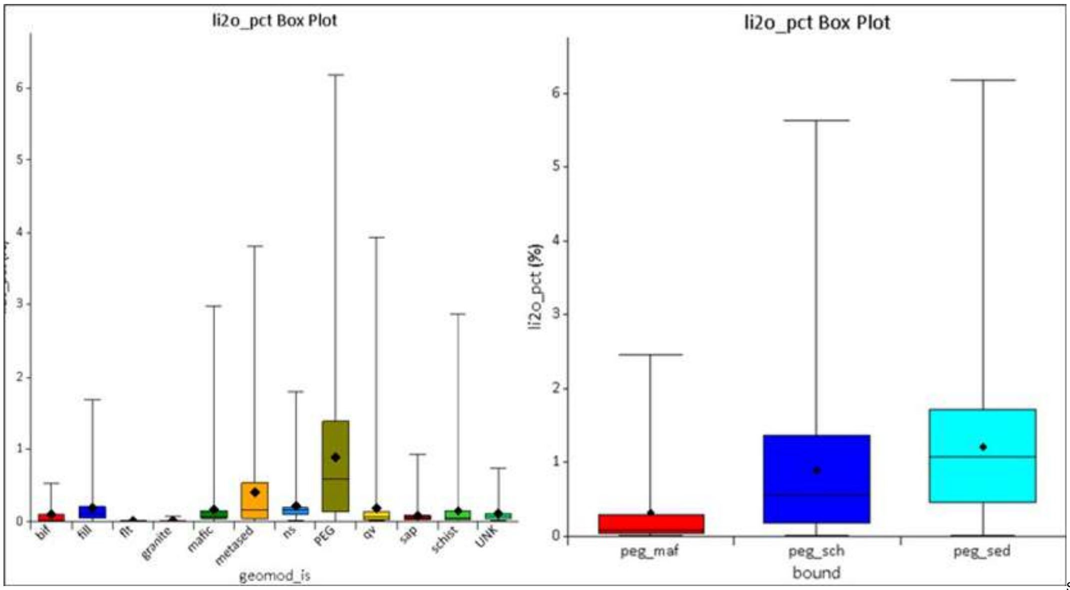
11.3.3 Exploratory Data Analysis

EDA was calculated for the major mineralized domains and for primary and secondary variables with economic interest. Summary descriptive statistics were calculated by domain including a variety of graphics including box and whisker plots, histograms, and bivariate statistics (Figure 11-9 though Figure 11-11).

Column	Domain	Count	Min	Max	Mean	Variance	StDev	CV	Median	25%	50%	75%	IQR	Upper Outlier
li2o_pct	All	34,683	0.010	6.185	0.714	0.74	0.858	1.2	0.317	0.064	0.317	1.168	1.104	2.824
li2o_pct	bif	10	0.010	0.530	0.098	0.03	0.162	1.7	0.022	0.014	0.022	0.097	0.083	0.222
li2o_pct	fill	406	0.010	1.694	0.195	0.07	0.256	1.3	0.108	0.055	0.108	0.209	0.154	0.440
li2o_pct	flt	2	0.014	0.015	0.015	0.00	0.001	0.1	0.014	0.014	0.014	0.015	0.001	0.017
li2o_pct	granite	351	0.010	0.081	0.020	0.00	0.009	0.5	0.017	0.014	0.017	0.023	0.009	0.037
li2o_pct	mafic	589	0.010	2.982	0.173	0.08	0.288	1.7	0.071	0.046	0.071	0.149	0.103	0.304
li2o_pct	metased	941	0.010	3.809	0.402	0.30	0.545	1.4	0.157	0.042	0.157	0.533	0.491	1.270
li2o_pct	ns	48	0.012	1.799	0.219	0.08	0.286	1.3	0.157	0.098	0.157	0.196	0.098	0.343
li2o_pct	PEG	26,304	0.010	6.185	0.886	0.82	0.905	1.0	0.584	0.135	0.584	1.397	1.262	3.290
li2o_pct	qv	46	0.011	3.939	0.189	0.33	0.578	3.1	0.066	0.033	0.066	0.134	0.101	0.286
li2o_pct	sap	301	0.010	0.928	0.080	0.01	0.11	1.4	0.042	0.027	0.042	0.086	0.059	0.175
li2o_pct	schist	5,644	0.010	2.868	0.150	0.06	0.249	1.7	0.058	0.03	0.058	0.153	0.123	0.338
li2o_pct	UNK	41	0.012	0.735	0.112	0.02	0.133	1.2	0.072	0.037	0.072	0.115	0.078	0.232

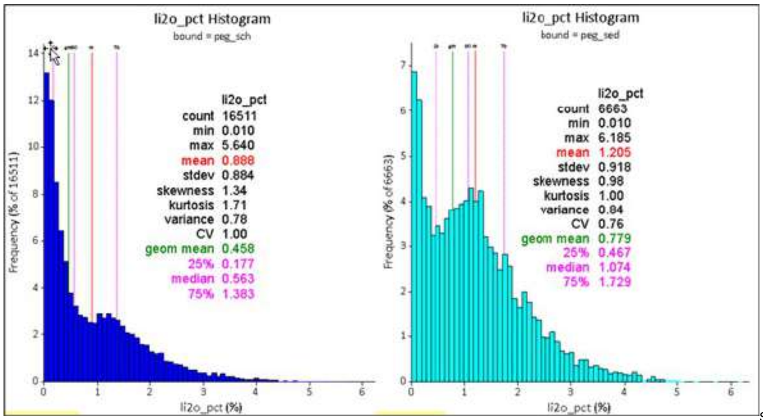
Source: SRK, 2020

Figure 11-9: Summary Descriptive Statistics by Logged Lithology Type



Source: SRK, 2020

Figure 11-10: Box and Whisker Plots for Li_2O for (L) all Lithologies and (R) Pegmatite Domains



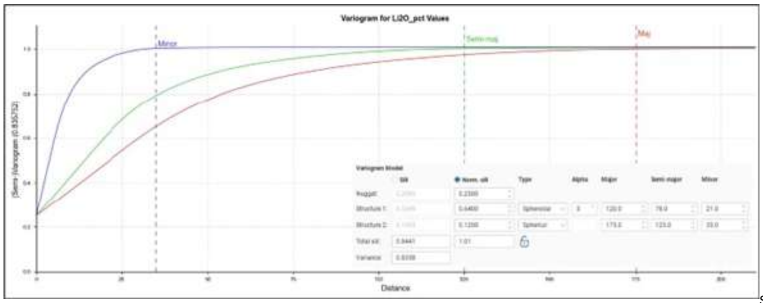
Source: SRK, 2020

Figure 11-11: Histogram of Li_2O Distribution for (L) Schist-Hosted and (R) Metasediment-Hosted Pegmatites

11.3.4 Spatial Continuity

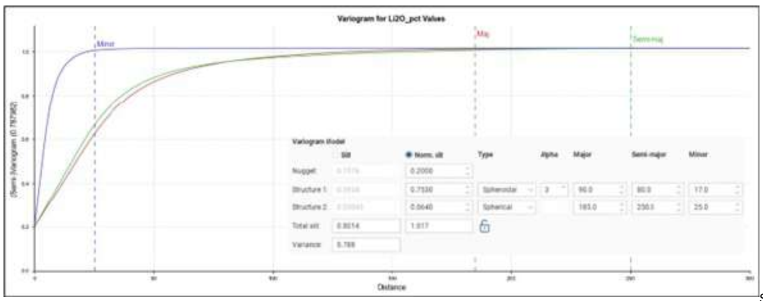
The spatial continuity was determined by calculating semi-variograms for key economic variables by domain. Variograms were calculated per domain for the metasedimentary and schist domains which contain the majority of Li_2O mineralization on the property. The modeled west mafic volcanic block utilized the spatial continuity data from the schist domain while Tinstone domain used variography from the metasedimentary domain. These two domains are deemed of secondary importance and contain limited data to generate reliable variograms.

Figure 11-12 to Figure 11-15 provide the modeled variography for Li_2O and Fe as the primary economic variables on the Wodgina property.



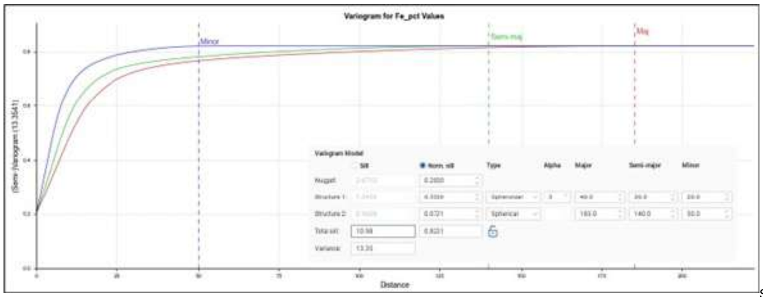
Source: SRK, 2020

Figure 11-12: Modeled Semi-Variogram for Li_2O in the Metasedimentary Domain



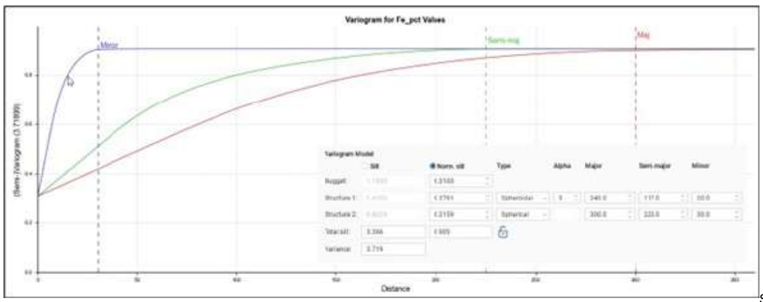
Source: SRK, 2020

Figure 11-13: Modeled Semi-Variogram for Li_2O in the Schist Domain



Source: SRK, 2020

Figure 11-14: Modeled Semi-Variogram for Fe in the Metasedimentary Domain



Source: SRK, 2020

Figure 11-15: Modeled Semi-Variogram for Fe in the Schist Domain

The interpretations of spatial continuity between the two major domains show similar nugget effects but materially different ranges for Li_2O between the two separate host rock types of the pegmatite dikes. The metasedimentary hosted pegmatites show longer ranges with more gradual variance when compared to the schist-hosted pegmatites in the North Hill area.

Iron variability shows similar yet inverse ranges in pegmatites hosted in the two primary rock types. In the metasedimentary hosted pegmatites of the Cassiterite area show near omni-directional behavior with relatively short ranges of continuity while Fe in the schist-hosted pegmatites of the North Hill area show materially longer ranges of continuity. The Fe nugget effect in the schist domain is relatively higher compared to the metasedimentary-hosted pegmatites suggesting greater inherent variability.

11.3.5 Estimation and Search Neighborhood

Resource estimation was performed in Leapfrog Geo and Maptek's Vulcan software. Grade interpolation is based on hard boundaries within the pegmatite lithology broken down into two separate domains based on host lithology type. Estimation methodology is a combination of Ordinary

Kriging (OK) and inverse distance weighting squared (IDW2). Additionally, a nearest neighbor (NN) estimate was performed for validation purposes only.

A multi-pass method of estimation was utilized to aid in preliminary classification determination with each pass increasing the search size while reducing the limitations on number of samples and drillholes. The result has each block coded by which pass was used for estimation thus aiding in visualizing block volumes of increased confidence in the first and second passes compared to the larger and more relaxed criteria of the third pass.

The search neighborhood was selected based on modeled variogram interpretations, iterative processes of search criteria variation, and the resulting output OK quality estimates for Kriging efficiency (KE) and slope of regression (SoR).

Table 11-1: Variography Parameters for the 2020 Resource Block Model

Variable	Domain	Pass	Variable Orientation	Estimation Method	Ellipsoid			Samples			Octants	Outlier Restrictions	Block Discretization
					Major	Semi-Major	Minor	Min	Max	Max per DH			
Li_2O	Metased	1	yes	OK	80	70	20	4	10	3	No	None	5,5,5
Li_2O	Metased	2	yes	OK	150	150	40	3	10	2	No	None	5,5,5
Li_2O	Metased	3	yes	IDW2	300	300	50	3	8	2	No	None	5,5,5
Li_2O	Schist	1	yes	OK	100	100	20	4	10	3	No	5.1	5,5,5
Li_2O	Schist	2	yes	OK	175	175	40	3	10	2	No	5.1	5,5,5
Li_2O	Schist	3	yes	IDW2	300	300	50	3	10	2	No	None	5,5,5
Li_2O	Tinstone	1	yes	OK	100	100	20	4	10	2	No	None	5,5,5
Li_2O	Tinstone	2	yes	OK	200	200	40	3	10	2	No	None	5,5,5
Li_2O	Tinstone	3	no	OK	300	300	60	3	8	2	No	None	5,5,5
Li_2O	West Mafic	1	yes	OK	100	100	20	4	10	3	No	5.1	5,5,5
Li_2O	West Mafic	2	yes	OK	175	175	40	3	10	2	No	5.1	5,5,5
Li_2O	West Mafic	3	yes	IDW2	300	300	50	3	8	2	No	None	5,5,5

Source: SRK, 2020

Secondary elements were estimated in the pegmatite domain but not used for the economic evaluation of the project. These secondary elements include: As, K_2O, Na_2O, S, and Ta_2O_5. Though not directly utilized for mineral resource determination, these elements may be considered useful for other aspects of the operation.

Each secondary element was estimated using composited drilling data in the same manner as Li_2O and Fe. Estimation was into the hard domain of pegmatite by host lithology. The estimation criteria for each secondary element are the same:

- IDW squared was used as the estimation method
- A search ellipsoid of 300 m x 300 m x 75 m was used
- A minimum of four samples and a maximum of eight samples with a maximum of two composites per drillhole was used
- SRK used variable anisotropy based on the same pegmatite sub-domain as Li_2O and Fe

Bulk density was coded into the resource block model based on host lithology of the domain. Table 11-2 provides the bulk density value assigned to each lithology.

Table 11-2: Assigned Bulk Density in Resource Block Model

Lithology Type	Sub-Domain	Bulk Density
pegmatite	Cassiterite area	2.73
pegmatite	North Hill area	2.80
pegmatite	Mafic volcanics	2.73
schist	n/a	2.96
metasediments	n/a	2.96
mafic volcanics	n/a	2.96

Source: SRK, 2021

11.4 Reasonable Prospects for Economic Extraction

The CoG used is 0.5% Li_2O, which is based on historical CoG assumptions and remain unchanged from the previous TRS.

An economic pit shell was used to constrain mineral resource classification. The parameters used for construction of the economic pit shell include:

- Price: US$584/t of 6% concentrate at mine gate
- Processing and G&A Costs: US$23/t of processed mineralized material
- Mining Cost: US$2.85/t moved base mining cost (from elevation 300) and US$0.03/t moved incremental cost per 10 m bench resulting in average US$3.40/t mining cost.
- Mass Yield Equation: (Li_2O% * metallurgical recovery) / concentrate grade
    - Li_2O% = lithium grade in percent
    - Metallurgical recovery = 65%
    - Concentrate grade = 6%

SRK notes that assumptions used in the determination of the CoG and economic pit shell are based on a combination of historical data provided by MARBL and current trends in the lithium market. The underlying economic assumptions remain unchanged from the previous TRS. A more detailed market study and contractual pricing is planned for future refinements to the economic assumptions at the Wodgina property.

11.5 Resource Classification and Criteria

The mineral resources have been classified as Indicated and Inferred based on the SEC S-K 1300 definitions for mineral resource classification. The following criteria were used by SRK for classification:

Indicated Mineral Resources

The criteria used to determine Indicated mineral resource includes:

- Pegmatite mineralization hosted within the historically mined metasedimentary domain in the Cassiterite area
- Mean distance between drillholes is less than 100 m
- Drillholes geologically logged
- Li_2O data meets minimum requirements for internal QA/QC
- Located within the economic pit shell of 0.7% Li_2O
- Material above the 0.5% Li_2O CoG
- Within the QP-created volumes for Indicated mineral resources

Inferred Mineral Resources

The criteria used to determine Inferred mineral resources includes:

- Pegmatite mineralization hosted within either the metasedimentary or schist domains of the Cassiterite and North Hill area respectively
- Mean distance between drillholes is greater than 100 m
- Li_2O data meets minimum requirements for internal QA/QC
- Located within the economic pit shell of 0.7% Li_2O
- Material above the 0.5% Li_2O CoG
- Within the QP-created volumes for Inferred mineral resources.

SRK notes the mineral resource classification is assigned accounting for the current geological understanding of the deposit, drilling data and spacing, continuity of mineralization, the general lack of metallurgical and mineralogical data, predominant use of RC drilling that may result in smearing of grades, poorly logged geology, a lack of a detailed structural model in a deposit largely controlled by structure, the nature of pulp re-assay being the primary source of lithium geochemical data, analytical quality control, and uncertainty associated with bulk density determination. The Indicated resources are restricted to the Cassiterite area due to the history of economic mining and processing of the metasedimentary-hosted pegmatite dikes.

11.6 Uncertainty

The mineral resources have been classified to account for the assessed risk and uncertainty associated with the site geology, structure, grade continuity, fundamental data confidence, and tonnage conversion factors. SRK has identified the areas of key uncertainty as follows:

Metallurgical Recovery of Li_2O from Pegmatites in the North Hill Area

Due to the general lack of mineralogical and metallurgical data in the North Hill area, there is uncertainly related to the metallurgical recoverability of Li_2O from the pegmatite dikes in this area. No historical mining or processing has occurred in North Hill. The host rock type is different from the

Cassiterite area, the dikes show a different geometry, and the limited trace geochemical data show differences suggesting different mineralogy. Therefore, mineral resources in this area have been classified as Inferred to reflect this uncertainty.

Lack of Detailed Structural Model

The pegmatites at the Wodgina property are largely thought to be structurally controlled, yet no structural model exists to aid in predicting dike location. Historical drilling has failed to generate sufficient structural data and therefore all current interpretations are based on regional mapping, historical pit mapping, and a legacy structural assumption. A deposit featuring structurally hosted mineralization with poor understanding of structure represents uncertainty in accurately predicting tonnages and grade on the Wodgina property. This has been a feature of previous Wodgina estimates, which incorporated limited information and made more generalized assumptions on continuity, thereby resulting in a different interpretation.

Lack of Confidence in Lithology Logging

RC drilling has largely been used to characterize the Wodgina deposit. The RC drilling method is occasionally problematic as it may dilute or smear grades if diligence is not taken during regular sampling procedures. Additionally, samples are ground chips which are notoriously difficult to log for detailed lithology and no structural information can be measured. In reviews of data, geological logging shows inconsistencies across the property. This lack of robust geological logging data and potential for sample dilution and/or smearing represents a minor risk and introduces uncertainly in fundamental data used to determine mineral resources.

Reliance on Historical Sample Pulps for Lithium Assays

Historically, the Wodgina property was operated for tantalum while lithium was not directly assayed. Starting in the mid-2010s, MARBL initiated a program of re-assay of historical lab rejects/pulps to gather Li_2O data. These data comprise the majority of analytical data supporting mineral resources. There is uncertainty as to the condition of historical pulps, potential degradation of minerals, and other items based on long-term site storage. SRK considers this risk to be relatively minor but is accounted for in the overall assessment of uncertainly in mineral resources.

Complex Nature of the Deposit

Lithium-bearing pegmatite dikes at the Wodgina property are highly variable in grade, thickness, and continuity. With limited DDH drilling, poor structural understanding, and inconsistent geological logging from RC chips, the ability to predict grades and volumes of continuous pegmatite dikes is considered challenging and uncertain. Additionally, based on historical production at the Tinstone pit, Cassiterite pit, and Wodgina pits across the Wodgina property, the mineralogy and chemistry are materially different within the pegmatite dikes in each pit area suggesting the potential for material differences in pegmatite chemistry over short distances. This variability of pegmatite dike chemistry/mineralogy represents uncertainly in the deposit when detailed geological characterization is not conducted.

Lack of Robust Bulk Density Measurements

Bulk density is poorly measured across lithologies on the Wodgina site, thus resulting in uncertainly associated with tonnage determination.

Variable QA/QC from Historical Data

The majority of pre-2016 analytical data was tested at either the on-site Wodgina laboratory or the company's internal Greenbushes laboratory, both considered internal laboratories. Limited data are available for the preparation and internal QA/QC on analytical data during this timeframe. Additionally, all drill samples analyzed prior to 2013 were not subject to a QA/QC program. As these data are utilized in the resource for the Wodgina Property, this represents uncertainly in sample collection, preparation, and storage of data. These historical sample pulps were used for all historical Li_2O analytical data.

Lack of Metallurgical Data from the TSF Deposit

The TSF represents tailings from historical tantalum operations on the Wodgina property. These materials have been drilled and assayed for Li_2O but feature no metallurgical/processing testwork. Tailings represent post-processed material that is finely ground, saturated, and typically exposed at surface for extended periods of time subject to weathering and oxidation. The ability to recover Li_2O from the TSF is not assumed until demonstrated by analytical work. Therefore, the TSF is excluded from disclosure as a mineral resource.

11.7 Multiple Commodity Resource

Lithium is the only economic material that is the focus of the Wodgina property. No other commodities are reported.

11.8 Mineral Resource Statement

Mineral resources at the Wodgina property have been determined by SRK during 2020 using the geological model and resource block model data current as of December 31, 2022. Table 11-3 provides the summary Mineral Resource statement for the Wodgina property. The underlying economic assumptions remain unchanged from the previous TRS. The resource block model, mineral resource economic pit, and cut-off grade economic assumptions remain unchanged from December 2021.

Table 11-3: Wodgina Summary Mineral Resources as of December 31, 2022 by SRK Consulting (U.S.), Inc.

Category	100% Tonnes (Mt)	Attributable Tonnes (Mt)	Li_2O (%)	Cut-Off (% Li_2O)	Mass Yield	100% Concentrate Tonnes at 6.0% Li_2O (Mt)	Attributable Concentrate Tonnes at 6% Li_2O (Mt)	100% Li Metal in Concentrate (Kt)	Attributable Li Metal In Concentrate (Kt)
Indicated	21.0	12.6	1.36	0.5	14.7%	3.1	1.9	86.2	51.7
Inferred	163.9	98.3	1.12	0.5	12.1%	19.9	11.9	554.3	332.6

Source: SRK, 2023
Notes:
- The Summary mineral resources attributable tonnes reflect Albemarle's 60% ownership percentage in the Wodgina project.
- The effective date for this mineral resource is December 31, 2022. All significant figures are rounded to reflect the relative accuracy of the estimates.
- Tonnages are presented as million metric tonnes (Mt) with lithium oxide (Li_2O) grades presented as percentages.
- The mineral resource estimate has been classified in accordance with SEC S-K 1300 guidelines and definitions.
- Mineral resources on the Wodgina property are contained within the Cassiterite Deposit which comprises the historically mined Cassiterite pit and undeveloped North Hill area.
- Mineral resources are not Mineral Reserves and do not have demonstrated economic viability. Inferred mineral resources have a high degree of uncertainty as to their economic and technical feasibility. It cannot be assumed that all or any part of an Inferred mineral resources can be upgraded to Measured or Indicated mineral resources.
- Metallurgical recovery of lithium has been estimated on a block basis at a consistent 65% based on documentation from historical plant production.
- To demonstrate reasonable prospects for economic extraction of mineral resources, a cut-off grade of 0.5% Li_2O is applied to material contained within an economic pit shell based on 65% recoverability assumption, long-term price assumptions of US$584 per tonne (t) at mine gate, variable mining costs averaging US$3.40/t, processing costs and G&A costs totaling US$23/t.
- The mineral resources are constrained by an economic pit shell using an overall 43° pit slope angle, 0% mining dilution, and 100% mining recovery.
- There are no known legal, political, environmental, or other risks that could materially affect the potential development of the mineral resources based on the level of study completed for this property.

11.9 Opinion on Influence for Economic Extraction

It is SRK's opinion that all identified technical and economic uncertainly related to the Wodgina property can be improved with additional work programs by MARBL. Additional geological and metallurgical characterization is required to address multiple identified uncertainties which are outlined in the Recommendations section of this TRS. Additional work programs are in-progress on the Wodgina property to address these issues including additional drilling and analyses. It is the QP's opinion that completion of these programs may reduce the risks as currently identified.

Given the geological complexity of the site and known variability associated with pegmatite deposits, even with completed geological characterization studies, there will likely continue to be an intrinsic degree of uncertainty on the property. It is SRKs opinion that this inherent uncertainty can be best managed at the short-term production scale through rigorous programs in blasthole and pit geological characterization.

12 Mineral Reserve Estimates

Mineral reserves have not been prepared for the Wodgina property at this time.

13 Mining Methods

The mining method at Wodgina is open pit with traditional drill-blast-shovel-haul operation.

14 Processing and Recovery Methods

The project is currently at an IA level of study, no details are provided on assumed processing and recovery. It is SRK's opinion that utilizing historical metallurgical recovery data from production is adequate for the disclosure of mineral resources in the Cassiterite area. However, the lack of metallurgical testing, mineralogy, and analyses across the property increases the risk of predictive recovery, which is key for mineral reserve estimation. Further work is required before confidence in this modifying factor is adequate for disclosure of mineral reserves.

15 Infrastructure

The Property hosts a variety of historic infrastructure from previous mining operations. The following information outlines a high-level summary of site infrastructure. The site is in the process of ramping up operations with mining start up commencing in mid-2022.

Equipment, infrastructure, and assets at the Wodgina property include the following:

- Three stage crushing plant capable of sustaining 5.65 Mt/y of ore feed to the Spodumene concentration plant
- Administrative and office buildings
- 750-room accommodation camp on the property
- 81 km, 10-inch gas pipeline to site
- A power station containing 32 2 MW gas gensets totaling 64 MW
- Three mature and reliable water bore fields with minimal contaminant removal required
- All weather airstrip capable of landing an A320 jet aircraft
- Extension of TSF3 for future tailing storage
- The Property is accessible via sealed, all-weather roads. Roads onsite are maintained dirt roads.

15.1 Power, Water and Pipelines

The Wodgina property has a dedicated 10-inch natural gas pipeline which runs from the Pilbara Energy pipeline to the property. The pipeline feeds the site power station consisting of 32 generator sets of 2 MW each for a total capacity of 64 MW. The natural gas pipeline was upgraded from a 4-inch to a 10-inch pipe in 2019.

Water is obtained from three dedicated water bore fields located on the property.

A series of monitoring bores are installed around the toe of the EWL. These monitoring bores require monthly reporting on water levels and quarterly reporting on ambient groundwater quality and will continue to be monitored for any analytical signs that acid production is occurring within the waste landform.

Groundwater data for the EWL monitoring bores is only in its infancy for WLPL, monitoring was conducted from September 2017 through closure of the operation in November 2019. Data collected for these bores in the last year of operation has been compared against ANZECC livestock drinking water guideline, the only exceedance reported was for TDS, which is consistent with the natural variation in the area.

16 Market Studies

There is currently no market study on the Property.

17 Environmental Studies, Permitting, and Plans, Negotiations, or Agreements with Local Individuals or Groups

The property is at an IA level, no environmental studies, permits, or details are available.

18 Capital and Operating Costs

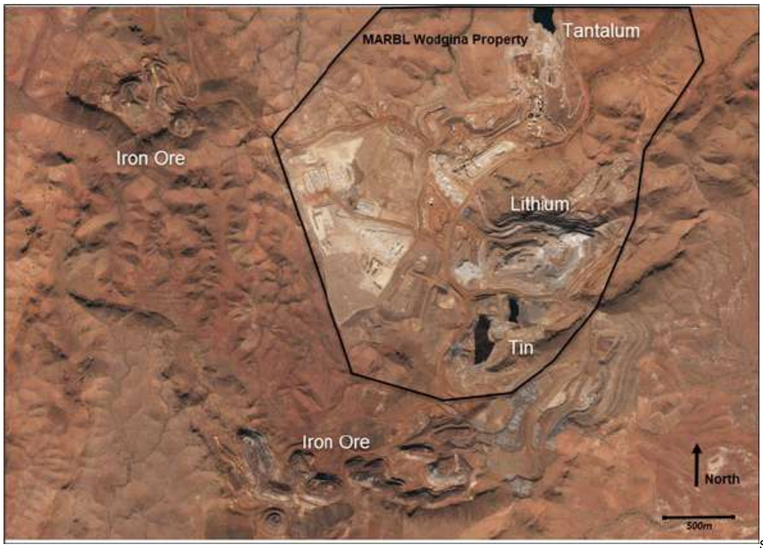
The property is at an IA level, no capital or operating cost estimates are available.

19 Economic Analysis

The property is at an IA level, no economic analyses are available.

20 Adjacent Properties

The Wodgina property is adjacent to several historical and current mining operations exploited for a variety of elements and commodities. These include properties which have been previously exploited for iron ore, tantalum, and tin.



Source: SRK, 2021

Figure 20-1: Adjacent Mining to the Wodgina Property

21 Other Relevant Data and Information

The Wodgina property re-started operations during mid-2022. Mining and processing are ramping up as of the effective date of this report. Additionally, the QPs note that additional technical work programs are in-process to address some uncertainties and risks as outlined in this TRS.

22 Interpretation and Conclusions

Summary interpretations and conclusions by SRK include:

- The geology of the site is complex with documented uncertainty related to interpretated lithology, structure, and pegmatite characterization across the property.
- The North Hill area represents a relatively large tonnage and moderate grade resource with potential for future development, but is poorly characterized with no metallurgical, mineralogical, structural, or detailed geological characterization completed.
- Historical mine planning has been performed on outdated geological and structural interpretation for the property.
- There is insufficient metallurgical testing to support disclosure of mineral resources in the TSF, should re-processing of historical tails be investigated.

Material risks and uncertainties associated with the Wodgina property are disclosed in detail in section 11.6. These uncertainties directly affect confidence in the stated mineral resources. SRK notes that there have been significant adjustments to the historical publicly disclosed resources on the basis of revisions to the geological model, the assessment of reasonable prospects for economic extraction, and uncertainty addressed through amended classification.

23 Recommendations

23.1 Recommended Work Programs

Based on the documented uncertainties associated with the geology and metallurgical recovery, SRK recommends the following work programs:

- Diamond drilling across the North Hill and Cassiterite deposits including detailed structural measurements, mineralogy, and geochemical assay.
- Detailed mineralogical and metallurgical testing program across the deposit area to confirm recovery assumptions.
- Detailed structural measurements compiled into a 3D structural model of the property to aid in interpretation of the mineralized pegmatites.
- Re-logging of historic drilling for improved geological data confidence.
- Determination and modeling of potentially deleterious materials including Fe, clays, micas, and sulfides.
- Updated geological modeling, resource estimation, and reporting of mineral resources accounting for all findings from drilling and other studies.
- Updated economic assumptions and input parameters for CoG determination and an economic pit shell update.
- Conduct metallurgical testwork of tailings materials to assess recoverability and economic viability.
- Conduct testing or commence twin drilling of previous holes to demonstrate the reliability of the historical pulp data supporting the Li assays using mineral resource calculations.
- The project should advance to Pre-Feasibility Study (PFS) levels of development with accompanying technical study of relevant modifying factors of the mineral resource.

SRK notes that MARBL is currently undertaking a drilling program to address some of these issues on the Wodgina property. Ongoing drilling and technical study should be considered mandatory for future Wodgina project development and continued operation.

24 References

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25 Reliance on Information Provided by the Registrant

SRK's opinion contained within this TRS is based upon data and communications provided by the registrant which was validated and deemed appropriate for use. SRK did not collect or analyze any information as part of this TRS but relied entirely on historical records, documentation, and data as provided. SRK used its expertise and experience to determine if public, historical, and provided data was suitable for inclusion in this TRS and made unique interpretations based on this information.

SRK is reliant upon the registrant for all items related to the legality of mineral rights, claims, and approval to mine on the property. SRK are not legal experts and therefore relied entirely on information provided by the registrant to be current and accurate. Additionally, all items disclosed in this TRS related to encumbrances, royalties, or other agreements have been directly provided by the registrant and not validated by SRK.

Table 25-1: Reliance on Information Provided by the Registrant

Category	Report Item/ Portion	Portion of Technical Report Summary	Disclose why the Qualified Person considers it reasonable to rely upon the registrant
Legal Opinion	(Sub-Chapters 3.3 through 3.7: Mineral Title, Claim, Mineral Rights, Lease, or Option Disclosure	Chapter 3	The registrant provided documentation summarizing the legal access and rights associated with all leased surface and mineral rights for the property. This information was reviewed by the registrant's legal representatives. The Qualified Person is not qualified to offer a legal perspective on MARBL's surface and title rights but has summarized this document and has had the registrant's personnel review and confirm statements contained herein.

Signature Page

This report titled “SEC Technical Report Summary, Initial Assessment, Wodgina, Western Australia” with an effective date of December 31, 2022, was prepared and signed by:

SRK Consulting (U.S.) Inc. ***(Signed)*** **SRK Consulting (U.S.) Inc.**

Dated at Denver, Colorado
February 14, 2023

Exhibit 96.5

RESPEC

JORDAN BROMINE OPERATION

Technical Report Summary as of December 31, 2023

214554
Final

14 February 2024

respec.com

rpsgroup.com

JORDAN BROMINE OPERATION

Technical Report Summary

Peer Review		
Michael Gallup, P. Eng.	[email]: michael.gallup@rpsgroup.com	9 February 2024
Approval for issue		
Michael Gallup, P. Eng.	[email]: michael.gallup@rpsgroup.com	9 February 2024

Prepared by:

RPS

Michael Gallup
Technical Director – Engineering
Suite 600
555 4th Avenue SW
Calgary AB
T2P 3E7

T +1 403 265 7226
E Michael.gallup@rpsgroup.com

and

RESPEC
Peter Christensen
Oscar Velasquez

146 East Third Street
PO Box 888
Lexington, Kentucky 40588

Prepared for:

Albemarle Corporation

4250 Congress Street
Suite 900
Charlotte, NC
28209
U.S.A.

T +1 225 388 7076
E

Suite 600
555 4th Avenue SW
Calgary AB
T2P 3E7

T +1 403 265 7226

RPS Ref: 214554

February 15, 2023

Albemarle Corporation

4250 Congress Street
Suite 900
Charlotte, NC
28209
U.S.A.

Jordan Bromine Operation
Technical Report Summary as of December 31, 2023

As requested in the engagement letter dated July 26, 2021, RPS and RESPEC have evaluated certain Bromine reserves and resource in the Kingdom of Jordan, as of December 31, 2023 ("Effective Date"), and submit the attached report of our findings. The evaluation was conducted in compliance with subpart 1300 of Regulation SK.

This report contains forward looking statements including expectations of future production and capital expenditures. Potential changes to current regulations may cause volumes actually recovered and amounts future net revenue actually received to differ significantly from the estimated quantities. Information concerning reserves and resources may also be deemed to be forward looking as estimates imply that the reserves or resources described can be profitably produced in the future. These statements are based on current expectations that involve a number of risks and uncertainties, which could cause the actual results to differ from those anticipated. These risks include, but are not limited to, the underlying risks of the mining industry (i.e., operational risks in development, exploration and production; potential delays or changes in plans with respect to exploration or development projects or capital expenditures; the uncertainty of resources estimates; the uncertainty of estimates and projections relating to production, costs and expenses, political and environmental factors), and commodity price and exchange rate fluctuation. Present values for various discount rates documented in this report may not necessarily represent fair market value of the reserves or resources.

Yours sincerely,
for RPS Energy Canada Ltd

Michael Gallup
Technical Director – Engineering
michael.gallup@rpsgroup.com
+1 403 265 7226

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INDEPENDENT CONSULTANT'S CONSENT AND WAIVER OF LIABILITY

The undersigned firm of Independent Consultants of Calgary, Alberta, Canada knows that it is named as having prepared an independent report of the bromine reserves of the Jordan property owned by Albemarle Corporation and it hereby gives consent to the use of its name and to the said report. The effective date of the report is December 31, 2023.

In the course of the evaluation, Albemarle provided RPS Energy Canada Ltd. (RPS) personnel with basic information which included the field's licensing agreements, geologic and production information, cost estimates, contractual terms, studies made by other parties and discussions of future plans. Any other engineering or economic data required to conduct the evaluation upon which the original and addendum reports are based, was obtained from public literature, and from RPS non-confidential client files. The extent and character of ownership and accuracy of all factual data supplied for this evaluation, from all sources, has been accepted as represented. RPS reserves the right to review all calculations referred to or included in the said reports and, if considered necessary, to revise the estimates in light of erroneous data supplied or information existing but not made available at the effective date, which becomes known subsequent to the effective date of the reports.

RPS Energy Canada Ltd.

1 EXECUTIVE SUMMARY

This Technical Report Summary ("TRS") was prepared by RESPEC at the request of Albemarle Corporation (Albemarle, or the company) for the company's Jordan Bromine Company ("JBC"). The TRS complies with disclosure standards of the SEC S-K Regulation 1300 following the TRS outline described in CFR 17 and reports the estimated reserves for the Jordan bromine operation as well as all summary information required as outlined in the SEC S-K Regulation 1300.

1.1 Property Description

The JBC operation is located in Safi, Jordan, and is located on a 26-ha area on the southeastern edge of the Dead Sea, about 6 kilometers north of the of the Arab Potash Company (APC) plant. JBC also has a 2-hectare storage facility within the free-zone industrial area at the Port of Aqaba.

1.2 Mineral Rights

JBC was established in 1999 and is a joint venture between Albemarle Holdings Company Limited, a wholly owned subsidiary of Albemarle and the Arab Potash Company (APC). JBC's operations primarily consist of the manufacturing of bromine, from bromide-enriched brine which is a by-product of potash operations from the Dead Sea waters, conducted by APC. The Government of the Hashemite Kingdom of Jordan granted APC a concession for exclusive rights to exploit the minerals and salts from the Dead Sea brine until 2058. Rights granted to APC are applicable to JBC by virtue of APC's participation in the Joint Venture. APC maintains all the necessary permits to guarantee the continuous operation of its facilities under Jordanian legislation.

1.3 Geological Setting, Mineralization and Deposit

Movement of the plates that created the basin containing the Dead Sea began 15 Ma and the plates continue to diverge today at a rate of 5 to 10 mm per year[i]. The Dead Sea is an isolated hypersaline lake within the lowest part of the catchment basin and is a unique, current-day example of evaporitic sedimentation and accumulation within a brine body[1].

The climate, geology and location provide a setting that makes the Dead Sea a valuable large-scale natural resource for potash and bromine. Today, the Dead Sea has a surface area of 583 km2 and a brine volume of 110 km^3. The Dead Sea is the world's saltiest natural lake[ii], containing high concentrations of ions compared to that of regular sea water and an unusually high amount of magnesium and bromine. There is an estimated 900 million tonnes of bromine in the Dead Sea.

Evaporation greatly exceeds the inflow of water to the Dead Sea, causing a negative water balance and a receding shoreline of approximately 1.1 m to 1.25 m per year[1]. Variable evaporation rates and uncertain subsurface inflow of fresh water make it difficult to predict its water deficit. The Dead Sea contains a large and deep northern basin and a shallow southern basin. The southern Basin is a saline mudflat, and the water level is maintained by artificial flooding, with North Basin brine.

1.4 Exploration

There is no exploration as typically conducted for the characterization of a mineral deposit. A limited site investigation program was carried out in 1966 when most of the southern basin of the Dead Sea was covered in up to 3 m of brine. A more detailed program, with a cost of £3 million, took place in 1977 when the brine level had receded from the southern basin, leaving only land-locked ponds in the central depression.

1.5 Mineral Processing and Metallurgical Testing

The JBC bromine plants and connection to the APC C-7 carnallite ponds was designed to move substantial quantities of concentrated brine to the central bromine production facilities, where brine is processed to produce bromine. Knowing the consistency of the bromide salts ("bromides") within the feedbrine is critical for operations and business planning of the various bromine derivative sales. Feedbrine and tailbrine samples are taken frequently, upstream and downstream of the bromine tower, to capture any concentration changes.

The sampling process is systematic and documented. Bromides within the brine is measured by a widely used halogen titration process; methods appear to be reasonable and well established. The sampling and analytical processes are adequate to support the plant operation.

1.6 Mineral Resource Estimates

JBC's bromine production plant is atypical of many mineral mining and processing operations in that the feedstock for the plant is concentrated brine available from another mineral processing plant owned by APC. The feedstock for the APC plant is drawn from the Dead Sea, a nonconventional reservoir, a reservoir owned by the nations of Israel and Jordan.

As such, there are no specific resources owned by APC or JBC, but rather APC has exclusive rights granted by the Hashemite Kingdom of Jordan to withdraw brine from the Dead Sea and process it to extract minerals.

The measured resources of bromide ion attributable to Albemarle's 50% interest in its JBC joint venture is estimated to be approximately 175.69 MMt. From these large resources, JBC is extracting approximately 1 percent of the bromine available.

1.7 Mineral Reserves Estimates

Proven and probable reserves have been estimated based on the operational parameters, economics and concession agreements for JBC.

The reserve estimate is constrained by the time available under the concession agreement with the Hashemite Kingdom of Jordan, and the processing capability of the plant. The forecast volumes of brine processed are supported by demonstrated plant performance. The reserve estimate is not constrained by available resources, with approximately 1 percent of the measured resources being consumed. Costs are based on forward projections supported by historical operating and capital costs, with no major capital projects or plant expansions required to support the operating forecast. Revenues are based on a range of bromine sales prices between the spot price for the effective date of December 31, 2023, and the spot price less 15 percent, 30 percent and 45 percent.

The plants are forecast to process approximately 14.93 MMt of feedbrine per year on average over the remaining concession life. On an annual basis, the feed contains approximately 127,500 tonnes of bromide ion. At the plant process recovery of 90-95 percent (bromine from bromide), product bromine is estimated at approximately 118,000 tonnes per year.

The APC concession and JBC's ownership of the facility expires at the end of 2058. Over the 35 years of production from the reserves effective date of December 31, 2023, an estimated 4.13 MMt of bromine will be produced, which establishes the reserve estimate.

The proven reserves attributable to Albemarle's 50% interest in its JBC joint venture are estimated to be approximately 2.07 MMt of elemental bromine.

1.8 Mining Methods

Mining methods consist of all activities necessary to extract brine from the Dead Sea and extract Bromine. The low rainfall, low humidity and high temperatures in the Dead Sea area provide ideal conditions for recovering potash from the brine by solar evaporation. JBC obtains its feedbrine from APC's evaporation C-7 carnallite pond and this supply is intimately linked to the APC operation.

As evaporation takes place the specific gravity of the brine increases until its constituent salts progressively crystallize and precipitate out of solution, starting with sodium chloride (common salt) precipitating out to the bottom of the ponds (pre-carnallite ponds). Brine is transferred to other pans in succession where its specific gravity increases further, ultimately precipitating out of the sodium chloride. Carnallite precipitation takes place at C-7 carnallite pond. Where it is harvested from the brine and pumped as slurry to a process plant (where the potassium chloride is separated from the magnesium chloride). JBC extracts the bromide-rich, “carnallite-free” brine from pond C-7 through a pumping station with a capacity of approximately 84.1 MCM per year. This brine feeds the bromine and magnesium plants.

1.9 Processing and Recovery Methods

Bromide-enriched brine (feedbrine) is conveyed to the two bromine plants via two parallel bromine production trains within the JBC facility via an open channel. Elemental bromine is produced at the JBC plants through a series of chemical processes.

The brine is then mixed with chlorine to extract the remaining bromine from solution. Chlorinated brine enters the bromine distillation tower (at approximately 120°C) where additional chlorine is added to continue the reaction with any residual bromide salts and where the brine stream is heated by adding steam, maintaining a temperature above the boiling point. Bromine exiting the recovery section of the tower is purified.

Heated bromide-depleted brine (tailbrine) exits the bromine distillation tower and is mixed with a strong base to neutralize any remaining acid, bromine, or chlorine. Then it is pumped to a storage pond for cooling and eventual discharge, recycled back to the Dead Sea via the APC process plant. Vaporized bromine is condensed, and the wet bromine is fed to a glass lined crude bromine storage drum that acts as an intermediate storage before downstream purification (and removal of any dissolved chlorine).

1.10 Infrastructure

The Jordan Valley Highway/Route 65 is the primary method of access for supplies and personnel to JBC. The Port of Aqaba is the main entry point for supplies and equipment for JBC, where imported shipping containers are offloaded from ships and are transported by truck to JBC via the Jordan Valley Highway. Aqaba is approximately 205 km south of JBC via Highway 65. Major international airports can be readily accessed either at Amman or Aqaba. Jordan's railway transport runs north-south through Jordan and is not used to transport JBC employees and product.

JBC ships product in bulk through a storage terminal in Aqaba. There are above ground storage tanks as well as pumps and piping for loading these products onto ships. JBC main activities at Aqaba are raw material/product storing, importing, and exporting. An evaporation pond collects the waste streams from pipe flushing, housekeeping, and other activities.

Infrastructure and facilities to support the operation of the bromine production plant at the Safi site is compact and contained in an approximately 33 ha area. Fresh water is sources from the Mujib Reservoir, a man-made reservoir. Approximately 1.0 to 1.2 MCM of water is used annually.

Electricity is generated through the National Electric Power Company of Jordan (NEPCO) and distributed directly to JBC via the Electricity Distribution Company (EDCO), owned and operated by Kingdom Electricity Company. Overall, the project is well supported by quality infrastructure.

1.11 Market Studies

The global bromine market is expected to grow steadily at a Compound Annual Growth Rate (CAGR) of approximately 4.20 percent between 2023 and 2028. The growth trend is attributed in part by an increased demand for plastics and flame-retardant chemicals using bromine to develop fire resistance. Also driving the trend is the use of bromine and its derivatives as mercury reducing agents, for example, used for the reduction of mercury emissions from combustion of coal in coal-fired power plants. The need for specialty chemicals in various end-use industries such as oil and gas, automobile, pharmaceuticals, and construction will also drive the demand for bromine. The major producers of elemental bromine in the world are Israel, Jordan, China, and the United States. The global bromine market is dominated by manufacturers who have an extensive geographical presence with massive production facilities, all around the world.

A forecast of the global bromine market till 2025 suggests that Asia would be the fastest growing region for bromine consumption due to a growing population and the increasing purchasing power in the developing nations. The growth of agriculture and automobile industries in countries such as China and India will also drive the increasing demand for bromine.

In 2021, the price of bromine significantly increased, reaching a peak of $10,700 per tonne in November. The bromine spot price on the effective date of this report, December 31, 2023, was US$ 3,525 per tonne and the overall trend is towards a progressive decrease.

Bromine prices have greatly decreased in the last two years mainly because of reduced demand and an increase in the release of domestic inventories before the close of the financial year. The slow demand for Bromine in industries such as flame-retardant production and other end-use sectors is due to excess inventories in the local market.

The above-described behavior of the market is the product of a combination of factors, including China's decrease in bromine production from brine due to the country's electricity curtailment policy.

1.12 Environmental Studies, Permitting and Plans, Negotiations, or Agreements with Local Individuals or Groups

JBC has carried out environmental impact studies in compliance with Jordanian regulations. The environmental impact studies are part of the public domain and accessible through the MIGA web site (www.miga.org).

JBC complies with national environmental and labor regulations. It also meets or exceeds the international regulations of OSHA and NFPA. JBC is the first company of its kind in Jordan to become an authorized exporter into Europe and has been certified for ISO 9001, 14001 and VECAP (Voluntary Emissions Control Action Program). The company's environmental program has been ISO 14001 certified by Lloyd's Register since 2007 and further enhanced through the adoption of the integrated management system for quality (IS0 9001: 2015, OHSASL800L, 2007, ISO/4001:2015) certificate received in 2018.

JBC works closely with the local communities, governmental and non-governmental organizations (NGOs) to make a positive difference and help communities prosper, both socially and environmentally. The company has established the Caring for Jordan Foundation, which contributes to the well-being of Jordanians by helping them to improve their quality of life through support of sustainable community projects.

1.13 Capital and Operating Costs

The JBC facility is an active operation with a track record of industrial production of elemental bromine and most of the major capital expenditures have already taken place in the past. Review of the business plan provided by JBC confirmed no further facilities or plant capital is required because JBC intends to keep all of the major components of its industrial facility through the expiration of the concession contract. An annual sustaining capital allocation of approximately $13.00-$14.40 million has been included.

Plant operating costs and forecast budget were reviewed. Plant operating costs are expected to remain relatively constant and are forecast at $810/tonne of product bromine.

1.14 Economic Analysis

An economic model has been used to forecast cash flow from elemental bromine production and sales to derive a net present value for the bromine reserves. Cash flows have been generated using annual forecasts of production, sales revenues, operating costs and capital costs.

At the assumed bromine sales price range of $1,938 to $3,525/tonne, the operations generate an NPV of $0.52 billion to $1.53 billion at a discount rate of 15 percent as of December 31, 2023, demonstrating economic viability.

1.15 Interpretation and Conclusions

JBC primary raw material is bromide enriched brine from the adjacent APC potash processing business. APC has mineral rights to brine extracted from the Dead Sea through 2058. The measured resources for bromide ion in the Dead Sea is far in excess of the stated proven reserves of 4.13 million tonnes of bromine. The operation has been in production since 2002 and has a demonstrated production capacity to support the reserve estimate.

1.16 Recommendations

No additional work relevant to the existing reserves is applicable at this time. The JBC plants have demonstrated capacity to operate at the production levels forecasted through the life of the reserve. No significant capital projects are anticipated to extend the life or expand the capacity of the existing plants.

2 INTRODUCTION

2.1 Issuer of Report

This Technical Report Summary (TRS) was prepared at the request of Albemarle Corporation (Albemarle), and this report is being filed under SEC S-K Regulation 1300 (SEC S-K 1300) reporting requirements for Albemarle's Jordan Bromine Company (JBC) operation located in Safi, Jordan. The JBC is a joint venture with Arab Potash Company (APC). Headquartered in Charlotte, North Carolina, Albemarle is a global leader in specialty chemicals such as lithium, bromine, and refining catalysts.

2.2 Terms of Reference and Purpose

The following general information applies to this TRS:

- This document reports the estimated reserves for the JBC operation as well as all summary information required by the SEC S-K 1300. The focus of this TRS and the scientific and technical information in this report only apply to the JBC operation. RESPEC Consulting Inc. (RESPEC) is entirely independent of Albemarle and has no interest in the mineral property discussed in this report.
- This TRS was prepared by RESPEC, complies with disclosure standards of the SEC S-K Regulation 1300, and follows the TRS outline described in CFR 17, Part 229.600.
- The point of reference (i.e., effective date) of this report is December 31, 2023, which is also the deadline for the data included within this report.
- Reserve estimates are presented on a 100 percent basis (i.e., the reserve is the total reserve for JBC) with Albemarle's share of the reserve per the joint venture with APC is 50 percent.
- Units presented are metric units, unless otherwise noted and currency is expressed in United States dollars (USD or $) unless otherwise noted.
- Copyright of all text and other matters in this document, including the manner of presentation, is the exclusive property of RESPEC and Albemarle as per the Agreement signed between RESPEC, RPS Group (RPS), and Albemarle.
- RESPEC will receive a fee for preparing this TRS according to normal professional consulting practices. The fee is not contingent on the conclusions of this report and RESPEC will not receive any other benefit for preparing this report. RESPEC does not have any monetary or other interests that could be reasonably considered as capable of affecting its ability to provide an unbiased opinion in relation to the project. RESPEC is a 100 percent employee-owned global leader in integrated technology solutions for mining, energy, water, natural resources, infrastructure, and services.

2.3 Sources of Information

The interpretations and conclusions presented in this report are primarily based on the information obtained from the public sources and information provided by Albemarle. All source materials have been properly cited and are referenced in Chapter 24.0 of this report.

2.4 Glossary

Description of terms that are used throughout this report are provided in Table 2-1.

Table 2-1 Glossary of Terms

Term	Abbreviation	Description
Assay		A test performed to determine a sample's chemical content.
Brine		A high-concentration solution of salt (NaCl) in water (H_2O).
Bromide	Br	A compound of bromine with another element or group, especially a salt containing the anion Br− or an organic compound with bromine bonded to an alkyl radical.
Bromine		A halogen element with atomic number 35 and element symbol Br that is the 10th most abundant element in sea water and 64th in the earth's crust.
Carnallite	$KCl.MgCl_2\ 6(H_2O)$	A mineral containing hydrated potassium and magnesium chloride.
Halite	NaCl	Sodium chloride, which is a naturally occurring sodium salt mineral.
Jordanian dinar	JD	Official currency of the Hashemite Kingdom of Jordan
Million cubic meters	MCM	Million cubic meters, a measurement of volume
Million metric tonnes	MMt	Million metric tonnes
Sylvite	KCl	Potassium chloride, which is a metal halide salt consisting of potassium and chlorine, also known as potash.
Sylvinite		A rock consisting of a mineralogical mixture of halite and sylvite crystals ± minor clay and carnallite.
Potassium Oxide	K_2O	A standard generally used to indicate/report a potash deposit ore grade.
Insoluble		Water-insoluble impurities (e.g., generally clay, anhydrite, dolomite, or quartz).
Seismic Anomaly		A structural change in the natural, uniformly bedded geology.
Tetrabromobisphenol-A	TBBPA	A derivative of bromine and is one of the most prevalent flame retardants used in plastic paints, synthetic textiles, and electrical devices.
United States dollar	USD or $	Official currency of the United States of America

2.5 Personal Inspection

RESPEC visited the JBC bromine processing plant in September 2023 to inspect and verify that the information provided by JBC was accurate. The visit was successful, offering valuable insights into its advanced technology, safety measures, and commitment to environmental standards. Engaging discussions with the plant's management underscored its dedication to efficiency, sustainability, and continuous improvement. This visit confirmed the plant's responsible and eco-friendly bromine production practices, contributing significantly to a comprehensive understanding of its operations.

2.6 Report Version

The user of this document should ensure that this is the most recent Technical Report Summary for the project.

This report is an update of a previously filed report titled "Jordan Bromine Operation. Technical Report Summary" with an effective date of December 31, 2022 and a report date of February 14, 2023.

3 PROPERTY DESCRIPTION

JBC is in the Hashemite Kingdom of Jordan (Jordan), in the Governorate of Karak, and is located on the southeastern edge of the Dead Sea. The JBC production plant facility occupies a 26-hectare (ha) area with geographic coordinates of 31° 8' 34.85"N and 35° 31' 34.68"E. The JBC site, as shown in Figure 3.1, is located approximately 6 kilometers (km) north of the APC plant.

JBC also has a 2-ha storage facility within the free-zone industrial area at the Port of Aqaba. The facility is used to store bulk-liquid products before export and is located near the Jordan Oil Terminals Company, which is just west of the Aqaba Thermal Power Station and east of Solvochem-Holland. The site contains storage tanks and pumps and is connected to the nearest oil port by a 1.5-km pipeline. An extensive expansion of this facility was completed in 2013[iii].

The administrative division of Jordan is shown in Figure 3.2. The country consists of 12 Governorates (i.e., Muhafazah). Control of the Dead Sea waters and minerals is shared by Jordan on the east and Israel (including the West Bank) on the west.

3.1 Jordan Land Management and Regulatory Framework

Established in 1927, the Department of Lands and Surveys (DLS) is responsible for all legal property registration in Jordan. The DLS "has been established on a solid basis" according to *The Land Tenure Journal*, which is a peer-reviewed, open-access journal of the Climate, Energy and Tenure Division of the Food and Agriculture Organization of the United Nations[iv].

The Jordan Valley Authority (JVA) manages various aspects of economic activity and agriculture water management on the Jordan side of the Jordan Valley. The Aqaba Special Economic Zone Authority (ASEZA) is responsible for most government-related issues in the Aqaba Region[4]. The ASEZA was established in 2001 by the government of Jordan to independently (financially and administratively neutral) manage and regulate the economic development of the Aqaba Special Economic Zone. A description of the ASEZA and the laws and regulations are available at its website (http://www.aqabazone.com/).

The Ministry of Energy and Mineral Resources is the primary regulator of most mining activities in Jordan that provides information (e.g., studies and maps) to interested companies and investors to help facilitate exploration and extraction. These efforts promote a strong regulatory environment with international industry standard environmental and safety best practice regulations[v].

3.2 Mineral Rights

3.2.1 Jordan Bromine Company and Albemarle Joint Venture

JBC was established in 1999 as a joint venture between Albemarle Holdings Company Limited (a wholly owned subsidiary of Albemarle) and APC. Albemarle holds a 50 percent interest in JBC Limited. The bromide-enriched brine is a by-product of potash operations conducted by APC. JBC's operations primarily consist of the manufacturing of bromine, from which derivative products are made including TBBPA, calcium bromide, sodium bromide, hydrobromic acid, and potassium hydroxide.

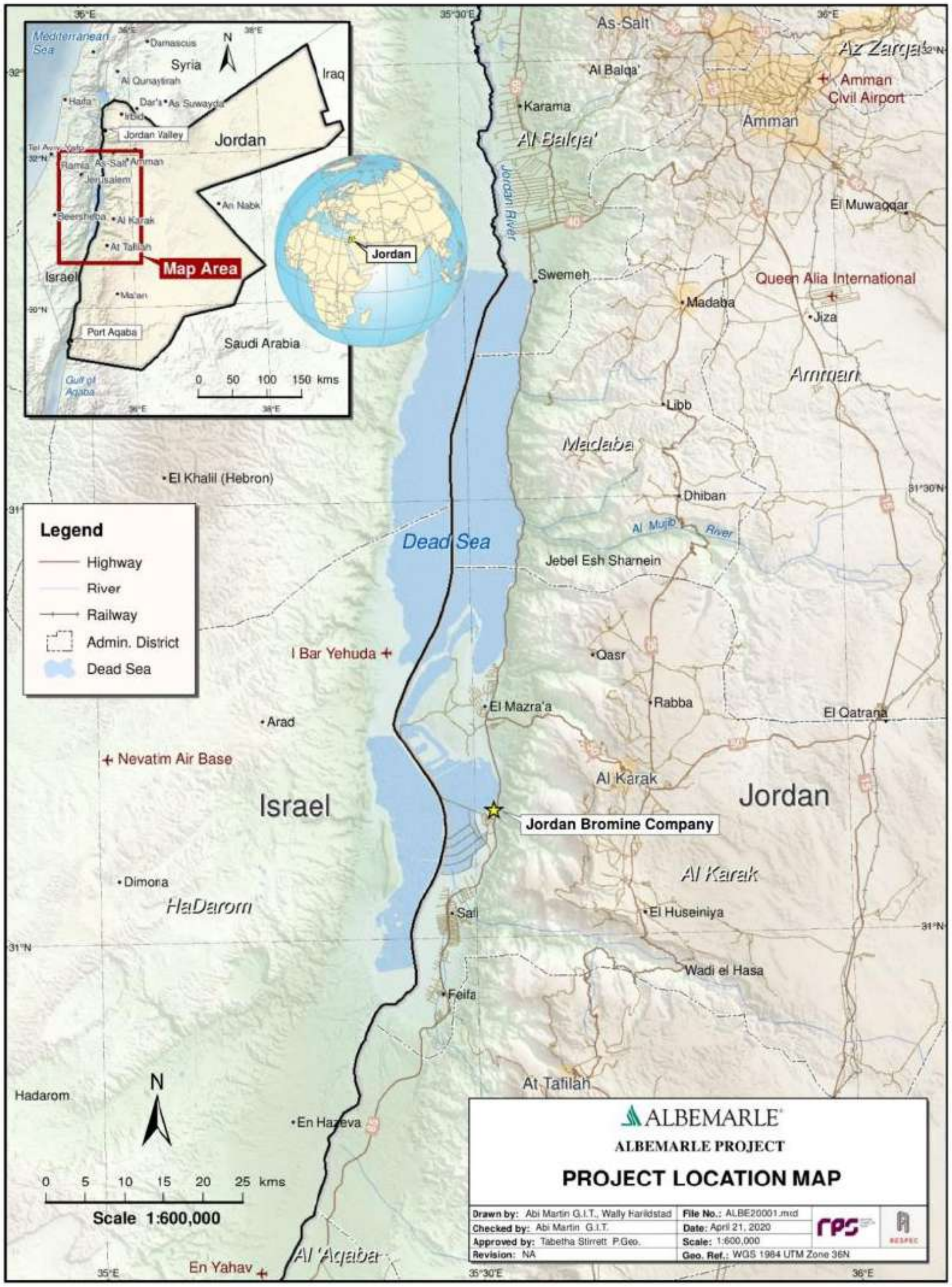

Figure 3.1: Jordan Bromine Company Project Location Map.

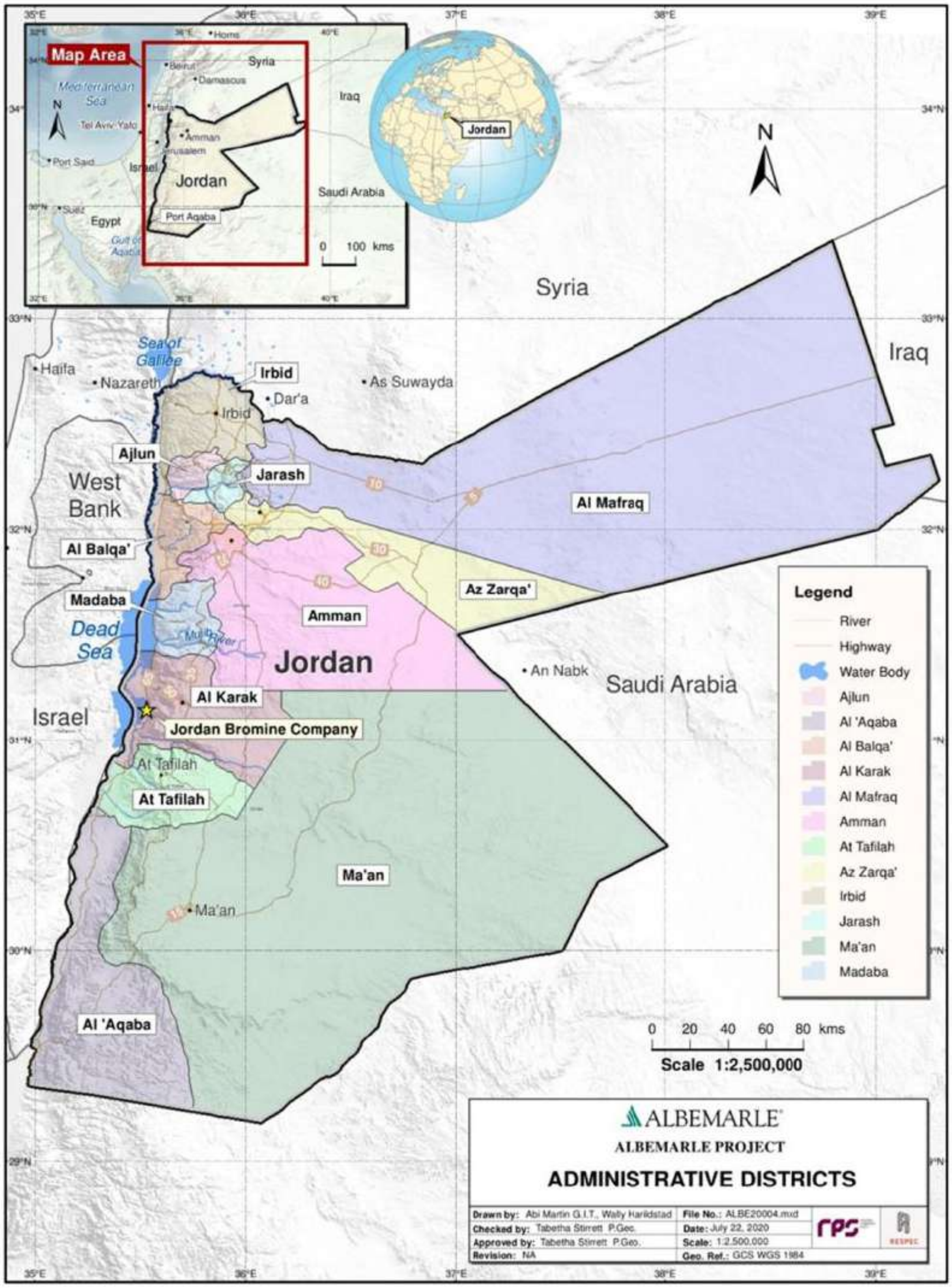

Figure 3.2: Administrative Divisions of Jordan.

The share agreement signed between APC and Albemarle Holdings Company Limited established that Albemarle's share on the losses, liabilities, and interest expense of the joint venture is 50 percent; however, its share in the joint venture's profit was 70 percent until 2012 and has been 60 percent since 2013. This percentage varies and depends on product split.

In 1958, the Government of the Hashemite Kingdom of Jordan granted APC a concession for exclusive rights to exploit the minerals and salts from the Dead Sea brine until 2058; at that time, APC factories and installations would become the property of the Government[vi]. APC was granted its exclusive mineral rights under the Concession Ratification Law No. 16 of 1958.

APC produces potash from the brine extracted from the Dead Sea. A concentrated bromide-enriched brine extracted from APC's evaporation ponds is the feed material for the JBC plant, as well as for the Manaseer Magnesia Company (MMC) (formally Jordan Magnesia) plant. The most relevant clauses of APC's concession Agreement with the Government of Jordan are summarized in the following text:

- The agreement grants to APC licenses to import all devices, tools, transport means, machinery, and construction material necessary for the entire duration of the concession, its expansion or completion, work continuation, and relocation.
- APC is exempted from import fees, customs fees, and all other fees imposed on imported goods, provided they are used for the purposes of the company. If APC sells the fee-exempted goods, those goods are subject to taxation as per the Jordanian customs law.
- APC's products are exempt from exportation licenses and all fees imposed on exported goods.
- APC retains exclusivity over the mining rights throughout the term of the concession.
- The concession grants ample rights to APC to acquire fresh water from the Jordan River, the Al Mujeb or the Maeen and Sweimeh, to be used at its facilities for mineral extraction and processing as well as to drill wells in the concession area to obtain fresh water. APC also has the right to use spring water from sources located out of the concession area, with the exception of sources that are registered as private property, and the right to request expropriation at the company's expense.
- APC also has the right to establish stone quarries on fee- and license-exempted, state-owned land.

All these rights are applicable to JBC by virtue of APC's participation in the joint venture.

3.2.2 Arab Potash Company

According to APC's website (http://arabpotash.com), they are the eighth largest potash producer in the world by volume of production and the sole producer of potash in the Arab world. APC also has one of the best track records among Jordanian corporations in the areas of work safety, good governance, sustainable community development, and environmental conservation. Established in 1956 in the Hashemite Kingdom of Jordan as a pan-Arab venture, APC operates under a concession from the Government of Jordan that grants it exclusive rights to extract, manufacture, and market minerals from the Dead Sea brine until 2058. Upon termination of the concession, 100 years from the date it was granted, ownership of all plants and installations will be transferred to the Government of the Hashemite Kingdom of Jordan at no cost to the latter.

In addition to its potash operations, APC also invests in several downstream and complementary industries related to the Dead Sea salts and minerals, including potassium nitrate, bromine, and other derivatives. As a major national institution and economic contributor, APC employs more than 2,200 workers across its locations in Amman, Aqaba, and Ghor Al-Safi. Potash production began in 1983 and has since progressed with various projects aimed at optimizing and expanding this production. The initial plant was built to a capacity of 1.2 million tonnes (MMt) of product and was expanded in the late 1980s to handle 1.4 MMt with key modifications undertaken with the Solar System to enhance the production of the ore accordingly. A second plant based on different technology with a capacity of 0.4 MMt was built in

1994 and brought the total production capacity to 1.8 MMt. Another cold crystallization plant of 0.45 MMt was built in 2010, which brought the total production capacity to 2.45 MMt. Further expansion is currently under evaluation to bring the total potash capacity to 3.2 MMt.

3.3 Significant Encumbrances or Risks to Performing Work On Permits

The brine supply to the JBC facility fully depends on raw material extracted and pre-processed, through an evaporation sequence, by APC. The pumping facilities, which will be described later in this report, are owned and operated by APC and covered by APC's permits. Because APC is a national enterprise and the sole producer of a key commodity, all the necessary permits are maintained by APC to guarantee the continuous operation of its facilities under Jordanian legislation. Therefore, the encumbrances and/or risks to perform work on the operational permits are considered minimal. The fact that APC is both the entity controlling the subject mineral rights and a partner in the joint venture, JBC contributes to a seamless coordination regarding the key permitting aspects of the operation.

4 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

4.1 Topography and Vegetation

The surface of the Dead Sea is at an elevation of approximately 430 meters (m) below sea level[vii] within the Dead Sea Rift Valley, which is the lowest surface on earth. The Dead Sea Rift Valley contains a series of pull-apart basins, including the Jordan Valley and Wadi Araba/Arava Valley, that connect to the Dead Sea[viii].

The Jordan River is within the Jordan Valley that extends south from the Sea of Galilee to the north and connects to the northern shoreline of the Dead Sea. The Jordan River is the only major source of water to the Dead Sea[ix]. The Jordan Valley is named the "food basket of Jordan." With a continual supply of water (dams and irrigation) and its year-round warm temperatures, the Jordan Valley and the Southern Ghor are among the most important agricultural areas in Jordan[9].

The Wadi Araba/Arava Valley extends from the southern shore of the Dead Sea and continues south to the Port of Aqaba. This valley is geologically related to the Jordan Rift Valley[x]. This stretch of valley land is predominantly sand-dune-covered desert with scattered settlements, but the northern and the southern shore areas support some irrigated agriculture[10].

Most of the Dead Sea shoreline is surrounded by steeply dipping, incised valleys and mountainous terrain. From the Port of Aqaba, the elevation rises from sea level to about 200 m above sea level along the Wadi Araba Ghor and drops drastically below sea level at the Dead Sea. The elevation gently rises but stays below sea level along the Jordan River/Valley depression, north to the Sea of Galilee (Figure 4.1).

The Wadi Araba - Dead Sea depression steeply rises to the east and forms the mountain ridge (known as the Northern Highlands), which is home to Jordan's natural forests and are intersected by many deep wadis (canyons)[9]. Mountain elevations reach 1,850 m above sea level and are steeper and less vegetated in the south along the mountain ridge[9].

An east-west ridge separates the deep northern Dead Sea basin from a shallow southern Dead Sea basin (or lagoons). The Dead Sea is approximately 80 km long, 13 km wide and around 330 m deep in the north basin[xi]. The southern shallow basin is made up of shallow lagoons that average 2 m in depth. The southern basin would be exposed and dried up because of the continued drop in sea level if not for their current use as solar evaporation ponds that were constructed for the chemical extraction industry[10].

Saline-tolerant vegetation begins to grow 50 to 100 m from the Dead Sea shoreline and diversifies to less salt-tolerant vegetation moving away from the Dead Sea, with vegetation variety and density increasing within the wadis[3]. Figure 4.2 displays the vegetation types in Jordan.

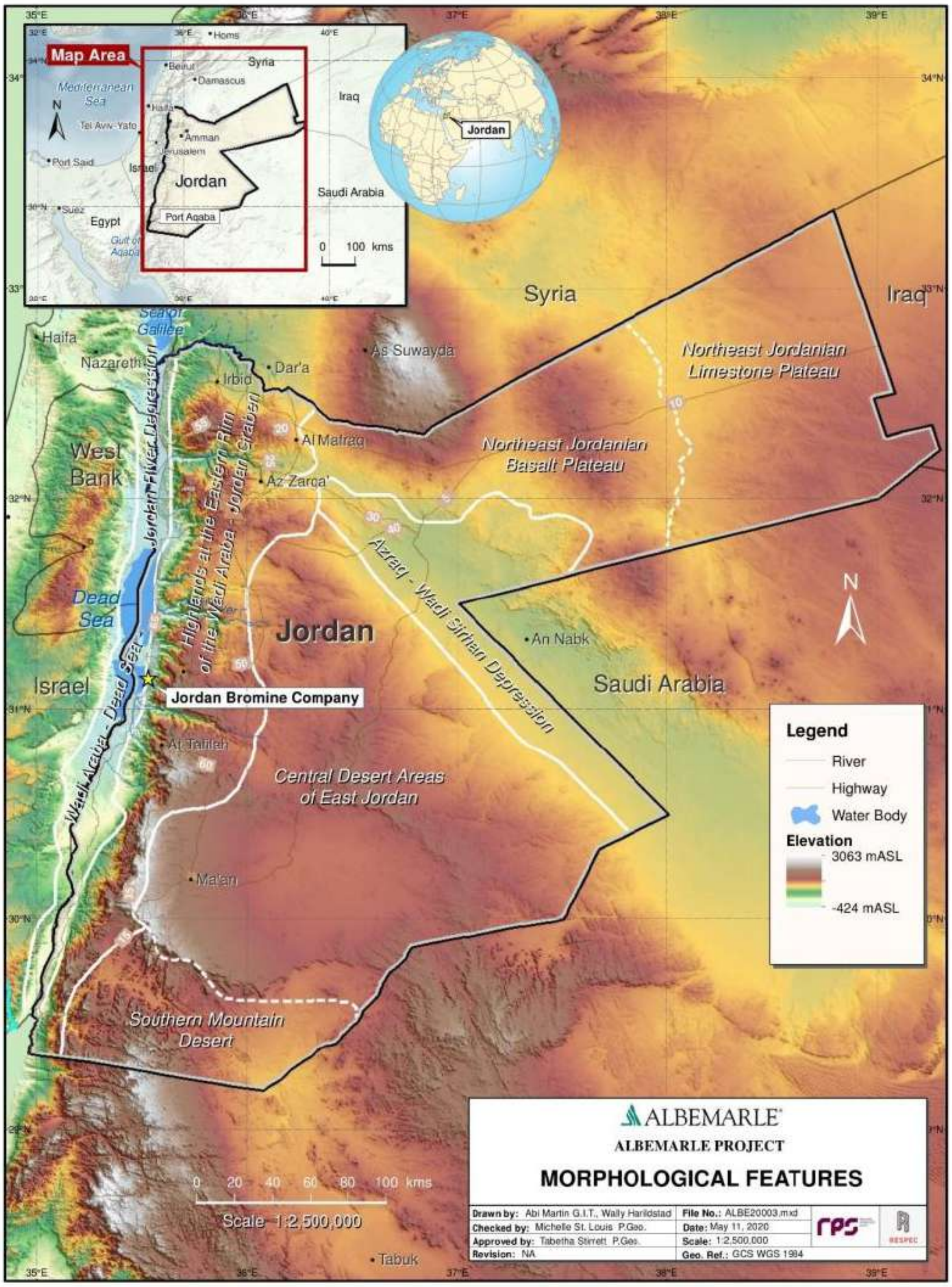

Figure 4.1: Morphological Features and General Elevation.

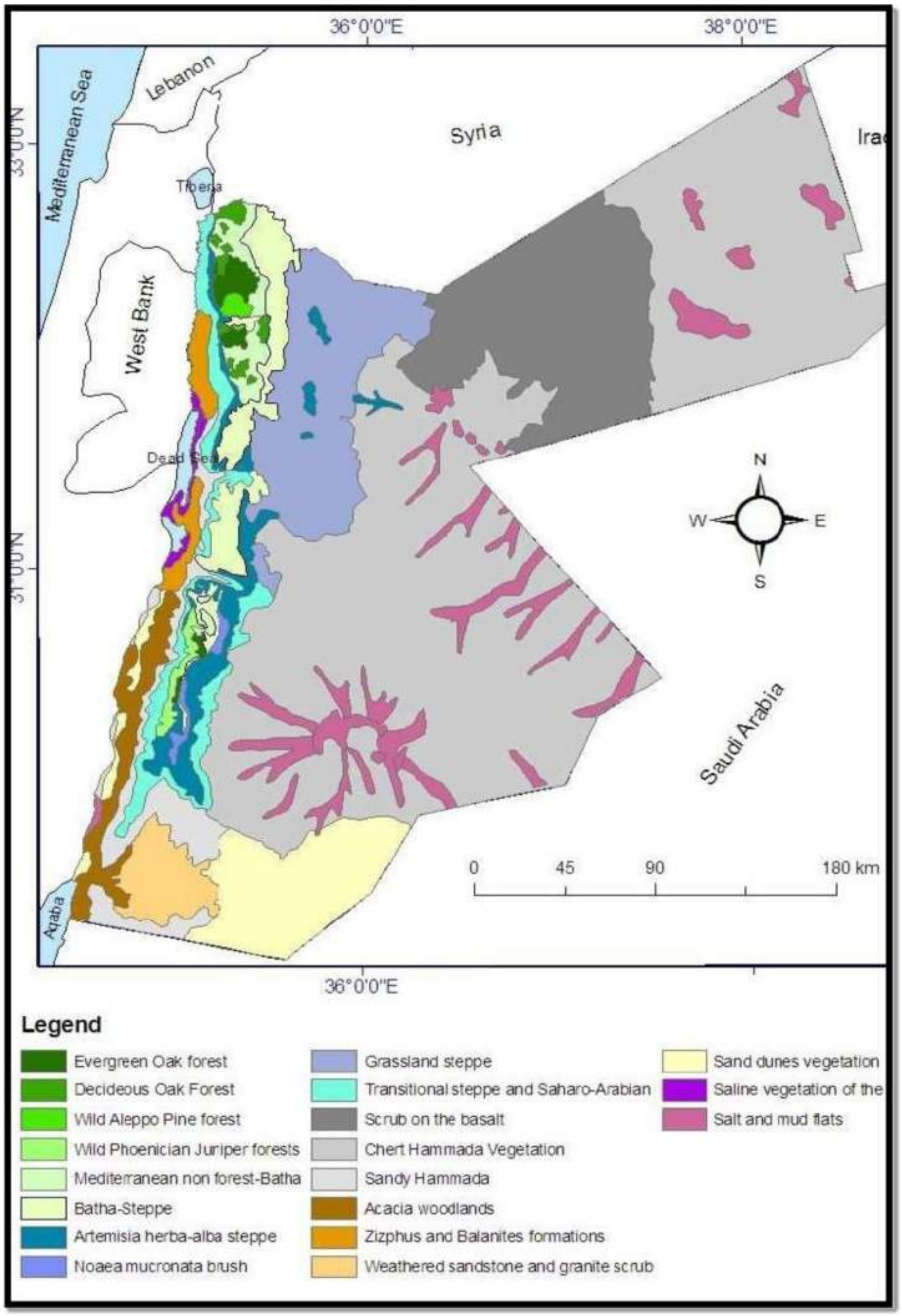

Figure 4.2: Vegetation Types of Jordan[3].

The Gulf of Aqaba (or Gulf of Eilat, Israel) is a large gulf at the northeastern tip of the Red Sea. The gulf is 177 km long with an average width of about 12 to 17 km [https://www.britannica.com/place/Gulf-of-Aqaba]. The gulf coastline is primarily mountainous with the east side bordered by Jordan (approximately 27 km of Jordan coastline is on the northeastern portion) and Saudi Arabia. The west side of the gulf is bordered by Egypt and a small portion of Israel coastline (in the very northwestern portion of the gulf).

4.2 Accessibility and Local Resources

The geographical location of Jordan has made it a crossroads of the Middle East for thousands of years. Jordan continues to play a major role by participating in and providing a fairway for trades because of its location at the junction of Africa, Asia, and Europe[4].

JBC is approximately 137 km south-southwest from Amman (the capital city of Jordan) and 40 km from the city of Al-Karak. The Jordan Valley Highway/Route 65 runs north-south and locally along the east side of the Dead Sea and is the primary access method for supplies and personnel to JBC. The Port of Aqaba is the main entry point for supplies and equipment for JBC, where shipping containers imported on ships are offloaded to trucks and transported to JBC via the Jordan Valley Highway/Route 65.

The Jordan Valley Highway/Route 65 is a major highway that runs from the northwestern region of Jordan (from North Shuna) along the western edge of Jordan and south to Aqaba and the Port of Aqaba. JBC is situated midway along this highway, which is interconnected to several primary and secondary highways available to the western region of Jordan.

From the outskirts of Amman, JBC can be accessed via vehicle by traveling southwest on Dead Sea Road/Route 40 for approximately 35 km and then south on the Jordan Valley Highway/Route 65 for 77 km. Various networks of primary and secondary highways and roads surround Amman.

JBC is 40 km from Al-Karak (one of Jordan's major cities) and can be reached via vehicle by travelling west on Al-Karak Highway/Route 50 for 26 km to Jordan Valley Highway/Route 65 and then south for 12.2 km. The community of Gawr al-Mazraah is in close proximity to JBC and is located 14.5 km north of JBC along Jordan Valley Highway/Route 65. The primary and secondary highways are provided in Figure 3.1.

The Port of Aqaba is located 205 km south of JBC along the Jordan Valley Highway/Route 65 and is the only port in Jordan and the main entry point for supplies and equipment for JBC. The Jordanian port is on the Red Sea's Gulf of Aqaba and is owned by the Aqaba Development Corporation. The port has undergone major redevelopment and expansion since 2002 and consists of 12 terminals with more than 32 specialized berths, which are operated by world-class operators (https://www.adc.jo/).

Jordan has three commercial airports that are all located within proximity to the JBC plant, as shown in Figure 3.1. The Queen Alia International Airport and Amman/Marka Civil Airport are 35 km south of Amman and located approximately 121 km north and northeast of JBC via Jordan Valley Highway/Route 65 and secondary roads and highway. The King Hussein International Airport is in Aqaba, which is 205 km south of JBC.

Jordan's railway transport line is operated by Hijazi Jordan Railway and the Aqaba Railway Corporation (Al Rawabi Environment & Energy Consultancies). The line runs north-south through Jordan and is not used to transport JBC employees and/or product.

4.3 Climate

Located within a desert, the Dead Sea and its shoreline is extremely arid. Summer temperatures average 34 degrees Celsius (°C) in August with maximum temperatures reaching 51°C. Mild winter temperatures in January average 17°C on the south shore and 14°C on the north shore[7]. Hot, dry southerly winds can be very strong and can potentially cause sandstorms. Rainfall averages are only 2.5 inches (65 millimeter) per year[7] and occurs primarily during the winter months of November to March; January is the coldest and rainiest month in the Ghor Safi area[3]. Figure 4.3 is taken from the Red Sea Dead Sea Water Conveyance Study[10] and depicts the average annual rainfall over an area that included Jordan and Israel.

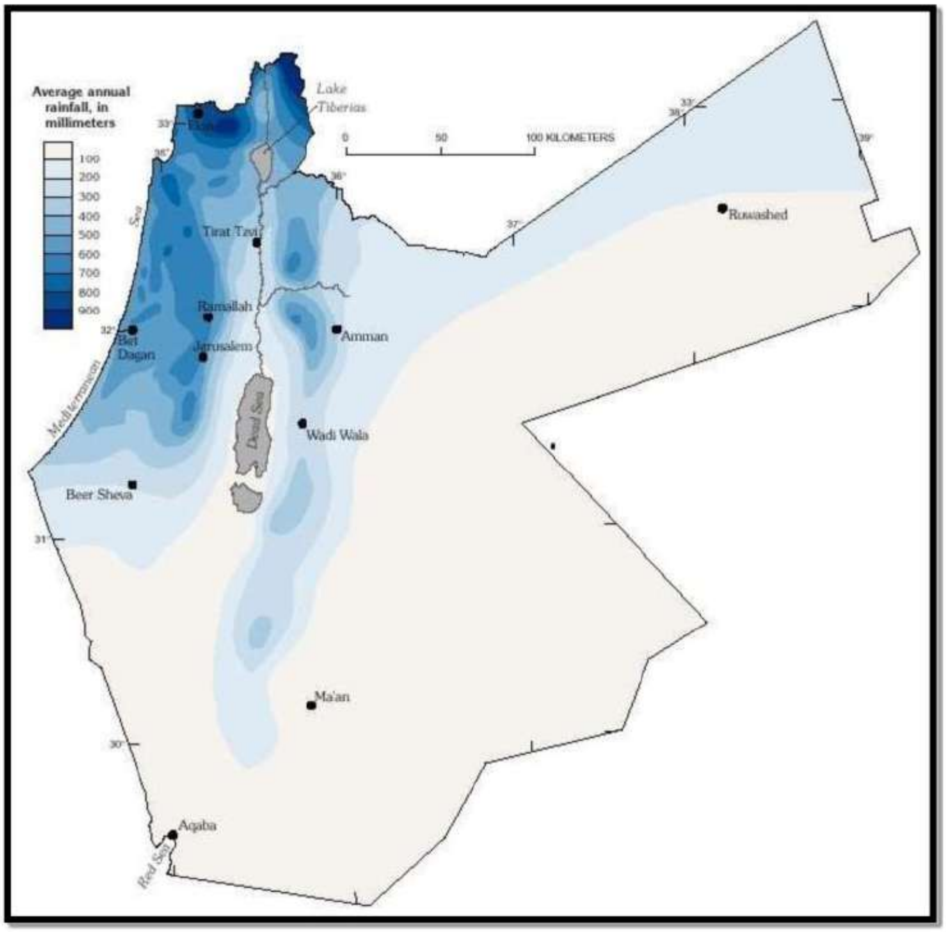

Figure 4.3: Average Annual Rainfall [10].

4.4 Infrastructure

The JBC facility is located in the Karak Governorate of Jordan and is connected to the nearby city of Al-Karak by the Jordan Valley Highway/Route 65 and the Al-Karak Highway/Route 50. The site is connected to the city of Amman by the Dead Sea Road/Route 40 and the Jordan Valley Highway/Route 65. The Jordan Valley Highway/Route 65 connects the facility with the Port of Aqaba in the Red Sea.

Electricity is generated through the National Electric Power Company of Jordan (NEPCO) and is distributed directly to JBC through the Electricity Distribution Company (EDCO). EDCO is owned and operated by Kingdom Electricity Company, which is one of the preeminent holding companies in Jordan that invests in energy generation and distribution companies/utilities.

In February 2014, Noble Energy Inc. (Noble Energy), a partner in Israel's Tamar natural-gas field, announced that they had signed an agreement to supply APC and JBC with fuel beginning in 2016[xii]. In January 2017, APC and JBC were connected to Israel's national pipeline network and gas exports had started that month. The agreement with Noble Energy appears to have a duration of 15 years (until 2032) and is based on a price of $5.50 per million British thermal unit (USD/btu) and be linked to the price of Brent crude oil[xiii].

In November 2018, APC and JBC announced that the quantity of natural gas that Noble Energy would supply to both Jordanian companies would increase in 2019. This additional agreement would extend until the end of the original agreement in 2032[xiv]

JBC employs more than 350 people. Most personnel who work shifts (i.e., lower-technical staff and labor) typically stay in a company residence located near the JBC plant, and higher-level technical staff and management usually commute from Amman[3]. The company residence is equipped with internet, televisions, a sports hall, and a cafeteria that is catered by a contractor[3]. Small towns and villages are located between Amman and JBC; however, few personnel reside in these communities.

The Port of Aqaba is the main entry point for supplies and equipment for JBC, where shipping containers imported on ships are offloaded to trucks and transported to JBC via the Jordan Valley Highway/Route 65.

4.5 Water Resources

Fresh water is supplied by the Mujib River that originates from the Mujib Reservoir (or dam), which is a man-made reservoir created in 1987 by the Royal Society for the Conservation of Nature. The Mujib River flows west through the Wadi Mujib Canyon and into the Dead Sea. According to JBC, approximately 1.0 to 1.2 million cubic meters (MCM) of water is used annually. Per the JV agreement, APC guarantees that JBC will receive all the brine and fresh water it requires for its operations.

JBC's water supply is provided by APC. APC is enhancing its water security through several projects, primarily by constructing dams in the southern regions. APC has financed the construction of the 4 million m3 Wadi Ibn Hammad Dam in the Al-Karak Governorate and is studying the feasibility of financing the construction of Al-Wadat Dam in the Tafilah Governorate. These projects will achieve water cost savings and provide water to the local communities and the agriculture sector[6].

5 HISTORY

JBC is Jordan's first and only producer and manufacturer of bromine and bromine derivatives and was established in January 1999. JBC is registered as a private Free Zone Establishment in Safi, located in the southeastern area of the Dead Sea, Jordan, and is the first Jordanian company to become certified in the International Maritime Dangerous Goods (IMDG) Code, the Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), and the International Air Transport Association (IATA). JBC has successfully established sales in more than 30 countries worldwide since its inception and is the first company of its kind in Jordan to become an authorized exporter to Europe.

The following timeline is the history of the development of JBC joint venture and is summarized from the Albemarle Website.

- **1999**: Albemarle forms a joint venture with Jordan Dead Sea Industries Company (JODICO) and APC to manufacture bromine and bromine derivatives in a world-scale complex to be built in Jordan.
- **2000**: JBC is registered as a private Free Zone Establishment in Safi in southeast Jordan in June.
- **2002**: The JBC bromine plant begins operation.
- **2003**: Hydrogen bromide (HBr) and calcium bromide (CaBr)/sodium bromide (NaBr) plants begin operating. JBC also becomes an authorized exporter to Europe of bromine and bromine derivatives.
- **2005**: JBC receives IMDG, ADR, and IATA certifications. The chlorine plant begins operations.
- **2011**: JBC announces that it will double the capacity of its bromine production to meet expanding global customer requirements.
- **2013**: JBC completes the first phase of its expansion to double its bromine production capacity.
- **2017**: The expansion of JBC's TBBPA facilities goes into operation.

6 GEOLOGICAL SETTING, MINERALIZATION, AND DEPOSIT

6.1 Regional Geology

The Dead Sea Basin, as shown in Figure 6.1, is a tectonically subsiding, strike-slip depression that belongs to the Aqaba-Dead Sea-Jordan Valley rift that formed between the African and Arabian diverging tectonic plates (an active plate boundary) and connected the Red Sea to Turkey[xv]. The Dead Sea depression is a result of the transform faulting between the plates; the Western Boundary fault and the Arava fault are drawn on Figure 6.2[1]. The Dead Sea is a hypersaline lake within the lowest part of the catchment basin and is a unique, current-day example of evaporitic sedimentation and accumulation within a brine body[1].

Movement of the plates that created the basin began 15 million years ago (Ma) and the plates continue to diverge at a current rate of 5 to 10 mm per year[1]. Holocene and Miocene sediments comprise approximately 8 to 10 km of the basin fill that underlies the Dead Sea[1]. The Mediterranean Sea water is believed to have invaded the trough depression around 4 to 6 Ma and deposited 2 to 3 km of halite-rich evaporites of the Sedom Formation[1]. These evaporites form diapirs and subcrops along the Western Margin faults[1] within the basin. Mount Sedom is an exposed salt diapir at the southwest corner of the Dead Sea. Fluviatile and lacustrine sediments of the Amora and Lisan Formations comprise 3 to 4 km of sediments that overlie the Sedom Formation and underlie the Dead Sea deposits, as shown in Figure 6.2[1]. Figure 6.3 provides a simple schematic of the structural features for the Dead Sea area. The JBC Environmental Impact Assessment Report, 2012 includes a figure drawn by Powell [1988][xvi] that illustrates the generalized geological map of the JBC area and is provided in Figure 6.4.

6.2 Local Geology

The Dead Sea is not only the lowest surface on earth but is also the saltiest natural lake on earth with an average salinity of 342 grams per kilogram (g/kg) as of 2011, which is 9.6 times as salty as the ocean[xvii]. The climate, geology, and location provide a setting that makes the Dead Sea a valuable large-scale natural resource for potash and bromine. When the Dead Sea was first formed, the volume was likely 4 to 5 times larger than the current volume[2]. Today, the Dead Sea waterbody has a surface area of 583 square kilometers (km^2) and a brine volume of 110 cubic kilometers (km^3)[1].

Warren [2006][1] explains that the northern basin is the only permanent body of water (See Figure 6.1, Physiological Features Map). The southern basin is a saline pan and saline mudflat that would have been subaerially exposed, but the water level is maintained by artificial flooding with north basin brine and controlled evaporation for industrial salt extraction on the Israeli and Jordanian sides of the Dead Sea. Warren [2006][1] draws the various depositional settings and general geology surrounding the Dead Sea, including the saline mudflats and pans at the southern end of the sea, as depicted in Figure 6.5.

Evaporation greatly exceeds the inflow of water to the Dead Sea, especially since the mid-twentieth century, because of increased diversion and damming of the Jordan River for agricultural and domestic use. The Dead Sea has been receding approximately 1.1 to 1.25 m per year[1]. Warren [2006][1] described that in 400 years (from 2006), the Dead Sea will drop 80 m below its current sea level and the remaining brine will have approximately 380 grams per liter (g/L) of dissolved solids and a density of 1.27 kilograms per liter (kg/L). Simply, these rates suggest that the surface of the Dead Sea will drop approximately 1 m and, depending on the slope, the shoreline could travel 5 to 6.25m seaward over a span of 5 years. While action on falling sea level may be considered a risk to the rights of access to the resources and ultimately reserves, this is not considered likely to be a problem prior to expiry of the lease agreement in 2058.

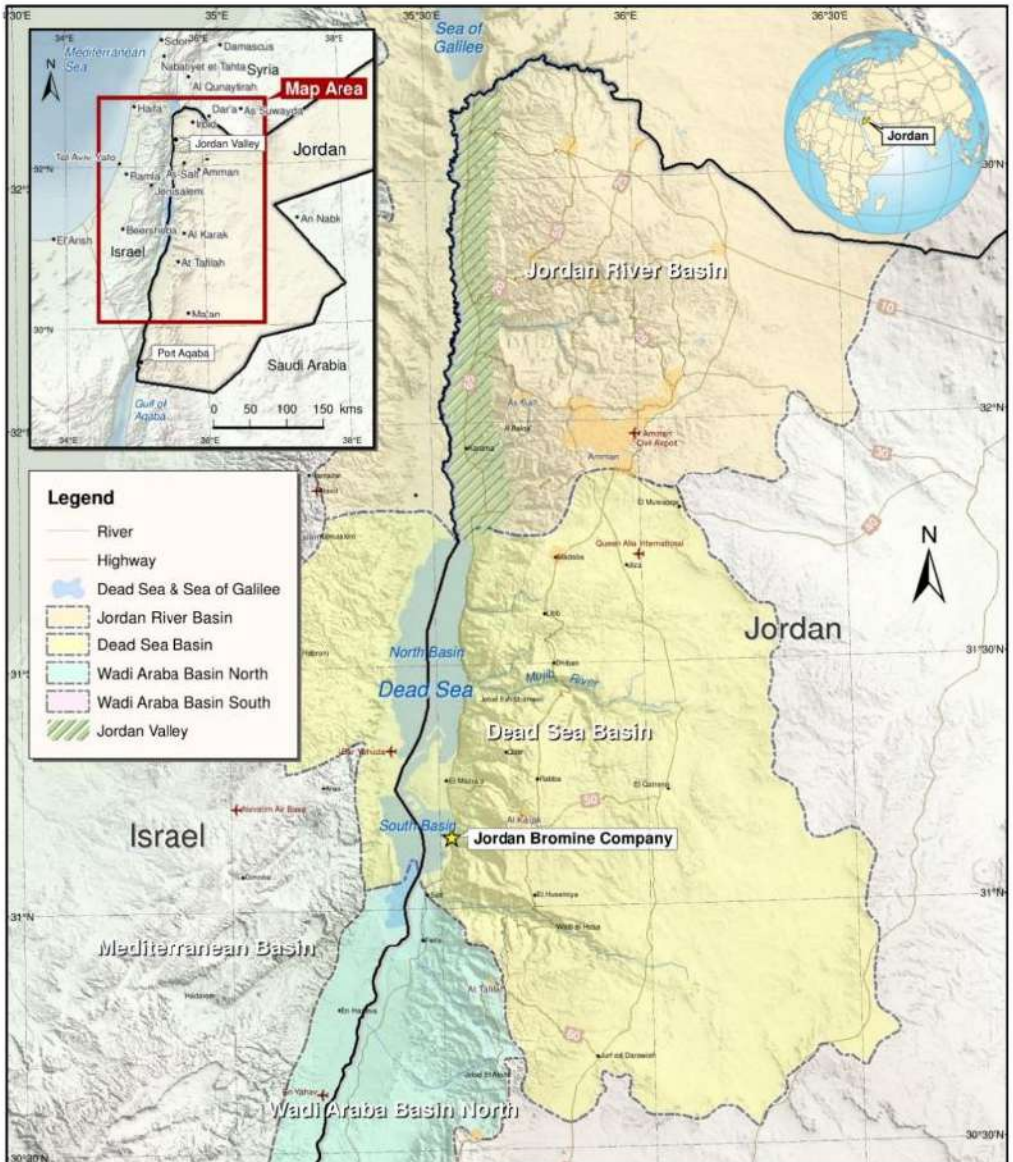

Figure 6.1: Physiological Features.

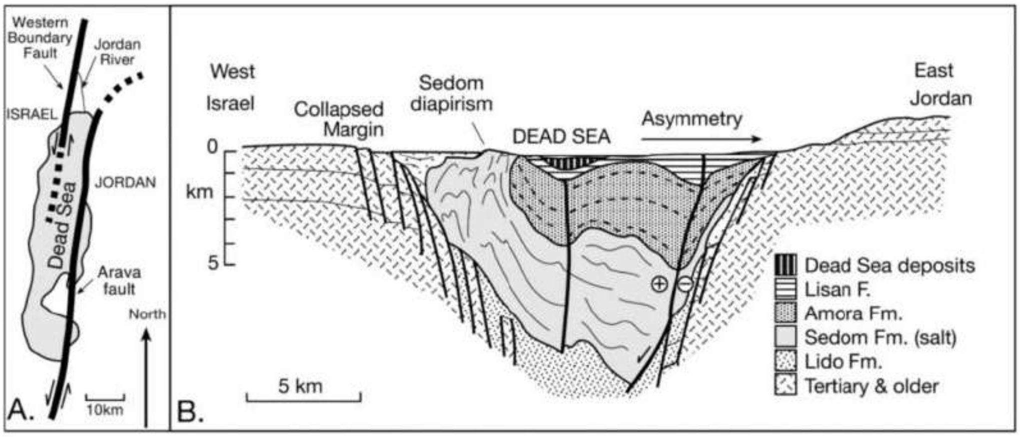

Figure 6.2: (A) Plan View of the Dead Sea in Relation to the Western Boundary Fault and the Arava Fault and (B) Generalized Cross Section of the Dead Sea Lake Geology[1].

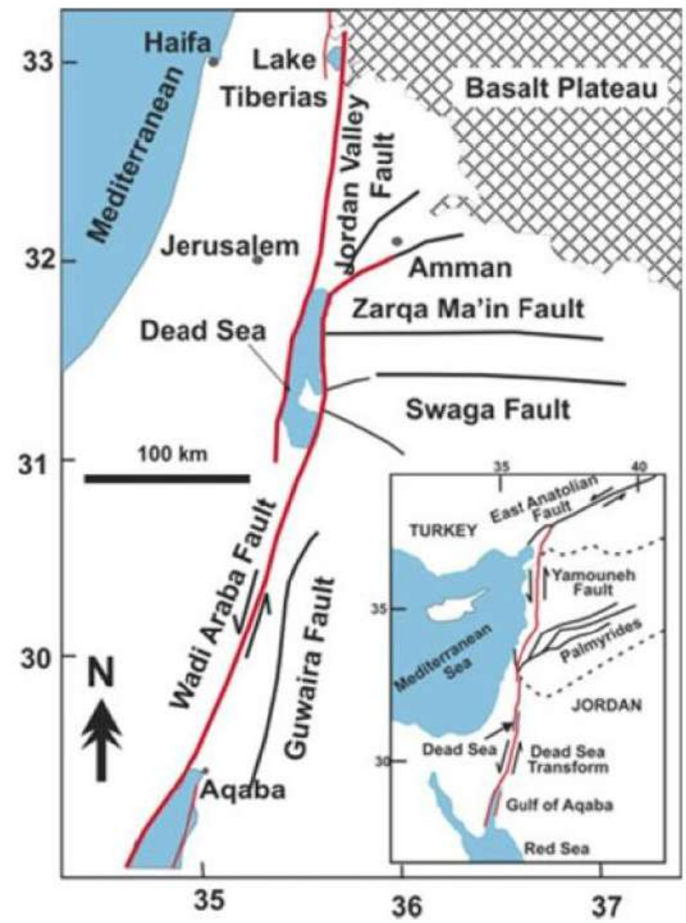

Figure 6.3: Main Regional Faults in the Area [18].

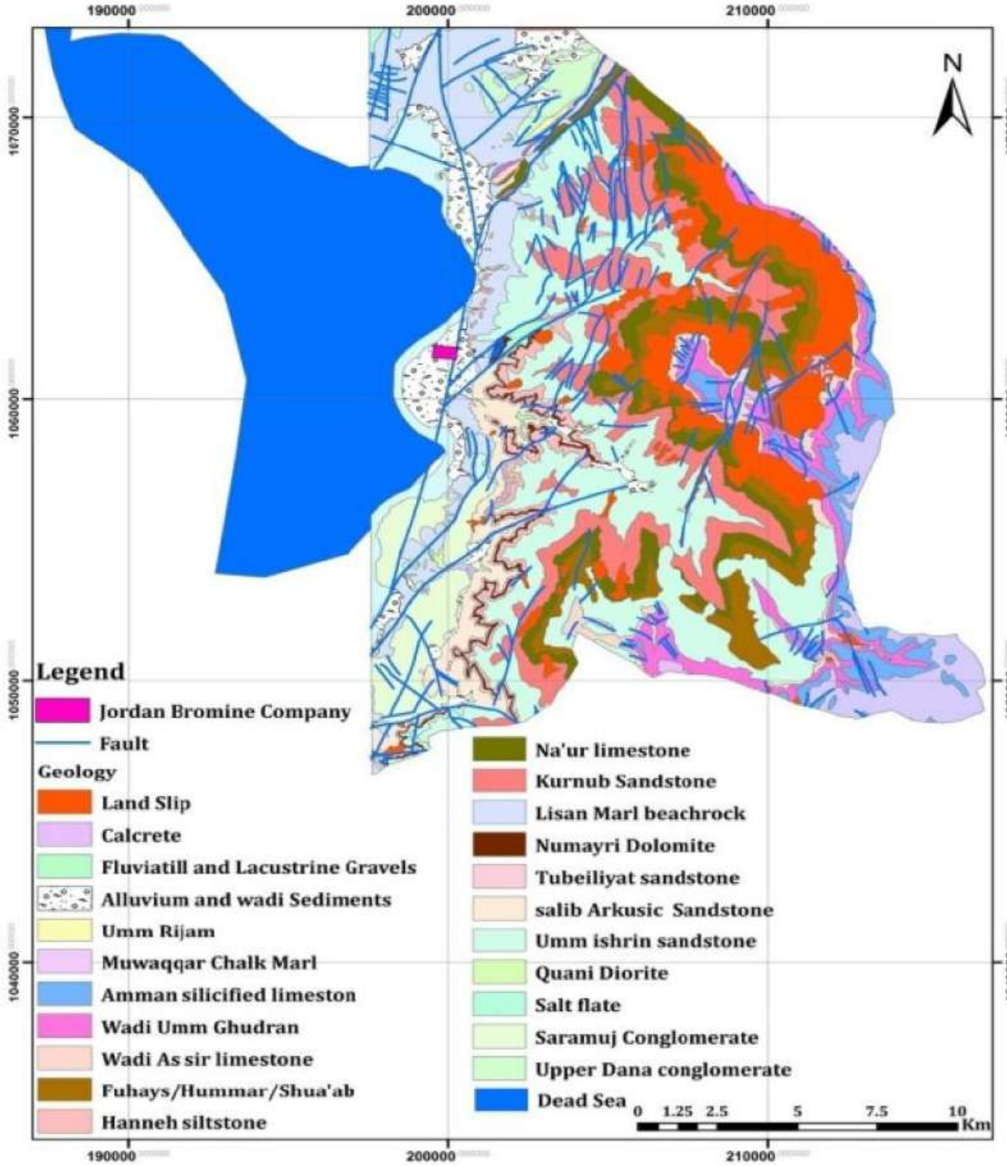

Figure 6.4: Map of the Jordan Bromine Company Area and Its Generalized Geology, Including Faults [10,17].

The sea level generally rises slightly in winter by unpredictable, brief runoff and sudden flood events[1]. As the sea level continues to decrease, the brine/freshwater interface within the surrounding groundwater moves toward the sea[19]. The infiltration of less saline groundwater is causing the dissolution of localized rock salt in the ground, thus causing an increased occurrence of sinkholes. The Dead Sea level is expected to continue decreasing with the ongoing demand for fresh water within the area[19]. Chemical extraction by solar evaporation ponds in the southern basin also contributes to the drop in the sea level by artificially increasing the rate of evaporation[19].

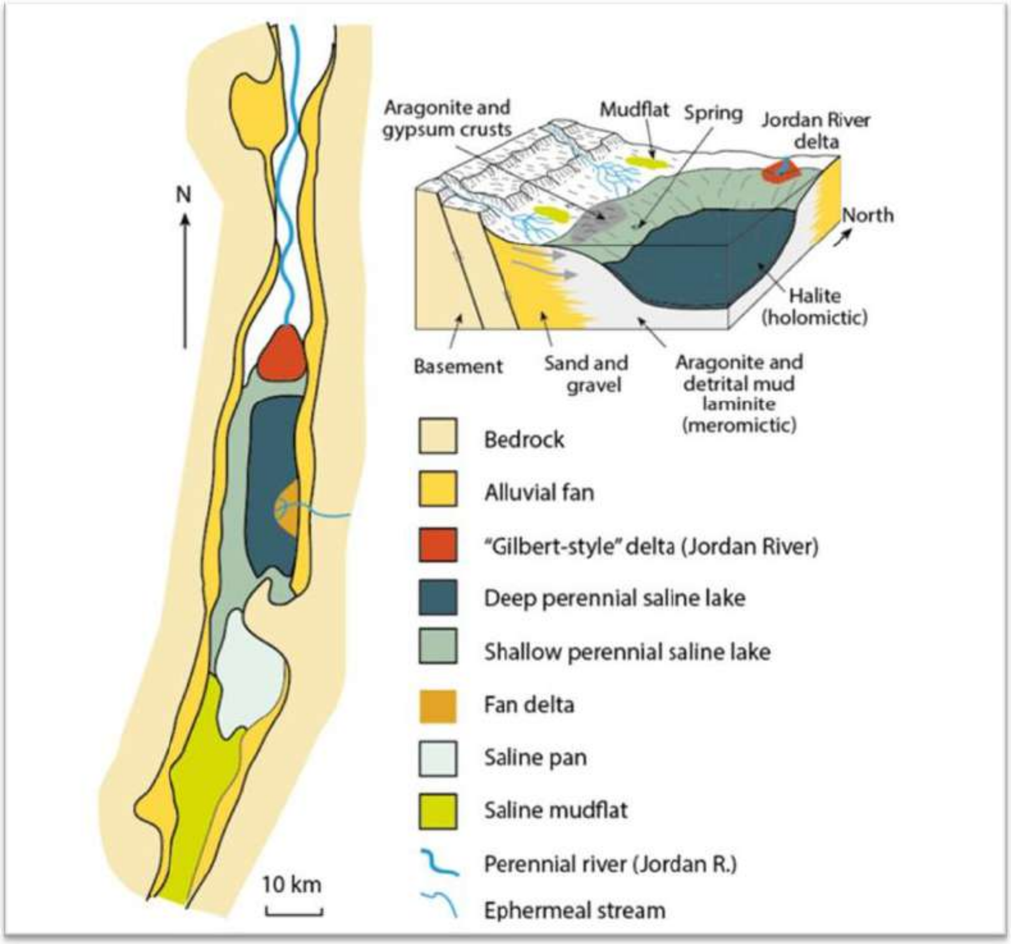

Figure 6.5: Depositional Settings of the Dead Sea[1].

The Red Sea-Dead Sea Water Conveyance Study Program – Final Report[19] states that water balance estimates for the Dead Sea vary wildly because of unknown amounts of water influx from underground streams, variable evaporation rates and an uncertain accumulation of salt collecting on the sea floor. The study also mentions that an evolution of the sea water occurs as the climate becomes warmer and the water becomes more saline and denser with time. Evaporation of the Dead Sea water slows as the water salinity increases[1].

Until 1979, the Dead Sea waters were stratified, and water density increased with depth[1]. The decreased influx of fresh water from the Jordan River, evaporation, and increased influx of end brine from the southern evaporation ponds caused an increase in surface-water salinity and density, which led the deep waters to overturn, mix with the surface waters, and homogenize and oxidize the entire water column in 1979[xx]. After 1979, the Dead Sea became less stratified with periodic intermixing of layers (holomictic) and only periodically alters from holomictic to more rigidly stratified (meromictic) with episodes of higher-than-normal influx of fresh water into the basin[1]. During the Holocene era, overturn occurred periodically and is marked by a well-developed, coarse crystalline, deep-water halite.

The Dead Sea is supersaturated with halite (NaCl), and coarse crystalline halite has been rapidly accumulating at the bottom of the Dead Sea since the overturn in 1979[1]. Fine-grained halite interbedded with gypsum layers is more common around the sea edge and shallow waters (less than 50 m depth)[1]. During the summer, sea waters become thermally stratified with the sun's extra heat; the surface waters become warmer and the sea divides into two distinct layers [21]. The warmer, surface layer also becomes saltier than the lower, cooler layer because of increased evaporation[22]. Winter is generally associated with supersaturated levels of NaCl [2].

6.3 Property Geology and Mineralization

Supersaturated with halite, the Dead Sea has an annual negative water balance (i.e., the sea level drops), which is a result of the diversion of fresh water that would normally drain into the Dead Sea[20]. The water deficit by volume is greater than appears as the water level falls because of the coinciding salt precipitation on the sea floor. The water balance is complicated and not well understood because of the variations in freshwater influx, variable evaporation rates, and uncertain subsurface inflow. The evaporation rate of a brine surface decreases with the increase in the amount of dissolved salts and is not comparable to the same evaporation rate of a body of fresh water under the same conditions.

The Dead Sea is the world's saltiest natural lake with a definite chemical stratification[2]. The Dead Sea brine solution contains high concentrations of ions compared to that of regular sea water and has an unusually high amount of magnesium and bromine and low amounts of carbonate and sulfate. Table 6-1 compares the average ion concentration of the Dead Sea with regular sea water.

The relative ionic composition of the brine changes through the years because of continual evaporation, ongoing massive salt deposition, and the reinjection of the dense end brines in the south. End-brine reinjection has a local effect on halite saturation and ion/cation chemistry near the southern end of the north basin. The change in brine chemistry generally changes the solubility of evaporitic salt and brine physical properties (i.e., saturation, heat capacity, and viscosity)[23].

Wisniak [2002][2] reports that an estimated 900 MMt of bromine exists in the Dead Sea. The reason for the high levels of bromine found in the water is not well understood, but the salt brines are believed to have formed during the Tertiary period[2]. The evaporation ponds demonstrate the bromide-enrichment process that is theorized to have occurred many years ago and on a much larger scale. Residual brines are extremely rich in bromide. The feedbrine has a specific gravity of 1.24 and contains 5,000 parts per million (ppm) of bromine. After controlled evaporation occurs in the southern basin ponds following the precipitation of halite and carnallite, the residual brine has a specific gravity of 1.341[2] and 8,742 ppm of bromine [JBC production reports].

Table 6-1: Typical Concentration of Ions in the Dead Sea and Regular Sea Water Grams per Liter

Ions	In Dead Sea (g/L)	In Regular Seawater (g/L)
	Cations	
Sodium (Na^+)	39	10.7
Magnesium (Mg^{2+})	39.2	1.27
Calcium (Ca^{2+})	17	0.42
Potassium (K^+)	7	0.4
	Anions	
Chloride (Cl^-)	208	19.4
Bromide (Br^-)	5	0.07
Sulfate $(SO^{2-})_4$	0.5	3.6
Total	**315**	**33.68**

7 EXPLORATION

Although typically conducted, no exploration was required to characterize the mineral deposit as the minerals are extracted from the Dead Sea, which has been extensively characterized. Typical chemistry of the Dead Sea brine is provided in Table 6-1.

Woods Ballard and Brice [1984][xxiv] describe the geotechnical exploration work done for the design of the dike system necessary for the construction of APC's evaporation ponds. This information assists in understanding the shallow geological conditions underlying the evaporation ponds and ancillary structures.

A limited site investigation program[24] was carried out in 1966 when most of the southern basin of the Dead Sea was covered in up to 3 m of brine. A more detailed program, with a cost of £3 million, took place in 1977 when the brine level had receded from the southern basin, leaving only land-locked ponds in the central depression.

The very soft clays which overlay the area to form the flat foundation for the basins were deposited by streams which discharge into the area from the wadi Araba and the eastern hills. The foundation clay is interspersed with layers of uncemented salts. These salts are formed during the modern depositional process, when the sea level has receded sufficiently to allow brine at the southern end to become concentrated to the point of precipitation. The wadis have also formed fans of boulders, gravels and sands where they exit from the escarpment and indent the eastern shoreline.

To undertake the site investigation program in 1977, major access problems had to be resolved. The very soft mud in the carnallite pond area would not support normal investigation equipment. Elsewhere brine pools of varying depth covered part of the surface of the central depression and were 10 m deep at the main intake location off the Lisan Peninsula in the Dead Sea.

A drilling rig was mounted on a 15 × 15 m Mackley Ace hover pontoon to allow drilling on the soft mud and over the sea. The unit was maneuvered into position by a Gemco amphibious transporter on land and by a motor launch in deep brine. The unit was serviced with small Nimbus hovercrafts which were also used for reconnaissance of the area. There was some difficulty in controlling the unit when it was being moved to new locations in windy conditions. In the areas of very soft mud, which precluded the use of the Gemco, anchors had to be laid by hand in the mud to enable the pontoon to be winched into position. It was possible to walk on these areas only with the aid of specially made 'mud shoes' produced on site from plywood boards.

Shallow pools of evaporating brines were formed in the central basin 7 km from the shoreline in which jagged reefs of hard salt crystals had formed, protruding up to 700 mm above the brine level. Neither the hover pontoon nor the hovercraft could be used in this particular area as the reefs ripped the hover skirts. Investigations of conditions in this area were carried out using a lightweight drilling rig mounted on the Gemco, with workforce and materials being ferried out by helicopter.

The investigations concentrated on solving two main problems: establishing the most economical design of dike on very soft mud and finding the best method of constructing a cut-off under part of the western perimeter dike for control of seepage through the uncemented salt layers.

The team carried out in situ vane tests and triaxial tests on undisturbed samples to give a preliminary indication of the strength of the mud. The inherent inaccuracy in using small vanes to determine large-scale strength criteria and the difficulty to obtain truly undisturbed samples led to the requirement for full-scale trial dikes. Three trial dikes were then constructed in various materials, with various cross sections, instrumented and loaded to failure.

In situ permeability tests were carried out in the salt and clay strata to establish design criteria for seepage control. To confirm the proposed diaphragm wall, trial cut-off trenches were formed 150 mm wide and 3 m deep in the rock salt using a chain-saw type cutter. A 2.5-mm-thick, medium-stiff high-density polyethylene impermeable membrane was inserted into the trench which was then filled with a self-setting mud.

8 SAMPLE PREPARATION, ANALYSES, AND SECURITY

The deposit (i.e., the Dead Sea) has been characterized based on ample information collected from multiple sources, including companies dedicated to extracting and processing brine as well as scientific institutions. Therefore, the various sampling and testing protocols and sample chain-of-custody documentation that are generally used to characterize the reserves/deposit are not included in this report.

JBC has its own internal lab facilities for testing with advanced technology and well trained staff. The lab complies with ISO 19000, 14001 and OHSAS 18001 certification requirements and follows industry best practices in terms of laboratory procedures. JBC has decided to further improve its lab by pursuing compliance with ISO 17025 requirements and this process is ongoing.

JBC's analytical laboratory is managed by a team of experts, including a chemist, supervisors and technicians, all working around the clock in shifts, to maintain the integrity of the lab at all times.

JBC is an ongoing operation that has processed concentrated brine extracted from the Dead Sea for many years. Therefore, JBC has an extensive database of quality data that were obtained by APC and JBC. This data confirms the characteristics of the brine obtained from the Dead Sea (APC) and the Carnallite Pond C-7 (APC and JBC).

Chapter 10.0 discusses the sample preparation, analyses, and security of the brine samples used to test the quality of the brine.

It is the QP's opinion that Albemarle's laboratory facilities meet or exceed the industry standard requirements for such facilities and that the implemented practices for the collection and preparation of samples, as well as the methodology followed to carry out the analytical work (including the sample security protocols) are based on industry best practices and, therefore, are adequate for their intended purposes.

9 DATA VERIFICATION

Sampling and testing records from 2019 through 2023 were provided by JBC and were used as source material for the TRS. The JBC plant has been operating for approximately 20 years and the quality of the brine extracted from the Dead Sea by APC and the feedbrine coming from APC's Carnallite Pond C-7 is continuously monitored and well understood. The typical density values, as well as the chemical composition of the brine, are well documented, and in the Qualified Person's (QP's) opinion, the quality data provided by JBC are adequate to understand the process and estimate mineral resources and reserves.

The data reviewed by the QP show a sampling and testing system in place that is comparable to the best management practices of the industry. The records contain detailed information on dates, times and the name of the operators who performed the sample-collection process. Documentation provided by JBC also shows appropriate chain-of-custody documentation of the samples and the standard analytical methods that were implemented for quality testing.

10 MINERAL PROCESSING AND METALLURGICAL TESTING

The methods used to test the quality of the brine before it reached the JBC plant is discussed in this chapter. Understanding the quality of the brine before it enters the plant is critical to ensure that the plant feed is consistent. The analytical procedures discussed herein are not typically used in the mining and exploration industry (e.g., geochemical assaying); however, the methods employed are sufficient for JBC to run their plant properly and efficiently.

10.1 Brine Sample Collection

The JBC bromine plants and the connection to APC's Carnallite Pond C-7 were designed for the explicit purpose of gathering substantial quantities of brine for transport to the central bromine production facilities. Once at the facility, the bulk brine is processed to produce bromine. Concentration measurements of the bromide salts (hereafter referred to as bromides) are critical to the successful operation of the bromine plant. The brine consistency is critical for forecasting various bromine derivative sales and the overall health of the Albemarle/JBC bromine business.

Bromine samples from the JBC brine plant are taken in two strategic locations: (1) upstream of the bromine tower and (2) downstream of the bromine tower. Because of the nature of brine collection, the feedbrine (i.e., upstream brine) concentration of bromides remain relatively consistent; however, the concentration does vary and depends on weather/climate and APC's process consistency. Feedbrine samples are therefore frequently taken to capture concentration changes and more effectively adjust downstream operating parameters.

Tailbrine (i.e., downstream brine) samples are also taken frequently to primarily ensure that existing parameters at the bromine tower are set correctly. JBC operators collect brine samples multiple times per day and as requested by plant management. The sampling method includes the following steps:

1. Travel to each feedbrine and/or tailbrine sampling area within the plant
2. Slowly open the sample valves to purge out collected debris or stagnant brine to ensure that the samples collected are representative of the actual flow
3. Collect approximately 1 liter of brine within the sample bottle (roughly filling to the bottle's capacity)
4. Label the sample bottle with the date, time, and name of the operator who collected the sample. The label also indicates if the sample corresponds to feedbrine or tailbrine. Cap the bottle and transport to the on-site analytical laboratory for testing.

Because of the long-established operation of the JBC bromine plant, the samples collected at both feedbrine and tailbrine collection sites are only regularly tested for bromide salts. The composition of the feedbrine and tailbrine, in terms of additional salt content outside of the bromide salts, has been very consistent over the last 20 years of production and consists of magnesium, sodium, calcium, and potassium chlorides. Density measurements are not frequently taken based on the lack of density change in the brine over time. Samples are taken within the plant approximately every 2 to 4 hours to monitor process efficiency and allow operators to make adjustments to the bromine plant operations.

10.2 Security

Samples are taken directly from the sampling point to the internal JBC quality control (QC) laboratory. Samples are verified by the QC laboratory technician and operator during delivery and tracked through an electronic sample monitoring system where samples are given a designated number and the results of analytical tests are posted. Samples are not sent to external laboratories for testing; however, some samples are sent to internal analytical laboratories at different Albemarle sites (primarily the Process Development Center in Baton Rouge, Louisiana) for various other tests that are immaterial to plant operations.

A check standard is run for each titration and if the test passes the actual sample is analyzed. if the sample fails, the instrumentation is recalibrated. The laboratory does not hold any internationally recognized certifications.

10.3 Analytical Method

Halogen titration is the current process to measure bromine in brine. This method is widely used across the company for measuring bromine because of its simplicity and no complex machinery/analytical tools are required. The method involves use of different concentrations of chemicals for feedbrine and tailbrine. Firstly, a buffer solution is prepared by adding sodium fluoride and sodium dihydrogen phosphate in deionized water. Clorox bleach is then added, and the solution is heated on a hot plate for 15 minutes. Sodium formate is then added, after which the solution is heated for an additional 5 minutes and then cooled to room temperature. Potassium iodide and sulphuric acid is then added to the solution and then the solution is titrated with sodium thiosulfate until starch endpoint.

The QP has reviewed the analytical method as provided by JBC and the method appears to be reasonable and well-established.

11 MINERAL RESOURCE ESTIMATES

Estimating bromine resources from a nonconventional reservoir such as the Dead Sea presents many challenges. The elevation and the area and volume of this body of water are rapidly decreasing for the reasons explained in this report.

The decreasing water level in the Dead Sea has been of concern for many years and the concept of diverting seawater from the Mediterranean Sea or the Red Sea has been discussed in many publications. The principal objective of diverting seawater is to provide desalinated drinking water for the inhabitants of the surrounding areas of Palestinian Authority, Israel, and Jordan and to stop the decreasing water level of the Dead Sea. The desalination plant is proposed to produce fresh water using the Reverse Osmosis (RO) method.

Water mixing in the Dead Sea is slower because of low waves and wind compared to other waterbodies (e.g., seas and oceans). The Dead Sea is considered a stratified waterbody and is based on 44 available datasets on potential temperature and quasi-salinity. Traditionally, the density anomaly of the Dead Sea water from 1,000 kilograms per cubic meter (kg/m^3) at 25°C was used as an indicator of water salinity[xxv] and was called "quasi-salinity" and denoted as $\sigma 25$ or SIGMA-25.

A study by Bashitialshaaer et al. [2011][26] was developed by the Department of Water Resources Engineering, Lund University in Sweden, to investigate methods for understanding the variations of water level and volume of the Dead Sea under various scenarios. The Lund University study[26] developed two models for estimating changes in the Dead Sea level, surface area, and volume: (1) a single-layer (well-mixed) system and (2) a two-layer (stratified) system. The mathematical models used in the study were based on the Land-Ocean Interactions in the Coastal Zone (LOICZ) *Biogeochemical Modeling Guidelines* and have been validated by comparing the model performances with other modeling studies of the Dead Sea[xxvii]. The models were first employed to describe the dynamic behavior of the Dead Sea using the data available in 1997 as the initial conditions and simulating the evolution over a 100-year period. Historical data from 1976 to 2006 were then used to compare with simulations obtained from the model. Although the Dead Sea is not in a steady-state condition, it was assumed to be close to steady state during the first year. Water and salt balances may have internal inputs and outputs but are only a concern in the two-layer approach.

The first model employed encompassed a single layer for which the water and salt mass balances were derived. Salinity variations and water discharged from the desalination plant were considered with and without the proposed project. The Dead Sea shows relatively strong vertical stratification that can be assumed to resemble a two-layer system (also called a stratified system)[28].

Considering the significant differences in the salinities and densities of the input and output brine, as well as the Dead Sea itself, with respect to depth, a two-layer system was determined to provide a better description of the conditions than the single-layer system. The upper layer constitutes an average of approximately 10 percent of the total depth, and the rest of the lake constitutes a rather homogeneous lower layer. Values of volume, surface area, elevation, and cumulative levels of the Dead Sea for a 100-year period were predicted by the single-layer and two-layer models.

Compared to previous studies, the single-layer and two-layer models proved to be robust alternatives to the traditional water and salt balance techniques. These models allowed the water exchange to be successfully calculated through a relatively simple representation of a complex and dynamic system such as the Dead Sea.

Both analytical models were balanced using two approaches: water-mass balance and salt-mass balance. The single-layer model predicted 1.4 and 2.0 percent higher water levels than the two-layer model using the water-mass balance with and without RO discharge, respectively. The two-layer model yielded 3.7 and 4.0 percent higher values than the single-layer system using the salt-mass balance with and without RO discharge, respectively.

RESPEC opines that the two-layer model under the water-mass balance approach is a better representation of the Dead Sea environment and, therefore decided to use this model to predict present and future levels, areas, and volumes that are the bases for estimating resources. For this analysis, the current situation was assumed to be maintained, and the influence of a potential Red Sea to Dead Sea project was not considered. This model will be used to estimate the average water elevation, area, and volume at two critical points in time: 2023 (the effective date of this report) and 2058 (the end of APC's concession), and correspond to the Years 27 and 62, respectively, of the 100-year model (with 1997 as the base year [Year 1]).

The JBC facility has a proven track record of commercial production and, therefore, the reliability of the economic forecast operation is high. From the technical point of view, the quality of the feed, the expected recoveries and other key factors are well understood, by virtue of many years of operation.

The capital and operational costs correspond to a Class 1 estimate and therefore are also significantly accurate (between -10% and +10%), which minimizes the potential impact of those elements on the prospect of economic recovery. Economic factors have also been discussed at length in various sections of this technical report and it is the QP's opinion that they do not present any significant risk that could jeopardize the expected economic recovery of the operations. Moreover, it is the QP's opinion that no additional studies are required.

11.1 Dead Sea Elevation

Among the several institutions in Jordan and Israel that constantly monitor the level of the Dead Sea, the Israel Oceanographic and Limnological Research, which publishes a level chart on its web page, is provided in Figure 11.1. As of late-2023, the reported average water level of the Dead Sea is 431 m below mean sea level (bmsl), which is consistent with the model's forecast.

At the beginning of the last century, the water level was approximately 390 m bmsl with a surface area of 950 km^2. In 1966, the Dead Sea covered an area of 940 km^2 with 76 percent of the lake in the northern basin, and a total length of 76 km, and an average width of 14 km. The total volume of the water in the Dead Sea was estimated at 142 km^3 with only 0.5 percent in the southern basin. At the end of 1997, the water level was 411 m bmsl and the surface area 640 km^2,[29]. The surface area continues to decrease due to the high rate of evaporation and decreasing water inflow. The current volume of the Dead Sea is estimated at approximately 110.0 km3. Work undertaken by Ghatasheh et al. [2013] [18] presented in Table 11-1 shows historical water levels and surface areas for the time period of 1984 through 2012.

Figure 11.1 also shows the variations in the Dead Sea level[30]. Recorded level variations were compared with sea-level forecasts obtained from the selected simulation model and it was found that the selected two-layer model was highly accurate.

11.2 Dead Sea Volume

The drop in the sea level in the late twentieth and early twenty-first centuries changed the physical appearance of the Dead Sea. Most noticeably, the peninsula of Al-Lisān gradually extended eastward until the sea's northern and southern basins became separated by a strip of dry land. The southern basin was eventually subdivided into dozens of large evaporation pools (for extracting salt) and by the 21st century the basin had essentially ceased to be a natural body of water. The northern basin, which is effectively now the actual Dead Sea, largely retained its overall dimensions despite a great loss of water mainly because the shoreline plunged steeply downward from the surrounding landscape.

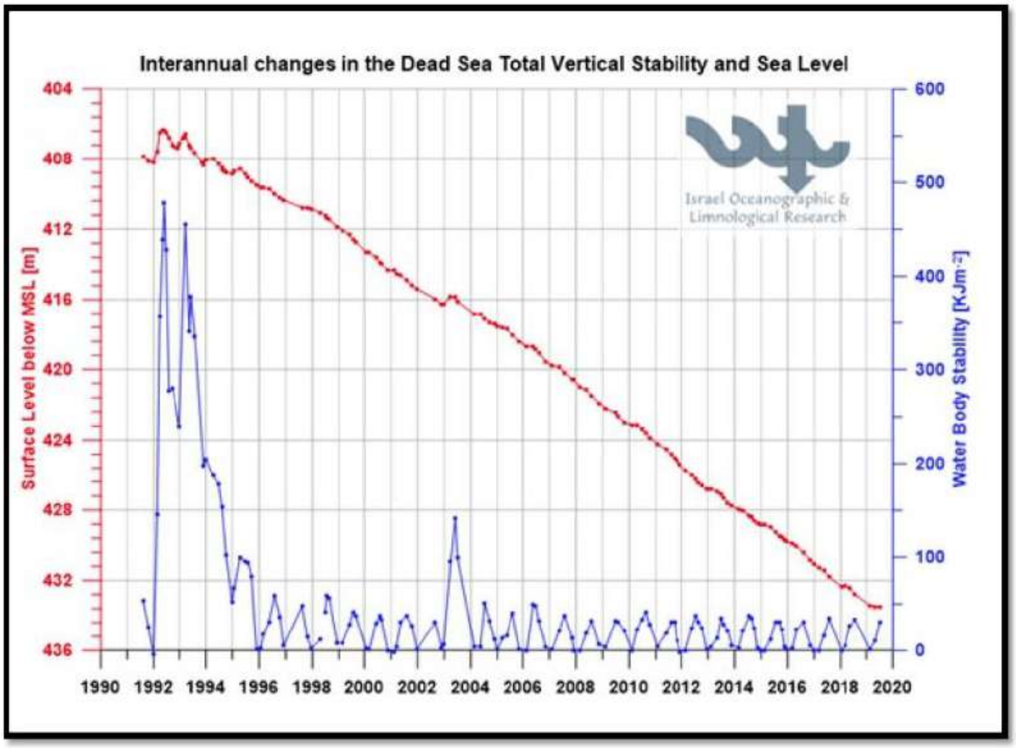

Figure 11.1: Interannual Changes in the Dead Sea Total Vertical Stability and Sea Level [30].

The inflow from the Jordan River, with high waters occurring in winter and spring, once averaged approximately 1.3 billion cubic meters per year (bcm/yr). However, the subsequent diversions of the Jordan River's waters reduced the river's flow to a small fraction of the previous amount and became the primary cause for the drop in the Dead Sea's water level. Four modest intermittent streams descend to the lake from Jordan to the east, through deep gorges: Al-ʿUẓaymī, Zarqāʾ Māʿīn, Al-Mawjib, and Al-Ḥasā. Several other wadis streams flow down spasmodically and briefly from the neighboring heights as well as from the depression of Wadi Al-ʿArabah. Thermal sulfur springs also feed the rivers. Evaporation in the summer and water inflow, especially in the winter and spring, once caused noticeable seasonal variations of 30 to 60 centimeters (cm) in the sea level, but those fluctuations have been overshadowed by the more-dramatic annual drops in the Dead Sea's surface level.

Concern over the continued drop in the Dead Sea's water level increased and prompted studies and a focus on conserving the Jordan River's water resources. In addition to proposals for reducing the amount of river water diverted by Israel and Jordan, the two countries discussed proposals for canals that would bring additional water to the Dead Sea. One of the projects that received approval from both countries in 2015 involved constructing a canal northward from the Red Sea. The plan, which included desalinization and hydroelectric plants along the canal, would deliver large quantities of brine (a by-product of the desalinization process) to the lake. The project was met, however, with skepticism and opposition from environmentalists and other parties who questioned the potentially harmful effects of mixing water from the two sources.

Table 11-1: Dead Sea Water Level and Surface Area [18]

Year	Surface Area (km^2)	Below Mean Sea Level (m)
1984	678.91	403.24
1985	675.46	404.13
1986	674.50	404.39
1987	670.87	405.36
1988	670.76	405.39
1989	663.21	407.50
1990	659.29	408.65
1991	658.32	408.94
1992	664.25	407.20
1993	552.64	407.56
1994	656.41	409.51
1995	653.26	410.48
1996	652.48	410.72
1997	661.55	410.98
1998	650.63	411.30
1999	646.88	412.50
2000	645.07	413.08
2001	643.92	413.46
2002	641.04	414.42
2003	641.85	414.15
2004	640.44	414.62
2005	635.85	415.85
2006	635.13	416.10
2007	633.00	417.19
2008	631.28	417.80
2009	628.02	418.98
2010	626.44	419.56
2011	623.26	420.74
2012	619.90	422.01

The area of the Dead Sea surface at the end of the 1950s was approximately 1,000 km^2, of which approximately 757 km^2 were located in the northern portion and 240 km^2 in the southern portion. Several studies state that the water level of the Dead Sea is dropping by an average of 0.9 m per year, which represents an annual water loss of approximately 600 MCM. The current volume of the Dead Sea is estimated to be approximately 110 km^3.

11.3 Dead Sea Salinity

The data collected by RESPEC as well as relevant forecasts indicate that the Dead Sea quasi-salinity (Sigma 25) is increasing, as illustrated in Figure 11.2.

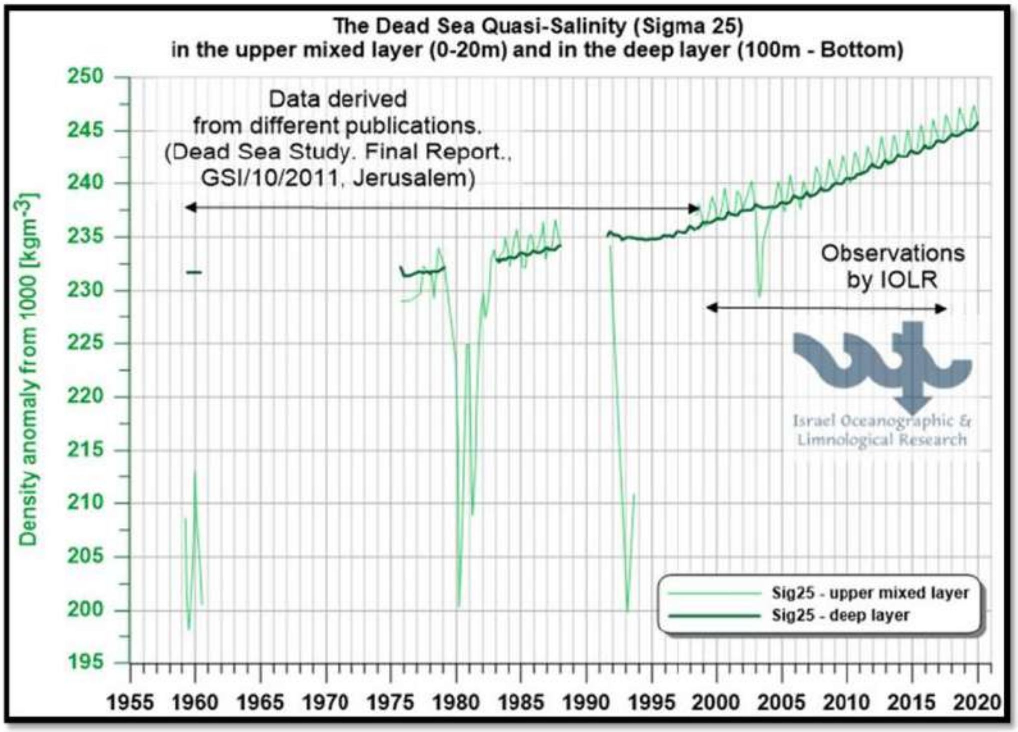

Figure 11.2: Quasi-Salinity (Sigma 25) of the Dead Sea. [30].

11.4 Simulation Model

The selected two-layer model takes into account the significant differences in the salinities and densities of the input and output with respect to depth and, therefore, provides a better description of the conditions of the Dead Sea. A comparison of historical water levels and areas with the model forecasts shows that the selected model is reliable and can be used to predict future water levels. The main components considered in the two-layer model and their interaction are illustrated in Figure 11.3. Table 11-2 summarizes the predicted level, area, and volume of the Dead Sea based on the selected two-layer model.

As mentioned, the two-layer model was developed to forecast the variations under both the baseline conditions (current situation) and the Red Sea-to-Dead Sea project implementation.

RESPEC deemed that the best fit between the model forecast and the historical data (between 1997 and 2021) was obtained from the water-mass balance approach. The Year 1997 represents the baseline case (Year 1) and 2021 corresponds to Year 25 of the model. The end of APC's concession will take place in 2058, which corresponds to Year 62.

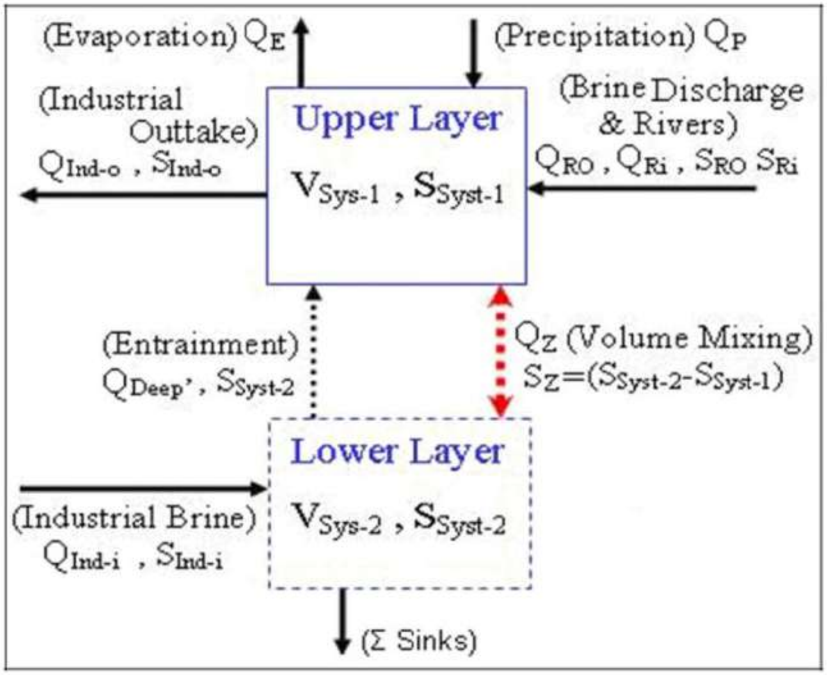

Figure 11.3: Schematic of the Mass Balance for the Dead Sea Using a Two-Layer System.

Table 11-2: Dead Sea Level, Area, and Volume as Predicted by a Two-Layer Model Based on the Water-Mass Balance Approach, Baseline year, 1997

Water-Mass Balance — 2-Layer Model (No RO)				
Year (cycle)	Year (date)	Level (m bmsl)	Area (km^2)	Volume (km^3)
1	1997	–411.00	640.00	131.00
25	2021	–430.30	580.22	109.54
30	2026	–433.41	570.95	105.06
60	2056	–458.56	492.30	78.23
62	2058	–462.44	480.09	76.44
90	2086	–488.58	398.43	51.39

11.5 Bromide Concentration

Bromide ion concentration is well-documented in the reviewed references and records provided by APC. The bromide concentration in the Dead Sea brine averages approximately 5,000 ppm, as reported by APC. The bromide concentration considered as the cut-off grade for resources estimation is 1,000 ppm.

11.6 Resource Estimation

Using on the values obtained from the two-layer model and the reported bromide concentration, a summary of the Dead Sea bromide ion resources is provided in Table 11-3. Because the waters of the

Dead Sea and the resources contained within are shared by the Hashemite Kingdom of Jordan and the State of Israel, the waters can be allocated proportionally to the surface area controlled by each country. The Dead Sea areas corresponding to Jordan, Israel, and the West Bank (under Israeli control) are depicted in Figure 11.4.

Table 11-3: Dead Sea Bromide Ion Resources

Year	Elevation (m)	Area (km^2)	Volume (km^3)	Brine Density (g/cm^3)	Brine Mass (MMt)	Bromide Concentration (ppm)	Bromide Ion Mass (MMt)
2024	-432.90	572.10	106.85	1.2492	133,482	5,037.00	672.35
2058	–462.44	480.09	76.44	1.2662	96.790	5,106.00	494.21

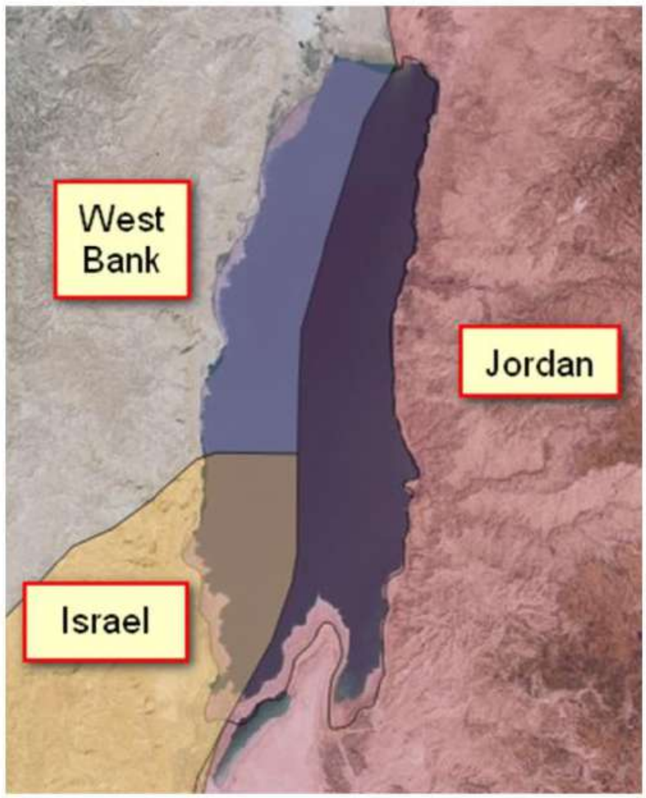

Figure 11.4: Schematization of the Water Mass Balance for the Dead Sea Using a Two-Layer System.

According to current GIS imagery and the official location of the international border between Israel and Jordan, the approximate 572.10 km^2 of surface area of the Dead Sea can be allocated as indicated in Table 11-4.

Table 11-4: Dead Sea Surface Area Allocation (as of 2023)

Jurisdictions	Area (km^2)	Allocation (%)
Israel and West Bank	273.13	47.47
Jordan	298.97	52.26
Total	572.10	100.00

The cut-off grade is an industry-accepted standard expression used to determine what part of a mineral deposit can be considered a mineral resource. It is the grade at which the cost of mining and processing the ore is equal to the desired selling price of the commodity extracted from the ore.

The considered sales price ranges between USD 1,938 and USD 3,525 per tonne and the operating cost ranges between USD 648 and USD 972 per tonne, as detailed in Section 18 of this report.

The cut-off grade of the Albemarle bromine operations has been estimated to be at 1,000 ppm. The bromide ion concentration in the brine extracted from the Dead Sea significantly exceeds the selected cut-off grade.

Based on the above allocation, an estimated 52.26 percent of the brine resources identified in the Dead Sea are controlled by Jordan (as of the effective date of this report) and, therefore, correspond to APC under the terms of its concession. *Consequently, as of December 2023, an estimated 133,482 MMt of brine measured resources with an average bromine ion concentration of 5,000 ppm, and a cut-off grade of 1,000 ppm (133,482 MMt × 52.26 percent = 69,757 MMt) is controlled by JBC. The measured resources of bromide ion attributable to Albemarle's 50% interest in its JBC joint venture is estimated to be approximately 175.69 MMt.* From these large resources, JBC is extracting approximately 1 percent of the bromine available. These estimates include Reserves. For perspective purposes, these estimates are a very large resource of which APC is accessing only a small portion.

The reported resources slightly differ from the values presented in the 2022 TRS because the end date of the forecast of this project (2058) has remained unchanged. One year of production and the evaporation in the Dead Sea during that year are also factors that had an impact on the figures.

12 MINERAL RESERVES ESTIMATES

Reserve estimates presented in this report are consistent with the definition in SEC S-K 1300:

> *Mineral reserve is an estimate of tonnage and grade or quality of indicated and measured mineral resources that, in the opinion of the qualified person, can be the basis of an economically viable project. More specifically, it is the economically mineable part of a measured or indicated mineral resource, which includes diluting materials and allowances for losses that may occur when the material is mined or extracted.*

Even though 351.37 MMt of bromide ion with a cutoff grade of 1,000 ppm have been identified as the measured resources currently available to JBC, only the portion of those resources that can be economically extracted and processed with JBC's current capacity and within the term of the concession agreement constitute proven reserves.

Based on the information supplied by JBC/APC and independently verified by RESPEC, APC has a present and forecast brine extraction capacity of 336.4 MCM per year of sea water from APC's PS4 pumping station. As described in Chapter 13.0 of this report, the brine is transferred through a series of evaporation ponds until reaching pond C-7, where another pumping station with a capacity equivalent to 24 percent of the PS4 pumping station (as indicated in APC and JBC production reports), pumps brine to supply the JBC Area 1 and Petra Bromine plants and also to the Manaseer Magnesia Company facility. Therefore, the maximum pumping capacity from pond C-7 is approximately 84.10 MCM per year.

APC/JBC have reported that the density of the brine pumped from pond C-7 is 1.3478 grams per cubic centimeter (g/cm^3) and the weighted average of the bromide ion concentration of the feedbrine from pond C-7 is 8,742 ppm, based on actual operational records provided by JBC; thus, approximately 0.97 MMt per year of bromine ion are pumped into the channel that feeds to JBC and MMC. The JBC plant's processing capacity at 16.7 MMt per year of feedbrine represents only a fraction of the feed tonnage available and, therefore, both operations have sufficient capacity for brine processing.

Table 12-1 provides JBC (Area 1 and Petra Bromine Plants) Brine Processing and Bromine Production Records (2021-2023).

Table 12-1: Jordan Bromine Company (Area 1 and Petra) Brine Processing and Bromine Production Records (2021-2023)

Data (Unit)	Area 1	Petra	Total
	Feedbrine Flow (tonnes)		
Total (2021-2023)	24,234,739.43	21,263,609.60	45,498,348.03
Annual Average	**8,078,246.48**	**7,087,869.53**	**15,166,116.01**
	Br2 Product (tonnes)		
Total (2021-2023)	188,764	162,576	350,867
Annual Average	**62,921.33**	**54,192.00**	**116,955.66**

In 2021, the plants jointly received approximately 14.55 MMt of brine, producing a total of 115,164 tonnes of bromine. In 2022, the plants received a total of 15.21 MMt of brine and produced 119,667 tonnes of bromine and in 2023 the total feed was approximately 15.43 MMt of feedbrine and the reported bromine production was 116,026 tonnes. The annual bromine production during the period 2021-2023 was 116,956 tonnes per year.

The original production forecast prepared by JBC assumes a slight improvement in the combined production capacity of the bromine plants, to reach a target of annual production of 123,000 tonnes per year in 2025. The QP has assumed and believes it is reasonable that the 2025 production capacity can be maintained through 2058. The overall average production for the time period of 2024 through 2058 is 118,000 tonnes per year of elemental bromine.

The considered sales price ranges between USD 1,938 and USD 3,525 per tonne and the operating cost ranges between USD 648 and USD 972 per tonne, as detailed in Section 18 of this report.

The cut-off grade of the Albemarle bromine operations has been estimated to be at 1,000 ppm. The bromide ion concentration in the brine extracted from pond C-7, which feeds the bromine plants, significantly exceeds the selected cut-off grade.

The reserves are constrained by plant capacity and the duration of the concession. *Consequently, as of December 2023, an estimated annual 14.93 MMt of feedbrine with an average grade of 7,645 ppm, and a cut-off grade of 1,000 ppm are controlled and will be processed by JBC. This is equivalent to 4.13 MMt of contained elemental bromine.* *The proven reserves attributable to Albemarle's 50% interest in its JBC joint venture are estimated to be approximately 2.07 MMt of elemental bromine*. This reserve estimate represents only a fraction of the total resource contained in the Dead Sea and accessible by APC/JBC and therefore, the estimate provides reasonable assurance that the project will not be affected by shortages of raw material over its life.

Being a mature project with significant historical production information, the reliability of the modifying factors for JBC are considerably high and therefore the risks associated with those modifying factors are relatively low.

The reported reserves slightly differ from the values presented in the 2022 TRS because the end date of the forecast of this project (2058) has remained unchanged. One year of production and the evaporation in the Dead Sea during that year are also factors that impacted in the figures.

It is the QP's opinion that the material factors that could cause actual results to differ materially from the conclusions, estimates, designs, forecasts or projections, including recovery factors, processing assumptions, cut off grades, etc., are well understood and, due to the nature of the deposit and the established extraction and processing operations, they are unlikely to significantly impact the mineral reserve estimates.

13 MINING METHOD

The mining method described summarizes the necessary activities to extract water from the Dead Sea and extract Bromine.

13.1 Brine Extraction Method

The chemical contents of the Dead Sea's brine (average density of 1.24 grams per cubic centimeter [g/cc]) hold a unique collection of salt minerals such as sodium chloride, potassium chloride, magnesium chloride, calcium chloride, and magnesium bromide. The low rainfall (70 mm per year), low humidity (average 45 percent) and high temperatures in the Dead Sea area provide ideal conditions for recovering potash from the brine by solar evaporation. The average concentrations of the ions (grams per liter [g/l]) in the Dead Sea are provided in Table 13-1.

Table 13-1: Ion Concentration in Dead Sea Water [xxxi]

Ions	Concentration (g/l)
Cations	
Sodium (Na^+)	39
Magnesium (Mg^{2+})	39.2
Calcium (Ca^{2+})	17
Potassium (K^+)	7
Anions	
Chloride (Cl^-)	208
Bromide (Br^-)	5
Sulfate (SO_4^{2-})	0.5
Total	**315.7**

JBC obtains feedbrine from APC's pond C-7 (i.e., carnallite pond) and this supply is intimately linked to APC's operations.

The principle of APC's process is that as evaporation takes place, the specific gravity of the brine increases until the constituent salts crystallize and progressively begin to precipitate. The brine concentrates in the initial evaporation pond (also known as a salt pan) until reaching a specific gravity of 1.26, when the sodium chloride (common salt) crystallizes and precipitates to the bottom of the pond at the rate of approximately 250 mm per year thickness in a pond with a brine depth of 1 to 2 m.

The brine is then transferred to other ponds (pre-carnallite ponds) where specific gravity is increased gradually to 1.31, and most of the sodium chloride has been removed through precipitation. At the specific gravity of 1.31, carnallite begins to crystallize and precipitate at the rate of approximately 400 mm/year, which takes place in pond C 7. The carnallite is then harvested by wet dredging from the pond bottom, and the dredged salts are pumped in a slurry to a processing plant where the potassium chloride is separated from the magnesium chloride.

The process through the evaporation ponds is continuous and a part of the final effluent from the carnallite ponds is sent to the JBC and MMC plants. The other part of the effluent is returned to the Dead Sea. A schematic illustration of the process sequence is provided in Figure 13.1.

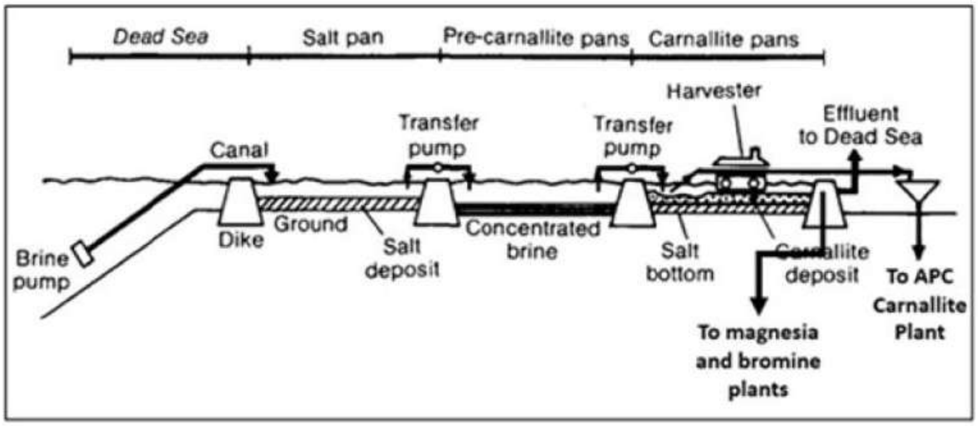

Figure 13.1: Process Sequence Schematic.

The capacity of potash production is largely determined by the extent of the flat areas available for forming evaporation ponds. The Dead Sea, which provides the sources of the chemicals, is in two areas: northern and southern basins.

The total area of the evaporation ponds was determined from the shape and gradient of the flat southern basin. The layout of the schematic within this area was determined by the process design, location of the brine source, harvesting limitations, and the need to route the effluent and flood water safely from the surrounding hills to the Dead Sea.

A 500-m-wide flood channel has been built between the western perimeter dike of the project and the adjacent Dead Sea Works dike in Israel to permit 1,000-year probability floods, calculated to be 2,900 cubic meters per second (m3/s) to be routed to the Dead Sea without damaging the potash works. The solar evaporation system is shown in Figure 13.2.

The Dead Sea brine pumping station has an installed capacity of 16,000 m^3 per hour per pump. The station is equipped with four pumps. Maximum annual capacity is 140.16 MCM per pump which based on operation at 80 percent availability and 75 percent utilization provides a brine volume of 336.4 MCM per year supply capacity to the APC facilities. This capacity is supported by the actual pumping records supplied by JBC and reviewed by the QP.

The brine that feeds the bromine and magnesium plants is extracted from pond C-7 through a pumping station with a capacity of approximately 84.1 MCM per year. The location of the Pond C-7 pumping station is shown in Figure 13.3.

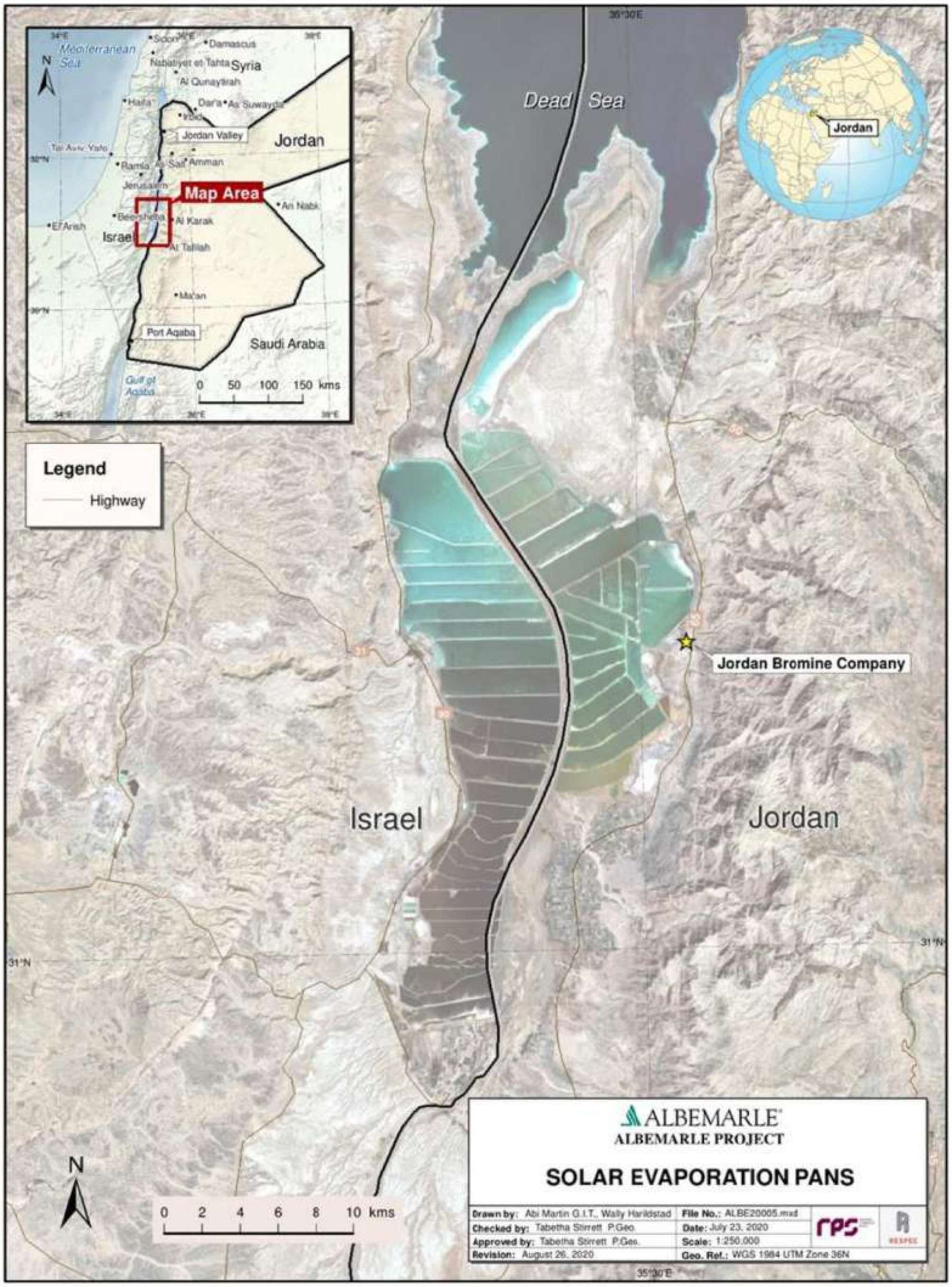

Figure 13.2: Solar Evaporation and Production Plant Map.

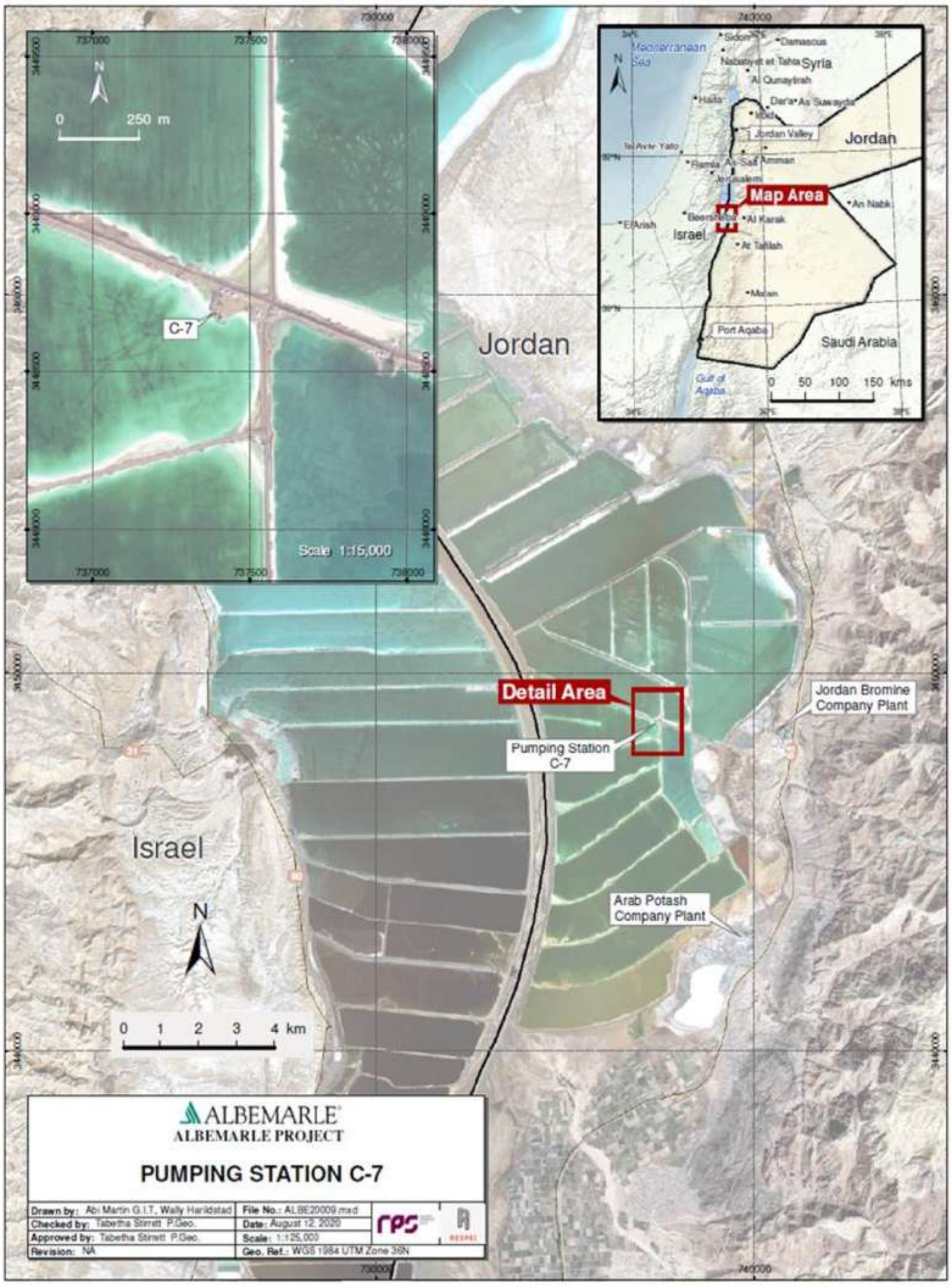

Figure 13.3: Pond C-7 Feedbrine Pumping Station (for Bromine and Magnesium Plants).

13.2 Life of Mine Production Schedule

The following table summarizes the life of mine production schedule of the project.

Table 13-2: Life of Mine Production schedule

LIFE OF MINE PRODUCTION SCHEDULE

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

FIELD: JBC (Jordan)
WORKING INTEREST: 100.0%

EFFECTIVE DATE OF ANALYSIS: 12/31/2023

RESERVES		Total Field		Company Share	
		Gross	Net	Gross	Net
Bromine	(k Tonnes)	4,130	4,130	4,130	4,130

FULL FIELD GROSS PRODUCTION													
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2033+	Total
Bromine Production	(k Tonne)	118	118	118	118	118	118	118	118	118	118	2,950	4,130

14 PROCESSING AND RECOVERY METHODS

JBC receives feedbrine from APC's pond C-7. The feedbrine is conveyed to the Area 1 and Petra bromine plants within the JBC facility through an open channel. Elemental bromine is produced at the JBC plants through a series of chemical processes described in this chapter.

14.1 Mineral Recovery Process Walkthrough

Brine from pond C-7 at APC is pumped to two, parallel bromine production trains for Area 1 and Petra with no major differences in the equipment or brine throughput of either; therefore, the Area 1 train will be described. The Petra train is essentially a duplicate of the Area 1 mineral recovery train, which is displayed in Figure 14.1

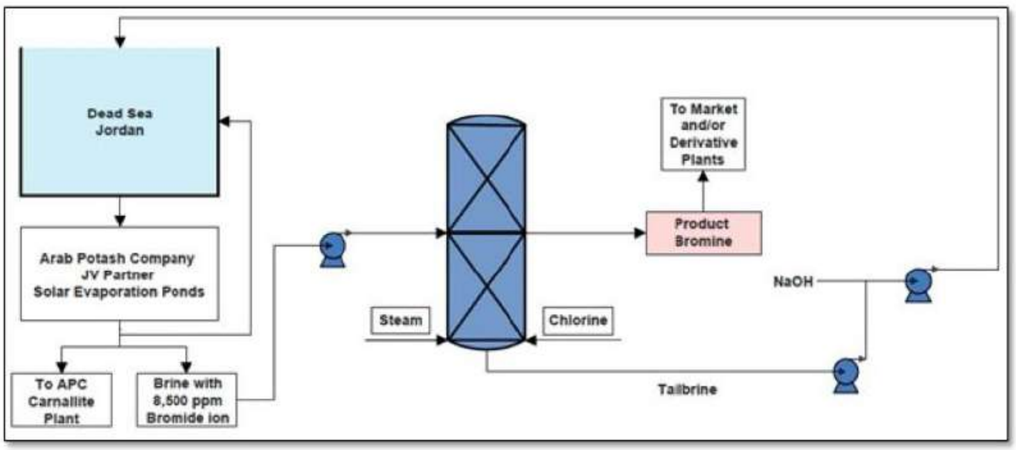

Figure 14.1: Area 1 and Petra Mineral Recovery Trains.

The brine is fed to a bank that consists of a static mixer and a heat exchanger. Different chlorine sources are used to feed both bromine plants, one which derives in a vaporized state from isotanks to the Petra plant and the other provided from an on-site Chlor-Alkali plant to the Area 1 bromine plant. Chlorine is fed before the heat exchanger and uses steam to continue to heat the brine/chlorine mixture. The mixture is then fed to the static mixer. The chlorine feed in this part of the process is designed to react a significant portion of the bromine in the feed as well as continue to heat the brine/chlorine/bromine stream before it reaches the bromine distillation tower. The combined brine stream, after the chlorine addition and mixing, enters the bromine distillation tower at approximately 120°C.

The brine enters the tower through the top and is fed to a distributor tray and then fed downwards. The brine mixes with the bromine vapor exiting the recovery section and the bromine saturates the incoming scrubber brine. Bromine that is not absorbed through the scrubber brine exits the tower toward the downstream separation and purification. The bromine-saturated scrubber brine re-enters the recovery section where the bromine vapor is revaporized for continued removal.

The bromide-depleted brine (i.e., tailbrine) exits out of the bromine distillation tower through the bottom and is fed to two pumps.

The tailbrine is mixed with a strong base to neutralize any remaining acid, bromine, or chlorine. The neutralized tailbrine is then pumped to a storage pond for cooling and eventual "discharge" into the Truce Canal that is recycled back to the APC processing plant.

The vaporized bromine exits the bromine distillation tower with a significant amount of water. This vapor stream is sent to a titanium heat exchanger that condenses the bromine and water vapor to liquid vapor using cooling water on the shell side. Any non-condensed acid or bromine vapors from the heat exchanger are sent to a scrubbing unit. A small stream of feedbrine is fed to the top of the scrubber to absorb any gaseous acid or bromine from the condenser and then recycled back to the tower.

The wet bromine is fed to a glass-lined crude bromine storage drum that acts as an intermediate hold-up before downstream purification.

The tailbrine stream, after stripped of bromine, is cooled and the pH is neutralized with caustic soda before discharging the brine to the Truce Canal. The tailbrine flow rate from the combined plants, Area 1 and Petra, is estimated to be approximately 1,700 m^3 per hour, as reported by JBC.

15 INFRASTRUCTURE

15.1 Roads and Rail

JBC is approximately 130 km south-southwest from Amman, and 40 km from the city of Al-Karak. The Jordan Valley Highway/Route 65 is a major highway that runs from the northwest region of Jordan, from North Shuna, along the western edge of Jordan and south to Aqaba and the Port of Aqaba. This highway is the primary access method for supplies and personnel to JBC. The Port of Aqaba is the main entry point for supplies and equipment for JBC, where shipping containers imported on ships are offloaded to trucks and transported to JBC by the Jordan Valley Highway/Route 65. Aqaba is approximately 205 km south of JBC. Major international airports can be readily accessed either at Amman or Aqaba.

Jordan's railway transport line is operated by the Hijazi Jordan Railway and the Aqaba Railway Corporation (Al Rawabi Environment & Energy Consultancies). The line runs north-south through Jordan and is not used to transport JBC employees and/or product.

15.2 Port Facilities

Jordan Bromine Company ships caustic potash (KOH), NaBr, and CaBr in bulk through a storage terminal in Aqaba. The terminal has storage tanks as well as pumps and piping for loading these products onto ships. JBC is using two sites at Aqaba:

- Aqaba Port
- JBC Terminal: A storage site in the free zone industrial area, to the west of Aqaba Power Station, approximately 1.5 km east of the Oil Terminal. Liquid products are stored at this site before they are exported through the Oil Terminal.

JBC's main activities at Aqaba are raw material/product storing, importing, and exporting. Materials that JBC handles at Aqaba Port and JBC's Terminal sites are shown in Table 15-1 and Table 15-2, respectively.

Table 15-1: Materials Handled by JBC at Aqaba Port and JBC Terminal

Material	Status
Hydrogen peroxide solution (50%)	Importing
Ethyl Alcohol (96%)	Importing
BPA (Bisphenol A) – powder	Importing
Bromine	Exporting
Hydrobromic Acid solution (48%)	Exporting
Ethyl Bromide	Exporting
TBBPA (Tetrabromo Bisphenol A) – powder	Exporting

JBC Terminal contains storage tanks and pumps for receiving and unloading products (calcium bromine [$CaBr_2$], NaBr, KOH 50 percent, and NaOH 50 percent) from the Ghor Al-Safi site. The products are sent and received to/from the JBC Terminal and Ghor Al-Safi sites using road tankers (i.e., trucks) and iso-tanks. The operation is controlled by the JBC Terminal supervisor in addition to four operators. The JBC Terminal site consists of aboveground tanks sitting on reinforced concrete bases. A water storage tank is also used for flushing the pipes that are used for loading ocean going vessels and for all water needs on the site.

Table 15-2: Materials Stored at Jordan Bromine Company Terminal

Material	Status
Calcium Bromide solution (55%)	Storage and Exporting
Sodium Bromide solution (45%)	Storage and Exporting
Potassium Hydroxide solution (50%)	Storage and Exporting
Sodium Hydroxide solution (50%)	Storage and Exporting

Nitrogen storage and vaporizer provides for the blanketing of each of the product storage tanks to maintain the products specifications and prevent absorbing carbon dioxide (CO_2) from the atmosphere that will lead to formation of carbonates and affect the pH of the product. The nitrogen is also used for purging the shipping lines after loading.

The products stored at the JBC Terminal are sold to external customers directly and transported by ocean-going vessels. When a vessel is loaded, two transfer lines (950 m long each) that extend from the JBC Terminal toward the Oil Terminal are used to deliver the product through hoses that are extended from the end of the lines at the terminal to the vessel.

After loading the vessel, the lines and hoses are flushed with water and then nitrogen is used to purge the hoses and loading pipelines. A nitrogen blanket is sometimes needed for vessels that are made of stainless steel when the loaded materials are $CaBr_2$ or NaBr.

All safety standards followed in the Aqaba site are the same as those followed at the Ghor Al-Safi site as per safety procedures. These safety standards follow the same company policy and targets. Personal protective equipment (PPE) is worn by all employees at the sites.

An evaporation pond collects the waste streams from pipe flushing, housekeeping, and other activities and is operated on the basis of natural evaporation with zero discharge coming from the pond. The estimated waste streams resulting from the plant's housekeeping and flushing of loading lines are approximately 120 (m^3 per month). The evaporation pond capacity is approximately 1,800 m^3 and is lined to protect the groundwater against infiltration and fenced to prevent trespassers.

The collected deposits (salts) from the pond are periodically removed and disposed of in a proper landfill in full compliance with ASEZA environmental directorate.

15.3 Plant Facilities

Infrastructure and facilities to support the operation of the bromine production plant at the Ghor Al-Safi site is contained in an approximately 33-ha area.

15.3.1 Water Supply

Fresh water is supplied from the Mujib River, a river that originates from the Mujib Reservoir, which is a man-made reservoir created in 1987 by the Royal Society for the Conservation of Nature. The Mujib River flows west through the Wadi Mujib Canyon and into the Dead Sea. Approximately 1.0 to 1.2 million cubic meters of water is used annually.

JBC has a contract for the water rights to the Mujib Reservoir, which is for the right to access 1.8 million m^3 of water per year. The water from the Mujib Reservoir is processed through a series of filtration units before being stored in a 250 m^3, carbon-steel tank. From this tank, the water is distributed to the various downstream users including cooling water, potable water, and reverse osmosis water.

15.3.2 Power Supply

Electricity is generated through the NEPCO and distributed directly to JBC by EDCO, a company owned and operated by Kingdom Electricity Company. Kingdom Electricity Company is one of the preeminent holding companies in Jordan that invests in energy generation and distribution companies/utilities.

The site load is below principal tariff level (< 22 MW). There are six substations on-site that are equipped with ABB switchgear and MCCs. The main transformer is a 33 kilovolt (KV)/11KV with 10.0/12.5 megavolt amperes (MVA) ONAN/ONAF rating. Nine additional stepdown transformers of different ratings provide site power at 420 volts (V). Concerning stability and outages by NEPCO/EDCO, most outages noted just voltage dips or spikes that trip the plant breaker and happen for a few seconds during winter.

Electrical blackout occurred on May 21, 2021. This blackout was the first one since 2003. Electrical infrastructure has improved significantly, but there are still some risks prevalent.

15.3.3 Brine Supply

Brine is supplied to the JBC plant area by pipeline from APC's pond C-7. Vertical pumps extract brine from pond C-7 with additional centrifugal pumps feeding the brine to the JBC plant site. Centrifugal pumps return the tailbrine from the bromine recovery tower to the Truce Canal through pipeline.

15.3.4 Waste-Steam Management

Downstream from the heat exchanger bank, the tailbrine is mixed with caustic soda to neutralize any remaining acid, bromine, or chlorine. The tail brine stream is neutralized by caustic soda before being discharged to the Truce Canal and then finally to the Dead Sea.

16 MARKET STUDIES

16.1 Bromine Market Overview

As reported by Technavio [2021][xxxii], a market research company, the global bromine market is expected to grow steadily at a Compound Annual Growth Rate (CAGR) of around 4.02 percent during 2022-2027 the bromine market has the potential to grow by USD 964.37 million. One major reason for this trend is the increased demand for plastics. Flame-retardant chemicals use bromine to develop fire resistance. Plastics are widely used in packaging, construction, electrical and electronics items, automotive, and many other industries. The increasing demand for plastics across various end-user industries is driving the demand for flame-retardant chemicals that in turn, will propel the bromine market.

Another trend that is responsible for a growing bromine market forecast is the growth in bromine and bromine derivatives used as mercury-reducing agents. Bromine derivatives are used in reducing mercury emissions from coal combustion in coal-fired power plants. Mercury emissions in the environment is a major concern for public health. The rising health concern along with stringent government regulations may increase global bromine market demand. Technavio [2021][32] also reports that the markets for specialty chemicals such as fluorochemicals and pyridine are expected to grow at a CAGR of around 5 to 7 percent during 2022-2025. The increased use of specialty chemicals in various end-use industries such as oil and gas, automobile, pharmaceuticals, and construction will also drive the demand for bromine.

16.2 Major Producers

The major producers of elemental bromine in the world are Israel, Jordan, China, and the United States, as shown in Table 16-1. The bromine production from the United States is withheld to avoid disclosing company proprietary data. The world total values exclude the bromine produced in the United States.

Table 16-1: Bromine Production in Metric Tonnes by Leading Countries (2017-2022) [xxxiii]

Country	2017 (Mt)	2018 (Mt)	2019 (Mt)	2020	2021(e)	2022(e)
Israel	180,000	175,000	180,000	170,000	182,000	180,000
Jordan	100,000	100,000	150,000	84,000	110,000	110,000
China	81,700	60,000	64,000	70,000	70,000	70,000
Japan	20,000	20,000	20,000	20,000	18,000	20,000
Ukraine	4,900	4,500	4,500	4,500	4,500	4,500
India	1,700	2,300	10,000	3,300	5,000	5,000
United States	W	W	W	W	W	W
World Total (Rounded)	**388,000**	**362,000**	**429,000**	**352,000**	**390,000**	**390,000**

(e) estimated
W = withheld.

The prominent players in the global bromine market are Israel Chemicals Limited (Israel), Albemarle Corporation (United States), Chemtura Corporation (United States), Tosoh Corporation (Japan),

Tata Chemicals Limited (India), Gulf Resources Inc. (China), TETRA Technologies, Inc. (United States), Hindustan Salts Limited (India), Honeywell International Inc. (United States), and Perekop Bromine (Republic of Crimea). T

16.3 Major Markets

The global bromine market is dominated by manufacturers who have an extensive geographical presence with massive production facilities, all around the world. Competition among the major players is mostly based on technological innovation, price, and product quality.

According to a report by Market Research Future [2020][xxxiv], which forecasts the global bromine market until 2023, the market is divided into five regions: Latin America, the Middle East and Africa, Asia Pacific, North America, and Europe. Among these, Market Research Future [2020][34] predicts that Asia would be the fastest-growing region for bromine consumption because of a growing population and increasing purchasing power in the developing nations. The growth of agriculture and automobile industries in countries such as China and India will also drive the increasing demand for bromine. North America will remain a dominant market, and developed industries such as cosmetics, automobile, and pharmaceuticals will affect the demand for bromine. The European region is expected to experience a moderate growth that will be driven by the cosmetic and automobile industries. The growing oil-and-gas drilling activities in Russia will also contribute to the growth of the bromine market.

16.4 Bromine Price Trend

The price of bromine gradually increased during the period 2014-2021. The price in January 2014 was approximately $2,800 per tonne and in January 2021 it had increased to approximately $5,200 per tonne.

In 2021, the price of bromine significantly increased, reaching a peak of $10,700 per tonne in November. The bromine spot price on the effective date of this report, December 31, 2023, was USD 3,525 per tonne and the overall trend is towards a progressive decrease.

Bromine prices have greatly decreased in the last two years mainly because of reduced demand and an increase in the release of domestic inventories before the close of the financial year. The slow demand for Bromine in industries such as flame-retardant production and other end-use sectors is due to excess inventories in the local market.

The above-described behavior of the market is the product of a combination of factors, including China's decrease in bromine production from brine due to the country's electricity curtailment policy.

Figure 16.1 illustrates the behavior of bromine prices in the period January 2014-December 2023.

Figure 16.1: Bromine Price Trend as per China Petroleum and Chemical Industry Federation (Price is in US$)[35]

16.5 Bromine Applications

JBC produces a variety of substances from bromine (www.jordanbromine.com). The specific derivatives produced are not discussed in detail in this technical report for proprietary reasons. The following list illustrate the ways that elemental bromine or bromine derivatives are used in a variety of products:

- **Flame Retardants:** Bromine is very efficient as a constituent element when used in producing flame retardants; therefore, only a small amount is needed to achieve fire resistance.
- **Biocides:** Bromine reacts with other substances in water to form bromine-containing substances that are disinfectants and odorless.
- **Pharmaceuticals:** Bromide ions have the ability to decrease the sensitivity of the central nervous system, which makes them effective for use as sedatives, anti-epileptics, and tranquillizers.
- **Mercury Emission Reduction:** Bromine-based products are used to reduce mercury emissions from coal-fired power plants.
- **Energy Storage:** Bromine-based storage technologies are a highly efficient and cost-effective electro-chemical energy storage solution that provides a range of options to successfully manage energy from renewable sources, minimize energy loss, reduce overall energy use and cost, and safeguard supply.
- **Water Treatment:** Bromine-based products are ideal solutions for water-treatment applications because of bromine's ability to kill harmful contaminants.
- **Oil-Drilling Fluids:** Bromine is used in clear brines to increase the efficiency and productivity of oil-and-gas wells.

17 ENVIRONMENTAL STUDIES, PERMITTING AND PLANS, NEGOTIATIONS, OR AGREEMENTS WITH LOCAL INDIVIDUALS OR GROUPS

17.1 Environmental Studies

JBC has conducted environmental impact studies in compliance with Jordanian regulations. The environmental impact studies are accessible through the Multilateral Investment Guarantee Agency (MIGA) website (www.miga.org) and are part of the public domain.

For the recent JBC capacity expansion, including the construction of the Petra Bromine plant and the Aqaba storage zone, JBC prepared environmental studies under international standards as part of the process to obtain financing from multilateral entities such as MIGA, which is a member of the World Bank Group.

These studies evaluated all key environmental aspects such as air quality, noise levels, water resources, biodiversity, socioeconomic conditions, archaeology, and traffic studies.

17.2 Environmental Compliance

17.2.1 Compliance With National Standards

JBC complies with national regulations including the Environment Protection Law (No. 52/2006), Public Health Law (No. 47/2008), Civil Defense Law (No. 18/1999) and Labor Law (No. 8/1996). JBC also meets or exceeds the Occupational Safety and Health Administration (OSHA) and National Fire Protection (NFPA) international regulations.

17.2.2 Compliance With International Standards

JBC is the first company of its kind in Jordan to become an authorized exporter to Europe and has been certified for International Organization of Standards (ISO) 9001, ISO14001 and the Voluntary Emissions Control Action Program (VECAP). The VECAP is a global chemical management program based on a Code of Best Practice for handling and using brominated flame retardants.

JBC's environmental program has been ISO 14001 certified by Lloyd's Register since 2007 and further enhanced through the adoption of the integrated management system for quality (IS0 9001: 2015, OHSASL800L, 2007, ISO/4001:2015) certifications received in 2018. Audits of the environmental program area are conducted on a monthly basis by JBC management, and regular corporate audits are conducted by Albemarle Health, Safety and Environmental staff.

All JBC employees receive awareness training on the primary environmental procedures (e.g., waste management), ISO 14001 procedures, and the VECAP program. JBC's operators are trained and certified to operate equipment that is critical to the environment, such as scrubbers and boilers. All employees handling waste materials are trained and certified on the specific handling procedures.

JBC has implemented multifaceted programs to reduce water consumption. JBC utilizes water recycling, and in 2011 it implemented a program which achieved a 15 percent reduction in freshwater consumption (~ 30 m^3 / hr). JBC's bromine production site in Safi has extensive water management and reduction programs in place and by applying a process heat integration and by operating at higher concentrations in certain process streams, it has managed to reduce the use of freshwater at its cooling towers by 2.6m^3/hr of fresh water.

In 2020, the water reused as part of the wastewater treatment was 77,000m^3, and in 2021 it is estimated to have reached 90,000m^3.

17.2.3 Environmental Monitoring

JBC has programs in place for monitoring noise and emissions to air and water. JBC also has a waste-management program that includes procedures for storage, handling, and disposing municipal, organic-containing, non-hazardous, and hazardous waste. A water-reduction program is also part of JBC's monitoring program.

An industrial hygiene program that is designed to ensure that employees are not harmed by exposure to chemicals or noise also exists, and work area and personal monitoring are conducted annually. JBC has an incident reporting system for reporting and tracking environmental and safety incidents. All incidents, including minor spills and releases, are reported and investigated with corrective actions are tracked in a database and reviewed monthly.

JBC has a HAZMAT team that is trained to respond to chemical spills and releases on company property or elsewhere in Jordan. Emergency response vehicles are equipped with materials used to stop and contain spills, as well as protective equipment for the employees. The company performs annual spill-response training with the Civil Defense Department offices in Safi and Aqaba.

17.3 Requirements and Plans for Waste and Tailings Disposal

Regarding the bromine production activities by JBC, the main waste product is the tailbrines (i.e., concentrated Dead Sea brines that are chemically neutralized before being sent back to the Dead Sea through the Truce Canal). Furthermore, JBC recently started two projects for the reclamation of water from waste streams that will lead to further reduction of the water footprint.

The waste product of the bromine-production process does not represent a hazardous waste and does not require any other treatment or procedure for final disposal.

JBC's waste management program includes procedures for storage, handling and disposal of municipal waste, organic-containing waste, non-hazardous waste, and hazardous waste.

As part of its waste management approach, JBC focuses its efforts to reduce environmental impact by tracking the waste generated at the plants, checking local and global markets for facilities that reuse or recycle the waste produced by JBC and by implementing measures to reduce the waste generated, especially hazardous waste that is sent to landfill.

17.4 Project Permitting Requirements, The Status of Any Permit Applications

The QP understands that JBC operates in compliance with Jordan's national regulations, such as the Environment Protection Law (No. 52/2006), the Public Health Law (No. 47/2008), the Civil Defense Law (No. 18/1999) and the Labor Law (No. 8/1996).

JBC works closely with the local communities, governmental, and nongovernmental organizations (NGOs) to positively impact and to help communities prosper socially and environmentally. JBC has also established the Caring for Jordan Foundation, which contributes to the well-being of Jordanians by helping them to improve their quality of life through support of sustainable community projects. The activities include providing computer laboratories in schools and supporting several local community organizations.

The project is aligned with the World Bank Group's Country Partnership Strategy for Jordan, which commits to strengthening the country's foundation for sustainable growth with a focus on competitiveness. MIGA's support is also aligned with the agency's efforts to mobilize $1 billion in insurance capacity to support foreign, direct investment into the Middle East and North Africa.

JBC has indicated that it seeks to help raise the quality of life for the communities where it operates for a balance of social development, environmental improvement, and economic development. JBC also provides small grants to various local projects and initiatives.

In 2011, JBC created the Community Advisory Panel (CAP) to enhance communication and cooperation with the local community. The CAP periodically connects community leaders with JBC management and staff to discuss concerns and strategize on local community development, environmental protection measures, educational and health-related development initiatives, and other key areas of JBC's involvement.

17.5 Qualified Person's Opinion

The QP opines that the JBC facility is operating in conformance with high industrial standards and is comparable with other similar facilities worldwide. The high level of compliance of the project is further confirmed by JBC's ISO 9001, 14001 and VECAP certifications.

JBC's robust Corporate Social Responsibility strategy is targeted at supporting sustainable community development projects and creating and funding sustainable social, cultural, and economic initiatives that service to local and national needs. JBC has a 3-year strategy that covers the Karak area, and in particular, particularly the communities of Qasaba, Ghor Al-Safi, and Ghor Mazra'a.

The QP found that the studies carried out by JBC met or exceeded the requirements of local and international industry standards and have been approved by Jordanian regulators. The QP also opines that JBC has effectively implemented its environmental and socioeconomic policies and has fulfilled its responsibilities efficiently.

18 CAPITAL AND OPERATING COSTS

The JBC facility is an active operation in the industrial production of elemental bromine and most of its major capital expenditures have already taken place. The facility has demonstrated its technical and financial feasibility and, therefore, the capital expenditures (CAPEX) and operating expenditures (OPEX) elements that are discussed in this section are directly related to sustaining the current production level through the term of APC's mineral concession (Year 2058).

JBC provided a model with the actual production, sales, and other financial elements that covers the time period from 2018 to 2023 (actuals) and forecasts for 2024 through 2028. After the QP had reviewed the model and assessed its soundness, the 2025 values (e.g., production and sales price) for the time period from 2026 to 2058 were used for the purpose of evaluating this project.

The Albemarle operation is a mature project which has been in commercial production for years. The accuracy of the capital and operating cost estimates used in the technical report are based on best industry practices and detailed historical information from the operation; therefore, they correspond to an AACE International Class 1 Estimate (AACE International Recommended Practice No. 18R-97).

As indicated by AACE, "Class 1 estimates are typically prepared to form a current control estimate to be used as the final control baseline against which all actual costs and resources will now be monitored for variations to the budget, and form a part of the change/variation control program. They may be used to evaluate bid checking, to support vendor/contractor negotiations, or for claim evaluations and dispute resolution."

Typical accuracy ranges for Class 1 estimates are -3% to -10% on the low side, and +3% to +15% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Albemarle's capital and operating cost estimates have an accuracy of -10% to +10%.

18.1 Capital Costs

The capital costs required for producing the bromine proven reserves have been forecasted based on an analysis of the historical plant capital costs, JBC's production plans, JBC's associated capital budget forecast, and QP's projections.

18.1.1 Development Facilities Costs

No further facilities or plant capital have been used in the business plan because JBC intends to keep all of the major components of its industrial facility through the expiration of the concession contract. JBC has, however, included a Brine Extraction CAPEX Allocation of approximately $13.00-$14.40 million in its model.

18.1.2 Plant Maintenance Capital (Working Capital)

Working capital has been forecasted as 23 percent of the implied revenue generated by the sales of elemental bromine. In the model prepared by JBC, the average annual working capital is approximately $213.90-$236.10 million.

18.2 Operating Costs

The operating costs required for producing and processing brine to obtain elemental bromine have been forecast based on JBC's production and operating budget. The total unit-production cost is forecast to be within the range of USD 648 to USD 972 per tonne of elemental bromine.

The following table contains details on Albemarle's annual capital by major components and operating costs by major cost centers. Columns beyond year 2033 have been combined and the values under 2034+ correspond to the sum of the individual figures through year 2058.

Table 18-1: Summary of Operating and Capital Expenses

SUMMARY OF OPERATING AND CAPITAL EXPENSES													
COMPANY: Albemarle Corporation **OPERATOR:** Albemarle Corporation		**CASHFLOW FORECAST CASE:** Real 2024$ **EFFECTIVE DATE OF ANALYSIS:** 12/31/2023								**FIELD:** JBC (Jordan)			
OPERATING AND CAPITAL COSTS **Year**		**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034+**	**Total**
Operating Costs													
Field and Plant Opex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,475.0	2,431
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	35.0
Total Opex, G&A, Abex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,475.0	2,431
Capital Costs													
Facilities (40%)	($MM/yr)	5.2	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	132.5	185
Plant (35%)	($MM/yr)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	115.0	161
Miscellaneous (25%)	($MM/yr)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	82.5	115
Total Capital Costs	($MM/yr)	13.0	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	330.0	461

19 ECONOMIC ANALYSIS

An economic model has been used to forecast cash flow from elemental bromine production and sales to derive a net present value for the bromine reserves. Cash flows have been generated using annual forecasts of production, sales revenues, and operating and capital costs. The salient features of the cash flow model include the following:

- **Elemental Bromine Production:** In the model prepared by JBC, elemental bromine production varies between 115 thousand and 120 thousand tonnes per year between years 2022 and 2026. After 2026, the production remains constant at 118 thousand tonnes per year through the term of the concession contract ending in Year 2058.
- **Average Selling Price:** The economic analysis has been developed for a range of sales prices comprising the spot price as of the effective date of this report, the spot price less 15 percent, 30 percent and 45 percent (between USD 1,938 and USD 3,525 per tonne).
- **Operating Cost:** Estimated between USD 648 and USD 972 per tonne.
- **Minority Interest:** Calculated as 18.20 percent starting in Year 2023 through Year 2058 and is the amount of profit shared with APC; the remaining 82 percent is allocated to Albemarle.
- **Working Capital:** Estimated as 23% of the implied revenue.
- **Brine Extraction CAPEX Allocation:** It fluctuates between USD 13.00 million and USD 14.40 million per year during the period 2023-2058).
- **Initial Date:** January 1, 2024.
- **Final Date:** December 31, 2058.
- **Discount Rate:** 15 percent.
- **Exchange Rate:** 1 JD = 1.41 USD.
- **Cost Basis:** All costs are expressed in constant Q4 2023 US dollars.

For the purposes of the cash flow model and net present value estimates, the QP has selected discrete values for each of the input parameters noted above that are near the mid-point of the ranges.

19.1 Royalties

The concession agreement between the Hashemite Kingdom of Jordan and JBC does not require payment of any royalty.

19.2 Bromine Market and Sales

Bromine produced from the JBC project is marketed and sold as elemental bromine to external clients, as well as to the JBC plants that produce derivative products. The market value of the elemental bromine produced has been determined by the historical record of elemental bromine sales revenues. The Company has supplied the elemental bromine sales revenue data, and based on its analysis, the QP determined that a sales price between USD 1,938 and USD 3,525 per tonne in the period 2024 to 2058 is consistent with historical sales and current market forecasts.

19.3 Income Tax

JBC has advised the QP that JBC is exempted from income tax based on Jordanian legislation.

19.4 Cash Flow Results

The QP has generated cash flow forecasts in real 2024$ terms. The results are summarized in the following tables. Columns beyond year 2033 have been combined and the values under 2034+ correspond to the sum of the individual figures through year 2058.

Table 19-1: Annual Cash Flow Summary – Proved Reserves – Spot Prices

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: JBC (Jordan)
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(k Tonnes)	4,130	4,130	4,130	4,130

PRESENT VALUE - COMPANY SHARE (Million US$) Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	8,095	3,786	2,230	1,529	1,153

PRODUCT PRICES												
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+
Bromine	(US$/kg)	$3.53	$3.53	$3.53	$3.53	$3.53	$3.53	$3.53	$3.53	$3.53	$3.53	$3.53

GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Brine Feed Flow	(MMt)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	418.5	574
Feed Grade	(ppm)	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742
Contained Br	(k Tonne)	136	136	136	136	136	136	136	136	136	136	3,659	5,014
Bromine Recovery	(%)	87	87	87	87	87	87	87	87	87	87	87	87
Bromine Production	(k Tonne)	118	118	118	118	118	118	118	118	118	118	2,950	4,130

COMPANY CASHFLOW Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	416.0	416.0	416.0	416.0	416.0	416.0	416.0	416.0	416.0	416.0	10,398.8	14,558
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating Costs													
Field and Plant Opex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,440.3	2,396
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35	35
Other Government Levies	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Opex, G&A, Abex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,475.0	2,431
Operating Cash Income Before Tax	($MM/yr)	320.4	320.4	320.4	320.4	320.4	320.4	320.4	320.4	320.4	320.4	8,923.8	12,127
Capital Costs													
Facilities (40%)	($MM/yr)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	132.0	185
Plant (35%)	($MM/yr)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	115.5	161
Miscellaneous (25%)	($MM/yr)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	82.5	115
Total Capital Costs	($MM/yr)	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	330.0	461
Minority Interest (18.2%)	($MM/yr)	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	75.7	1,892.6	2,650
Working Capital	($MM/yr)	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2
Cash Flow After Tax	($MM)	229.9	231.5	231.5	231.5	231.5	231.5	231.5	231.5	231.5	231.5	6,701.2	9,015

Table 19-2: Annual Cash Flow Summary – Proved Reserves – Spot Prices less 15%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation **OPERATOR:** Albemarle Corporation	**CASHFLOW FORECAST CASE:** Real 2024$ **PRICE FORECAST:** Spot -15% **ANNUAL COST INFLATION:** 0.0% **EFFECTIVE DATE OF ANALYSIS:** 12/31/2023	**FIELD:** JBC (Jordan) **WORKING INTEREST:** 100.0% **RESERVES CLASS:** Proved

RESERVES		Total Field		Company Share	
		Gross	Net	Gross	Net
Bromine	(k Tonnes)	4,130	4,130	4,130	4,130

PRESENT VALUE - COMPANY SHARE (Million US$)					
Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	6,310	2,951	1,738	1,192	899

PRODUCT PRICES												
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+
Bromine	(US$/kg)	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99

GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Brine Feed Flow	(MMt)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	418.5	574
Feed Grade	(ppm)	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742
Contained Br	(k Tonne)	136	136	136	136	136	136	136	136	136	136	3,659	5,014
Bromine Recovery	(%)	95	98	98	98	98	98	98	98	87	87	87	87
Bromine Production	(k Tonne)	129	133	133	133	133	133	133	133	118	118	2,950	4,246

COMPANY CASHFLOW Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	385.7	397.7	397.7	397.7	397.7	397.7	397.7	397.7	352.8	352.8	8,820.5	12,696
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating Costs													
Field and Plant Opex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,440.3	2,396
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35	35
Total Opex, G&A, Abex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,475.0	2,431
Operating Cash Income Before Tax	($MM/yr)	290.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	257.2	257.2	7,345.5	10,265
Capital Costs													
Facilities (40%)	($MM/yr)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	132.5	132.0	312
Plant (35%)	($MM/yr)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	115.0	115.5	272
Miscellaneous (25%)	($MM/yr)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	82.5	82.5	195
Total Capital Costs	($MM/yr)	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	330.0	330.0	778
Minority Interest (18.2%)	($MM/yr)	70.2	72.4	72.4	72.4	72.4	72.4	72.4	72.4	64.2	64.2	1,605.3	2,311
Working Capital	($MM/yr)	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Cash Flow After Tax	($MM)	205.4	216.6	216.6	216.6	216.6	216.6	216.6	216.6	179.9	-137.0	5,410.2	7,175

Table 19-3: Annual Cash Flow Summary – Proved Reserves – Spot Prices less 30%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot -30%
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: JBC (Jordan)
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved

RESERVES

		Total Field		Company Share	
		Gross	Net	Gross	Net
Bromine	(k Tonnes)	4,130	4,130	4,130	4,130

PRESENT VALUE - COMPANY SHARE (Million US$)

Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	4,525	2,116	1,246	855	645

PRODUCT PRICES

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+
Bromine	(US$/kg)	$2.47	$2.47	$2.47	$2.47	$2.47	$2.47	$2.47	$2.47	$2.47	$2.47	$2.47

GROSS PRODUCTION

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Brine Feed Flow	(MMt)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	418.5	574
Feed Grade	(ppm)	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742
Contained Br	(k Tonne)	136	136	136	136	136	136	136	136	136	136	3,659	5,014
Bromine Recovery	(%)	95	98	98	98	98	98	98	98	98	98	98	98
Bromine Production	(k Tonne)	129	133	133	133	133	133	133	133	133	133	2,950	4,276

COMPANY CASHFLOW

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	318.6	328.5	328.5	328.5	328.5	328.5	328.5	328.5	328.5	328.5	7,286.5	10,562
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating Costs													
Field and Plant Opex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,440.3	2,396
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35	35
Total Opex, G&A, Abex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,475.0	2,431
Operating Cash Income Before T	($MM/yr)	223.1	232.9	232.9	232.9	232.9	232.9	232.9	232.9	232.9	232.9	5,811.5	8,131
Capital Costs													
Facilities (40%)	($MM/yr)	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	132.0	185
Plant (35%)	($MM/yr)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	115.5	161
Miscellaneous (25%)	($MM/yr)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	82.5	115.3
Total Capital Costs	($MM/yr)	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	330.0	461
Minority Interest (18.2%)	($MM/yr)	58.0	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	59.8	1,326.1	1,922
Working Capital	($MM/yr)	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Cash Flow After Tax	($MM)	150.8	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	160.0	4,155.4	5,746

Table 19-4: Annual Cash Flow Summary – Proved Reserves – Spot Prices less 45%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation	**CASHFLOW FORECAST CASE:** Real 2024$	**FIELD:** JBC (Jordan)
OPERATOR: Albemarle Corporation	**PRICE FORECAST:** Spot -45%	**WORKING INTEREST:** 100.0%
	ANNUAL COST INFLATION: 0.0%	**RESERVES CLASS:** Proved
	EFFECTIVE DATE OF ANALYSIS: 12/31/2023	

RESERVES

		Total Field		Company Share	
		Gross	Net	Gross	Net
Bromine	(k Tonnes)	4,651	4,651	4,651	4,651

PRESENT VALUE - COMPANY SHARE (Million US$)

Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	2,740	1,282	755	517	390

PRODUCT PRICES

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+
Bromine	(US$/kg)	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94

GROSS PRODUCTION

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Brine Feed Flow	(MMt)	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	418.5	574
Feed Grade	(ppm)	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742	8,742
Contained Br	(k Tonne)	135.5	135.5	135.5	135.5	135.5	135.5	135.5	135.5	135.5	135.5	3,658.5	5,014
Bromine Recovery	(%)	87	87	87	87	87	87	87	87	87	87	87	87
Bromine Production	(k Tonne)	118	118	118	118	118	118	118	118	118	118	2,950	4,130

COMPANY CASHFLOW

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	228.9	228.9	228.9	228.9	228.9	228.9	228.9	228.9	228.9	228.9	5,723.0	8,012
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operating Costs													
Field and Plant Opex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,440.3	2,396
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35	35
Total Opex, G&A, Abex	($MM/yr)	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	95.6	1,475.0	2,431
Operating Cash Income Before T	($MM/yr)	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	4,248.0	5,581
Capital Costs													
Facilities (40%)	($MM/yr)	5.2	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3	132.0	184
Plant (35%)	($MM/yr)	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	115.5	161
Miscellaneous (25%)	($MM/yr)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	82.5	115
Total Capital Costs	($MM/yr)	13.0	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	330.0	461
Minority Interest (18.2%)	($MM/yr)	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	41.7	1,041.6	1,458
Working Capital	($MM/yr)	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
Cash Flow After Tax	($MM)	77.7	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	2,876.4	3,661

19.5 Net Present Value Estimate

Based on the above-mentioned cash flow model, the QP has estimated the net present value (NPV) of the project by using a range of discount rates discount rate between 0 and 15 percent, and the results are shown in the following tables.

Table 19-5: Jordan Bromine Company –NPV of Reserves as of December 31, 2023 – Spot Prices

Jordan Bromine Corporation - Bromine Reserves as of December 31, 2023 Spot Price Forecast						
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	4,130	8,095	3,786	2,230	1,529	1,153

Table 19-6: Jordan Bromine Company – NPV of Reserves as of December 31, 2023 – Spot Prices less 15%

Jordan Bromine Corporation - Bromine Reserves as of December 31, 2023 Spot Price Forecast less 15%						
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	4,130	6,310	2,951	1,738	1,192	899

Table 19-7: Jordan Bromine Company – NPV of Reserves as of December 31, 2023 – Spot Prices less 30%

Jordan Bromine Corporation - Bromine Reserves as of December 31, 2023 Spot Price Forecast less 30%						
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	4,130	4,525	2,116	1,246	855	645

Table 19-8: Jordan Bromine Company – NPV of Reserves as of December 31, 2023 – Spot Prices less 45%

Jordan Bromine Corporation - Bromine Reserves as of December 31, 2023 Spot Price Forecast less 45%						
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	4,130	2,740	1,282	755	517	390

Per the NPV estimate analysis, the 15% discounted NPV of the JBC project is estimated to be $0.52 and $1.53 billion as of December 31, 2023, demonstrating that the operations are economic and supporting the estimation of reserves. The following figure shows the full distribution of the NPV range for each price forecast for Proved reserves.

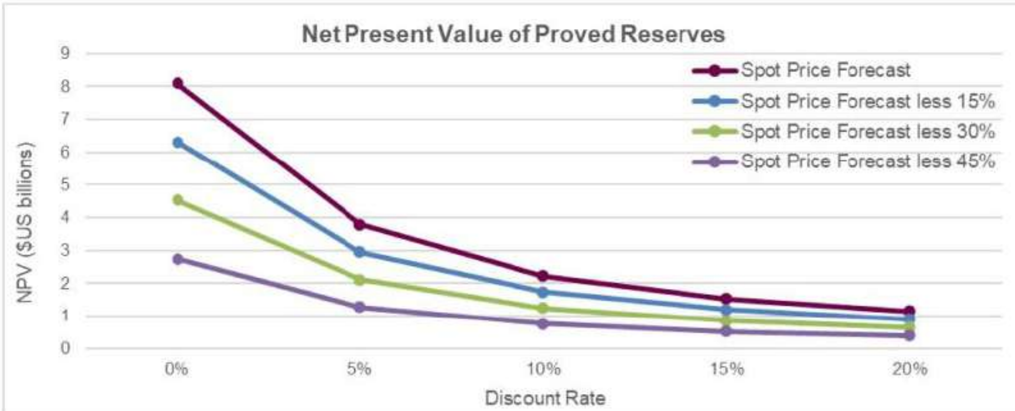

Figure 19.1: Net Present Value Distribution of Proved Reserves by Price Forecast.

20 ADJACENT PROPERTIES

Three properties are adjacent to the JBC plant in the Jordanian territory. The Manaseer Magnesia Company and APC are shown in Figure 20.1. The Israel Chemicals (ICL) Dead Sea Works Limited plant is adjacent and on the west side of the Jordan-Israel border. This plant is similar to the APC and JBC plants in that it produces potash, bromine, and bromine-derivative products.

20.1 Manaseer Magnesia Company

This report has extensively described the APC facilities and this section is a brief description of the Manaseer Magnesia Company property.

Manaseer Group acquired Manaseer Magnesia Company after purchasing the total shares of Jordan Magnesia Company in 2016 for a total of $12.5 million on a cash-free, debt-free basis. With this acquisition, Manaseer Group rehabilitated the plant and officially began operations.

The first phase of the Manaseer Magnesia Company plant operations, located in Ghor Al-Safi, comprised the production of caustic and hydrated lime. Manaseer Magnesia Company announced the commencement of the second phase of its plant operations to produce caustic calcined magnesia (CCM) at a capacity of up to 60,000 tonnes, with ambitious plans to further bolster production capacity in the future.

As of December 2023, the Manaseer Magnesia Plant was not operating.

20.2 Dead Sea Works Limited

ICL is a public company with dual-listed shares on the New York Stock Exchange (NYSE) and Tel Aviv Stock Exchange (TASE) (listed as NYSE:ICL and TASE:ICL). Shareholders include the Israel Corp. (45.93 percent) and the public (54.07 percent).

In 2018, ICL launched its "Business Culture of Leadership" strategy, which focused on enhancing market leadership across ICL's three core mineral value chains of bromine, potash, and phosphate, as well as realizing the growth potential of innovative agriculture solutions. To better align the organization with this strategy, ICL realigned the company into four business divisions: Industrial Products (Bromine), Potash, Phosphate Solutions, and Innovative Ag Solutions.

ICL's history began in the early twentieth century with the first efforts to extract minerals from the Dead Sea in Israel's south. After Israel's independence in 1948, the activities continued with the establishment of Dead Sea Works Limited, a state-owned company. During the early 1950s, several other government-owned companies were created to extract minerals from the Negev Desert and transform the minerals into chemical products. In 1975, ICL expanded through a consolidation with these companies, including Rotem Amfert Negev, Bromine Compounds, and TAMI (IMI) (ICL's research arm). ICL also grew through organic growth and acquisitions.

In 1992, the Israeli government began privatization of ICL, first by listing 19 percent of ICL shares on the TASE. In 1995, the State of Israel sold its controlling interest (24.9 percent of ICL's equity) to Israel Corp., which was then controlled by the Eisenberg family. In 1997, Israel Corp. acquired an additional 17 percent of ICL's shares with another 10 percent acquired a year later. Also, in 1998, the State of Israel sold 12 percent of ICL's shares to the general public, as well as 9 percent to Potash Corp.

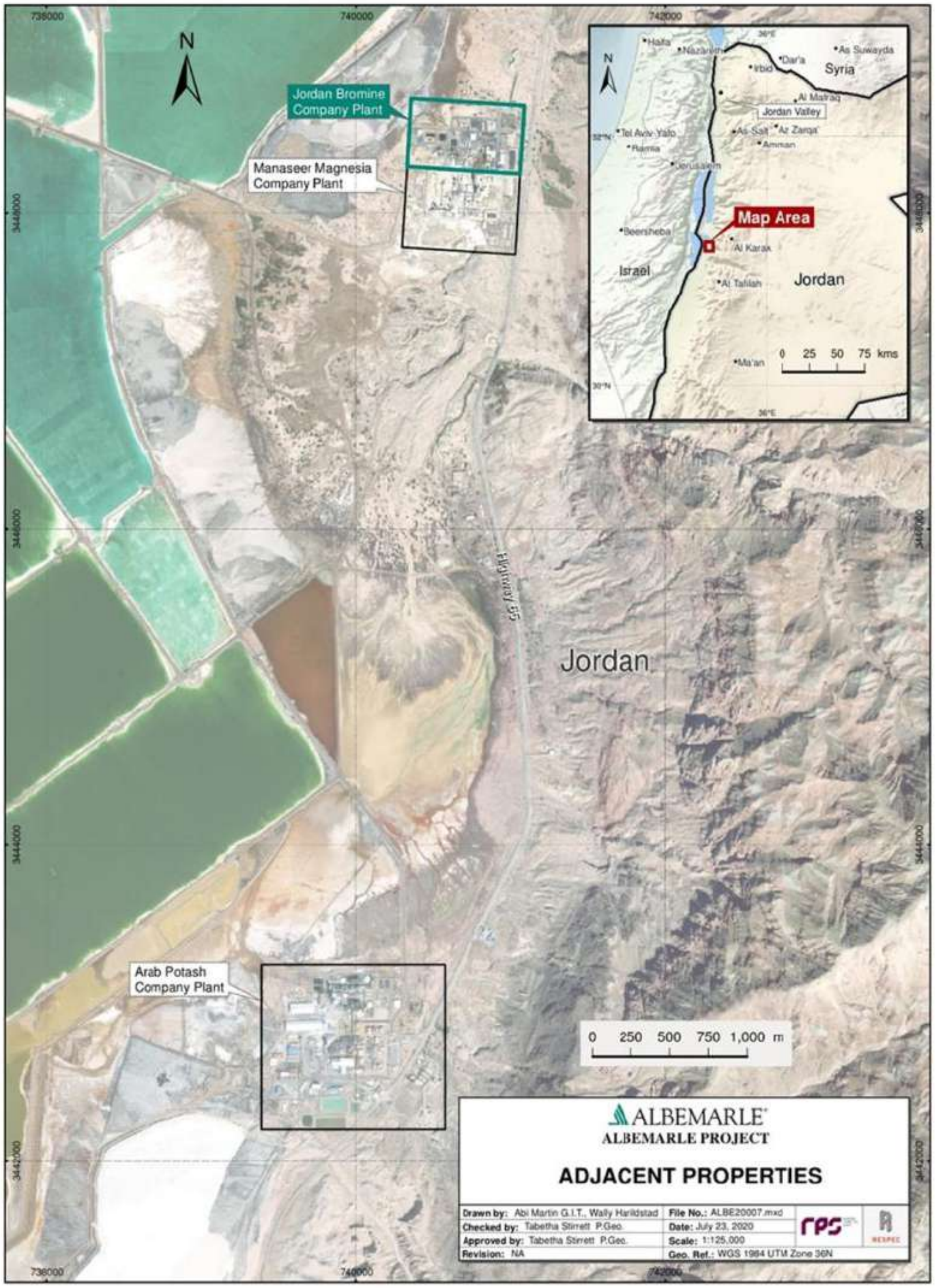

Figure 20.1: The Adjacent Properties of Manaseer Magnesia Company and Arab Potash Company.

In the late 1990s, the Ofer Group acquired control of Israel Corp., including ICL. During the last 15 years, ICL has expanded significantly, primarily by increasing its production capacity and global distribution, establishing regional offices and joint ventures, and through synergistic acquisitions.

In 2018, Potash Corp sold its holdings in ICL. Today, ICL is a global powerhouse in fertilizers and specialty chemicals and fulfills essential needs in three core end markets: agriculture, food, and engineered materials by using an integrated value chain based on specialty minerals.

21 OTHER RELEVANT DATA AND INFORMATION

This section is not applicable at this time.

22 INTERPRETATION AND CONCLUSIONS

22.1 General

- Jordan Bromine Company (JBC) is in the Hashemite Kingdom of Jordan (Jordan), in the Governorate of Karak, and is located on the southeastern edge of the Dead Sea. The JBC production plant facility occupies a 26-hectare (ha) area. It also has a 2-ha storage facility within the free-zone industrial area at the Port of Aqaba.
- In 1958, the Government of the Hashemite Kingdom of Jordan granted Arab Potash Company (APC) a concession for exclusive rights to exploit the minerals and salts from the Dead Sea brine until 2058; at that time, APC factories and installations would become the property of the Government[6]. APC was granted its exclusive mineral rights under the Concession Ratification Law No. 16 of 1958.
- JBC was established in 1999 as a joint venture between Albemarle Holdings Company Limited (a wholly owned subsidiary of Albemarle) and APC. Albemarle holds a 50 percent interest in JBC Limited. JBC's operations primarily consist of the manufacturing of bromine, from which derivative products are made including TBBPA, calcium bromide, sodium bromide, hydrobromic acid, and potassium hydroxide.
- The Joint Venture Agreement guarantees the supply of brine and fresh water for the JBC operations through the life of APC's concession (2058).
- The bromide-enriched brine, used by JBC as its main raw material, is a byproduct of potash operations conducted by APC. JBC's operations primarily consist of the manufacturing of bromine, from which derivative products are made including TBBPA, calcium bromide, sodium bromide, hydrobromic acid, and potassium hydroxide.
- Brine extracted from the Dead Sea by APC is stored in ponds where it evaporates and concentrates until the constituent salts crystallize and progressively begin to precipitate. At the specific gravity of 1.31, carnallite begins to crystallize and precipitate. The carnallite is then harvested by wet dredging from the pond bottom, and the dredged salts are pumped in a slurry to a processing plant where the potassium chloride is separated from the magnesium chloride.
- The process through the evaporation ponds is continuous and a part of the final effluent from the carnallite ponds is sent to the JBC and MMC plants. The other part of the effluent is returned to the Dead Sea.
- The bromide-enriched feedbrine received by JBC is put through an industrial process that includes a chlorination and distillation phases, which accomplishes the separation and recovery of elemental bromine.
- The JBC complex consist of two plants: Area 1 and Petra, which have a combined processing capacity of over 15 million tonnes of feedbrine per year, and an estimated production capacity in excess of 130 thousand tonnes of elemental bromine per year.
- An estimated 52.26 percent of the bromide ion resources identified in the Dead Sea are controlled by Jordan (as of the effective date of this report) and, therefore, correspond to APC under the terms of its concession. Consequently, as of December 31, 2023, an estimated 351.37 MMt of bromide ion resources (672.35MMt ×52.26 percent) controlled by JBC. The measured resources of bromide ion attributable to Albemarle's 50% interest in its JBC joint venture is estimated to be approximately 175.69 MMt. From these large resources, JBC is extracting approximately 1 percent of the bromine available. This estimate includes Reserves.
- The total Bromine reserves controlled by JBC as of 2023 are estimated at approximately 4.13 MMt of bromine (average of 118,000 tonnes/year over 35 years). The proven reserves attributable to Albemarle's 50% interest in its JBC joint venture are estimated to be

approximately 2.07 MMt of elemental bromine. This reserve estimate represents only a fraction of the total resource contained in the Dead Sea and accessible by APC/JBC and therefore, the estimate provides reasonable assurance that the project will not be affected by shortages of raw material over its life.

- JBC's location near the APC facilities provides access to power and transportation infrastructure. JBC also operates a terminal at the port of Aqaba through which it imports supplies for its processes and exports elemental bromine and other derivatives.
- The global bromine market is expected to grow steadily at a Compound Annual Growth Rate (CAGR) of around 4.20 percent between 2023 and 2028. The oil-and-gas industry is an important market for bromine derivatives; in particular, the so-called clear brine fluids (e.g., calcium bromide, sodium bromide, and zinc bromide) are used as completion fluids to minimize formation damage and control reservoir formation pressures. Other important markets are cosmetics, automobile, and pharmaceuticals.
- Bromine produced from the JBC project is marketed and sold as elemental bromine to external clients, as well as to the JBC plants that produce derivative products.
- JBC complies with national regulations as well as with the Occupational Safety and Health Administration (OSHA) and National Fire Protection (NFPA) international regulations. JBC is the first company of its kind in Jordan to become an authorized exporter to Europe and has been certified for International Organization of Standards (ISO) 9001, 14001, and the Voluntary Emissions Control Action Program (VECAP).
- JBC's robust Corporate Social Responsibility strategy is targeted at supporting sustainable community development projects and creating and funding sustainable social, cultural, and economic initiatives that service to local and national needs. JBC has effectively implemented its environmental and socioeconomic policies and has fulfilled its responsibilities efficiently.
- The JBC facility is an active operation in the industrial production of elemental bromine and most of its major capital expenditures have already taken place. The facility has demonstrated its technical and financial feasibility and, therefore, the capital expenditures (CAPEX) and operating expenditures (OPEX) elements that are presented in this report are directly related to sustaining the current production level through the term of APC's mineral concession (Year 2058).
- The market value of the elemental bromine produced by JBC has been determined by the historical record of elemental bromine sales revenues.
- Based on the cash flow model presented in Chapter 19, the net present value (NPV) of the project has been estimated by using a discount rate of 15 percent. The NPV of the JBC project is estimated to be between \$0.52 billion to \$1.53 billion as of December 31, 2023, demonstrating the operations are economic and supporting the estimation of reserves.

22.2 Discussion of Risk

In general, the risks for a large industrial project like JBC in Jordan could be considered moderate, in the opinion of the QP. This opinion is supported by analyses prepared by reputable institutions like the World Bank (www.doingbusiness.org), (Coface (www.coface.com), Societé Generale (https://import-export.societegenerale.fr), the International Labour Organization (www.ilo.org) and others.

The following is a detailed explanation of the major risks related to JBC project:

22.2.1 Geopolitical Risk

The local Jordanian politics should have minimal to no impact on JBC. The plant is at a sufficient distance from Amman; hence, any civil unrest would not impact operations. However, if the Jordanian government so desired, they could gain access to the Dead Sea for a separate bromine production facility. But JBC believes that it has the right of first refusal on this.

Jordan is politically stable, unlike most of its neighbors and it has the political and financial support from the Gulf monarchies and the Western countries. The World Bank projects Jordan's economy to grow by 2.7 percent in 2024.

By the end of 2023 Jordan's economy showed signs of gradual recovery following a moderate contraction of 2.2 percent in 2021. Recovery in economic growth during 2022 has been led by services and industry, yet many subsectors have not yet reached pre-pandemic performance.

The country's current account imbalances continued to widen for another year, particularly through the widening of the trade gap, though strong donor inflows helped Jordan build up its reserves. Jordan's development has historically benefited from international aid as the country has been able to become a central element of stability in the Near and Middle East, ensuring peace on the borders it shares with its neighboring countries. However, it is still vulnerable to international economic conditions and political instability in the Near and Middle East. The continued stability of Jordan hinges on three interrelated factors- its ability to maintain fiscal stability amid economic challenges, preserving relationships with its most important patrons, the US and the Gulf monarchies and mitigating the domestic effects of American or Israeli decisions taken regarding the Palestinians. The regional geopolitical stability is paramount to maintain uninterrupted supply chain and availability of raw materials for the property.

The economic activity of Jordan will continue to be driven by mining and tourism. The latter is a particular focus for the government, which aims to double the 2016 tourist numbers by 2020. As in the past, banking and insurance activities (21% of GDP in 2018) will be growth drivers. Growth will also be fueled by exports (about 19% of GDP in 2018), particularly in the mining sector, following the demonstration of official support at the London Initiative, a conference held to bolster investment in Jordan. The reopening of the Iraqi border (despite security risks) and related trade and investment agreements, lower import costs (oil and food) and quicker-than-expected engagement by domestic companies with the Association Agreement with the EU, should increase economic activity.

Jordan's pro-Western and pro-Gulf stance will remain the cornerstone of foreign policy for security and, increasingly, economic reasons. Jordan's central strategic position should ensure continued logistical, financial, and military assistance from the United States, its main ally, despite differences with US policy in this region. In recent decades, Jordan has managed to navigate a period of regional chaos, maintaining stability through largely cosmetic domestic reforms, with significant financial aid from the US and Saudi Arabia. These patrons have acted as a safety net for Jordan, which lacks the natural resources of many of its neighbours.

In addition to the humanitarian and financial crisis caused by the influx of Syrian refugees, which caused an increase in public spending, Jordan also must deal with a high unemployment rate, that rose further to 16.8% by the end of 2019 (ILOSTAT), a high poverty rate and high levels of inequality. There were numerous popular protests in 2019, including strikes by teachers calling for a 50% increase in salaries, which the government responded to by proposing wage hikes.

A further potential fracture exists between Jordan's citizens of Palestinian descent and its East Bank population. As the Israeli-Palestinian peace process is increasingly seen as dead, Jordan will face mounting pressure from its citizens of Palestinian descent to withdraw from the 1994 Wadi Araba treaty, which made peace between Israel and Jordan. While such a move would surely be popular with a broad section of the Jordanian public, Amman also faces strong incentives to maintain its cooperation. Among these are significant energy and water infrastructure projects on which the two countries have cooperated. Jordan could perhaps find other water and energy sources, but such alternatives may costly and unreliable. The monarchy is further caught between its popular demands and its American allies. The United States remains Amman's most important international partner, and a country as dependent as Jordan is on foreign transfers can ill-afford to jeopardize such relationships.

Jordan's economy showed a healthy recovery following a moderate contraction of 2.2 percent in 2021. The economy then managed to grow to 2.7 percent in Fall 2022 and has maintained the same economic growth rate in 2023.

22.2.2 Environmental Risk

Lower rainfall, increased drought, higher temperatures, and rising sea levels on the Gulf of Aqaba, are just some of the possible results of climate change affecting Jordan. Environmental problems there are further complicated by factors such as garbage disposal and road traffic. Also, the decreasing levels of the Dead Sea may be the single most critical environmental risk for the JBC project.

The scarcity and uneven distribution of precipitation over Jordan results in limited surface and groundwater resources available for domestic consumption and agricultural and industrial uses. Rapid population growth coupled with increased urbanization and industrialization are leading to the over-exploitation of aquifers and the contamination of diminishing supplies through: Inadequate industrial and municipal wastewater treatment capacities; Siting of industrial plants near or immediately upstream from potable supplies; and Overuse and misuse of pesticides, insecticides, fungicides and fertilizers leading to pollution of ground and surface water resources by irrigation drainage.

The Jordanian water shortages are a threat both to development and to the health of the population. Jordan has a multi-faceted difficulty with its lack of available water resources. Over the past decades, there have been extreme changes in climate that have drastically affected Jordan's water supply.

The water balance of the Dead Sea has been disturbed since the late 1950s. The lake has no outlet, and the heavy inflow of fresh water is carried off solely by evaporation, which is rapid in the hot desert climate. Due to large-scale projects by Israel and Jordan to divert water from the Jordan River for irrigation and other water needs, the surface of the Dead Sea has been dropping for at least the past 50 years.

The drop of the sea level increases the pumping and conveyance costs for the potash and bromine operations, due to the required relocation of the pumping facilities. However, these increases in cost are considered in the economic analyses of the operations. It is estimated that the predictable reduction in the level of the Dead Sea will not cause any significant impact on the potash and bromine projects within the APC/JBC mining concession, which will expire in 2058.

22.2.3 Additional Raw Materials Risk

Supply of raw materials have been impacted due to COVID. Certain raw materials such as BPA (Bisphenol A) and chlorine have seen shortages all over the world. JBC is evaluating the prospect of installing a second chlorine plant and talks are ongoing regarding financing, ownership, etc.

Flooding and other natural impediments may also interrupt the supply of raw materials. JBC is working to address some of these concerns.

22.2.4 Other Risk Considerations

Albemarle, the US Joint-Venture partner of JBC mentions in its 2020 Annual Report that it perceives the fact that it is subject to government regulation in the non-U.S. jurisdictions in which it conducts its business as a risk. In the specific case of Jordan, as discussed in this report, the regulatory framework of the country and its favorable business environment, make this potential risk not very likely.

Albemarle indicates that its substantial international operations, like in the case of the JBC Joint Venture, are subject to the typical risks of doing business in a foreign country. As stated by the QP, Jordan is a stable destination for business (both politically and financially). Furthermore, the fact that APC, a state-controlled entity is the JV's local partner, provides further assurance that the operation is shielded from several of the most significant risks listed by Albemarle.

The possibility of terrorist activities that could impact the normal operations of JBC is real and is perhaps one of the greatest risks for any business in the Middle East.

Albemarle indicated that it believes that it has sufficient inventory to continue producing at current levels, however, government mandated shutdowns could impact its ability to acquire additional materials and disrupt its customers' purchases.

The summary presented in Table 22-1 are the QP's opinion on the risks as highlighted by Albemarle:

Table 22-1: Project Risks

Risk	Level of Risk to the JBC Project
Material adverse effect of the COVID-19 pandemic on the company's results of operations, financial position, and cash flows.	This is a risk that affects industries worldwide. JBC has not reported any material impact on its liquidity. The length and severity of the pandemic may become a risk in the long run; however, Albemarle/ JBC have kept their financial flexibility during the pandemic by adopting adequate managerial and financial measures, including the implementation of a cross-functional Global Response Team, to assess the situation and take necessary actions to address employee health and safety and operational challenges.
Fluctuations in foreign currency exchange rates may affect product demand and may adversely affect the profitability in U.S. dollars of products and services we provide in international markets where payment for our products and services is made in the local currency.	This is a risk on the buyers' side of the business and not inherent to the JBC operation. Further, from a local operations standpoint, the Jordanian Dinar is pegged to the U.S. Dollar.
Transportation and other shipping costs may increase, or transportation may be inhibited.	Not likely in Jordan.
Increased cost or decreased availability of raw materials.	Not applicable. Resources beyond foreseeable life of project.
Changes in foreign laws and tax rates or U.S. laws and tax rates with respect to foreign income may unexpectedly increase the rate at which income is taxed, impose new and additional taxes on remittances, repatriation, or other payments by subsidiaries, or cause the loss of previously recorded tax benefits.	Not likely. Very stable exchange rate over the past several years as the Jordanian Dinar is pegged to the U.S. Dollar.
Foreign countries in which Albermarle do business may adopt other restrictions on foreign trade or investment, including currency exchange controls.	Not likely in Jordan.
Trade sanctions by or against these countries could result in losing access to customers and suppliers in those countries.	Possible but not likely.
Unexpected adverse changes in foreign laws or regulatory requirements may occur.	Possible but not likely.

Agreements with counterparties in foreign countries may be difficult for to enforce and related receivables may be difficult to collect.	Not applicable.
Compliance with the variety of foreign laws and regulations may be unduly burdensome.	Not applicable to the JBC operation.
Compliance with anti-bribery and anti-corruption laws (such as the Foreign Corrupt Practices Act) as well as anti-money-laundering laws may be costly.	Possible but not likely.
Unexpected adverse changes in export duties, quotas and tariffs and difficulties in obtaining export licenses may occur.	Not likely in Jordan.
General economic conditions in the countries in which Albemarle operate could have an adverse effect on our earnings from operations in those countries.	Possible but not likely.
Foreign operations may experience staffing difficulties and labor disputes.	Possible but not likely.
Termination or substantial modification of international trade agreements may adversely affect access to raw materials and to markets for products outside the U.S.	Not applicable to the JBC operation.
Foreign governments may nationalize or expropriate private enterprises.	Possible but not likely in Jordan.
Increased sovereign risk (such as default by or deterioration in the economies and credit worthiness of local governments) may occur.	Not likely.
Political or economic repercussions from terrorist activities, including the possibility of hyperinflationary conditions and political instability, may occur in certain countries in which Albemarle does business.	This is a risk in the Middle East, including Jordan.

22.2.5 Risk Conclusion

The QP concludes that the JBC operation in Jordan can be characterized as of moderate risk and that the political or economic repercussions from terrorist activities could be considered the greatest risk, due to its location in the Middle East. Other economic and political factors, as well as the environmental considerations of this type of operation need to be watched, but do not represent a risk to the business in the foreseeable future.

23 RECOMMENDATIONS

No additional work relevant to the existing reserves is applicable at this time. The JBC plants have demonstrated capacity to operate at the production levels forecasted through the life of the reserve. No significant capital projects are anticipated to extend the life or expand the capacity of the existing plants.

24 RELIANCE ON INFORMATION PROVIDED BY THE REGISTRANT

Data provided by Albemarle and relied on is included in the following report sections.

JBC production reports. JBC (Area 1 and Petra Bromine) Brine Processing and Bromine Production Records (2019) [Source: JBC's Operating Costs]

Table 24-1: Reliance on Information Provided by the Registrant

Category	Report Item/ Portion	Disclose why the Qualified Person considers it reasonable to rely upon the registrant
Macroeconomic trends	Section 19	The discount rate used was provided by Albemarle corporate finance group. The QP's experience evaluating international projects leads them to opine that the selected discount rate is representative of the expected risks associated with an ongoing chemical manufacturing operation in the Middle East/North Africa (MENA) region, particularly in a politically stable country like Jordan
Marketing information	Section 16.1	Market overview information obtained from Technavio, a market research company with expertise in the field.
	Section 16.2	Major producer information was sourced from USGS Mineral Commodity Summary for Bromine. The USGS is considered by the QP as a reliable source of such data. The USGS canvasses very thoroughly the world mineral markets and its commodity specialists gather first-hand information from both producers and consumers of minerals.
	Section 16.3	Information on major markets was sourced from Market Research Future, a source considered as reliable by the QP, as well as of gather publicly available market indicators.
	Section 16.5	Albemarle provided information on bromine applications which was reviewed by the QP and considered reasonable. The QP also reviewed the public domain in order to obtain general information on bromine applications.
Legal matters	Section 3.2	This section includes information obtained from the public domain, particularly the general aspects of the Jordanian mining and environmental frameworks. These sources included translations of Jordanian laws available from publicly available sources, as well as comments from Jordanian lawyers specialized in natural resources in specialized forums.
Environmental matters	Sections 17.3, 17.4	Albemarle provided certain information regarding plant operations, particularly in regards waste streams. The QP also obtained information from the public domain, including general aspects of the Jordanian environmental framework, and Environmental Impact Assessment reports prepared by JBC under international environmental standards, in order to obtain multi-lateral financing for expansion work at both the plant and port.
Local area commitments	Section 17.5	The QP obtained information for this section from various sources, including Albemarle and JBC. The QP also obtained information regarding social programs and commitments with the local communities from the public domain.
Governmental factors	Section 3.2	The QP reviewed information from the public domain on the interaction of JBC with Jordanian government agencies and with regulators responsible to manage the various aspects of APC's mineral concession on Dead Sea resources.

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Exhibit 96.6

MAGNOLIA FIELD BROMINE RESERVES AS OF DECEMBER 31, 2023

Magnolia, Arkansas, USA, property of Albemarle Corporation

220830
Final
14 February 2024

rpsgroup.com

MAGNOLIA FIELD BROMINE RESERVES AS OF DECEMBER 31, 2023

Magnolia, Arkansas, USA, property of Albemarle Corporation

Approval for issue		
Michael Gallup, P. Eng.	Michael.Gallup@rpsgroup.com	14 February 2024

Prepared by:

RPS

Michael Gallup
Technical Director – Engineering

Suite 600
555 4th Avenue SW
Calgary AB
T2P 3E7

T +1 403 265 7226
E Michael.Gallup@rpsgroup.com

and

RESPEC
Peter Christensen
Oscar Velasquez

146 East Third Street
PO Box 888
Lexington, Kentucky 40588

Prepared for:

Albemarle Corporation

4250 Congress Street
Suite 900
Charlotte, NC
28209
U.S.A.

T +1 225 388 7076

Suite 600
555 4th Avenue SW
Calgary AB
T2P 3E7
T +1 403 265 7226

RPS Ref: 214554

February 15, 2023

Albemarle Corporation
4250 Congress Street
Suite 900
Charlotte, NC
28209
U.S.A.

MAGNOLIA FIELD BROMINE RESERVES AS OF DECEMBER 31, 2023

Technical Report Summary as of December 31, 2023

As requested in the engagement letter dated September 15th. 2022, RPS and RESPEC have evaluated certain Bromine reserves and resources in the Magnolia field, Arkansas, USA, as of December 31, 2023 ("Effective Date") and submit the attached report of our findings. The evaluation was conducted in compliance with subpart 1300 of Regulation SK.

This report contains forward looking statements including expectations of future production and capital expenditures. Potential changes to current regulations may cause volumes actually recovered and amounts future net revenue actually received to differ significantly from the estimated quantities. Information concerning reserves and resources may also be deemed to be forward looking as estimates imply that the reserves or resources described can be profitably produced in the future. These statements are based on current expectations that involve a number of risks and uncertainties, which could cause the actual results to differ from those anticipated. These risks include, but are not limited to, the underlying risks of the mining industry (i.e., operational risks in development, exploration and production; potential delays or changes in plans with respect to exploration or development projects or capital expenditures; the uncertainty of resources estimates; the uncertainty of estimates and projections relating to production, costs and expenses, political and environmental factors), and commodity price and exchange rate fluctuation. Present values for various discount rates documented in this report may not necessarily represent fair market value of the reserves or resources.

Yours sincerely,
for RPS Energy Canada Ltd

Michael Gallup
Technical Director – Engineering
michael.gallup@rpsgroup.com
+1 403 290 2694

14 February 2024

February 14, 2024

CONSENT OF QUALIFIED PERSON

RPS Energy Canada Ltd. ("RPS"), in connection with Albemarle Corporation's Annual Report on Form 10-K for the year ended December 31, 2023 (the "Form 10-K"), consents to:

- the public filing by the Company and use of:
  - the technical report titled "SEC Technical Report Summary for Jordan Bromine Operation" (the "Jordan Bromine Technical Report Summary"), with an effective date of December 31, 2023 and dated February 14, 2024;
  - the technical report titled "SEC Technical Report Summary for Magnolia Field Bromine Reserves" (the "Magnolia Technical Report Summary" and together with the Jordan Bromine Technical Report Summary, the "Technical Report Summaries"), with an effective date of December 31, 2023 and dated February 14, 2024

  that were prepared in accordance with Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission and filed as exhibits to this Form 10-K;
- the incorporation by reference of the Technical Report Summaries into the Company's Registration Statements on Form S-3 (No. 333-269815) and the Registration Statements on Form S-8 (No. 333-150694, 333-166828, 333-188599, 333-223167 and 333-271578) (collectively, the "Registration Statements");
- the use of and references to our name, including our status as an expert or "qualified person" (as defined in Subpart 1300 of Regulation S-K promulgated by the U.S. Securities and Exchange Commission), in connection with the Form 10-K, the Registration Statements and the Technical Report Summaries; and
- any extracts from or a summary of the Technical Report Summaries in the Form 10-K and incorporated by reference in the Registration Statements and the use of any information derived, summarized, quoted, or referenced from the Technical Report Summaries, or portions thereof, that was prepared by us, that we supervised the preparation of, and/or that was reviewed and approved by us, that is included or incorporated by reference in the Form 10-K and the Registration Statements.

RPS is responsible for authoring, and this consent pertains to, the Technical Report Summaries. RPS certifies that it has read the Form 10-K and that it fairly and accurately represents the information in the Technical Report Summaries for which it is responsible.

RPS Energy Canada Ltd.

By:

Name: Michael Gallup

Title: Technical Director – Engineering

PROFESSIONAL ENGINEER ALBERTA
MICHAEL G. GALLUP
ID 85104

14 February 2024

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RESERVE AND RESOURCES DEFINITIONS

The following definitions have been used by RPS Energy Canada Ltd. (RPS) in evaluating reserves. These definitions are based on the SEC RIN3232-AL81 “Modernization of Property Disclosures for Mining Registrants” Final rule, October 31, 2018, and are consistent with the definitions of the Committee for Mineral Reserves International Reporting Standards (“CRIRSCO”) “International Reporting Template for the public reporting of Exploration Targets, Exploration Results, Mineral Resources and Mineral Reserves”, November 2019, as published by the International Council of Mining & Metals (“ICMM”).

Mineral Resources

A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth’s crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction.

The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

Mineral Resources are subdivided, in order of increasing geological confidence into Inferred, Indicated and Measured categories:

Inferred Mineral Resources

An Inferred Mineral Resource is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity.

An Inferred Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.

Indicated Mineral Resources

An Indicated Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit.

Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation.

An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource and may only be converted to a Probable Mineral Reserve.

Measured Mineral Resources

A Measured Mineral Resource is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit.

Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation.

A Measured Mineral Resource has a higher level of confidence than that applying to either an Indicated Mineral Resource or an Inferred Mineral Resource. It may be converted to a Proved Mineral Reserve or to a Probable Mineral Reserve.

Mineral Reserves

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource.

It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre- Feasibility or Feasibility level as appropriate that include application of Modifying Factors.

Probable Mineral Reserves

A Probable Mineral Reserve is the economically mineable part of an Indicated, and in some circumstances, a Measured Mineral Resource.

The confidence in the Modifying Factors applying to a Probable Mineral Reserve is lower than that applying to a Proved Mineral Reserve

Proved Mineral Reserves

A Proved Mineral Reserve is the economically mineable part of a Measured Mineral Resource. A Proved Mineral Reserve implies a high degree of confidence in the Modifying Factors.

INDEPENDENT CONSULTANT'S CONSENT AND WAIVER OF LIABILITY

The undersigned firm of Independent Consultants of Calgary, Alberta, Canada knows that it is named as having prepared an independent report and its addendum report of the bromine reserves and cash flows of the Magnolia bromine field operated by Albemarle Corporation, and it hereby gives consent to the use of its name and to the said report. The effective date of the report is December 31, 2023.

In the course of the evaluation, Albemarle provided RPS Energy Canada Ltd. (RPS) personnel with basic information which included the field's licensing agreements, geologic and production information, cost estimates, contractual terms, studies made by other parties and discussions of future plans. Any other engineering or economic data required to conduct the evaluation upon which the original and addendum reports are based, was obtained from public literature, and from RPS non-confidential client files. The extent and character of ownership and accuracy of all factual data supplied for this evaluation, from all sources, has been accepted as represented. RPS reserves the right to review all calculations referred to or included in the said reports and, if considered necessary, to revise the estimates in light of erroneous data supplied or information existing but not made available at the effective date, which becomes known subsequent to the effective date of the reports.

On behalf of RPS Energy Canada Ltd.

1 EXECUTIVE SUMMARY

RPS Energy Canada Limited ("RPS") has completed an evaluation of Albemarle's bromine reserves as of December 31, 2023, and assessed the following summary of results:

- The forecast production of sales bromide is 2,706 thousand tonnes for the Proved reserves case, plus an additional 611 thousand tonnes of Probable reserves, for a total Proved plus Probable reserves of 3,317 thousand tonnes. The ultimate recovery over 100% of the leased area at the end of this forecast represents a bromine recovery factor of 98% for both the 1P and 2P cases.
- The Smackover formation can be vertically subdivided into the upper Smackover, EOD 0 to 5, historically known as the Reynolds Oolite, and the lower Smackover, EOD 7-9, sometimes split into middle and lower in the literature. The reserves estimated in this report have been confined to the upper Smackover due to technology limitations.
- The bromine reserves represent an estimated net present value range to the Company as shown in the following economics summary tables:

Table 1-1: Albemarle Working Interest Reserves as of December 31, 2023 – Spot Prices

Albemarle Working Interest Bromine Reserves as of December 31, 2023 Spot Price Forecast											
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**4,110**	**1,956**	**1,157**	**779**	**567**	**3,054**	**1,463**	**870**	**587**	**427**
Probable	611	1,835	932	640	511	440	1,432	721	493	392	337
Proved + Probable	**3,317**	**5,946**	**2,887**	**1,797**	**1,290**	**1,007**	**4,487**	**2,184**	**1,363**	**979**	**764**

Table 1-2: Albemarle Working Interest Reserves as of December 31, 2023 – Spot Prices less 15%

Albemarle Working Interest Bromine Reserves as of December 31, 2023 Spot Price Forecast less 15%											
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**2,682**	**1,497**	**996**	**740**	**589**	**1,957**	**1,107**	**742**	**553**	**441**
Probable	611	1,513	603	327	214	157	1,185	472	256	168	123
Proved + Probable	**3,317**	**4,194**	**2,100**	**1,323**	**954**	**746**	**3,142**	**1,579**	**998**	**721**	**564**

Table 1-3: Albemarle Working Interest Reserves as of December 31, 2023 – Spot Prices less 30%

Albemarle Working Interest Bromine Reserves as of December 31, 2023 Spot Price Forecast less 30%											
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**1,253**	**838**	**592**	**450**	**362**	**860**	**601**	**432**	**331**	**267**
Probable	611	1,190	474	257	169	124	937	373	203	133	97
Proved + Probable	**3,317**	**2,443**	**1,312**	**849**	**619**	**486**	**1,797**	**974**	**634**	**463**	**364**

Table 1-4: Albemarle Working Interest Reserves as of December 31, 2023 – Spot Prices less 45%

Albemarle Working Interest Bromine Reserves as of December 31, 2023 Spot Price Forecast less 45%											
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**-175**	**179**	**188**	**160**	**135**	**-237**	**95**	**121**	**108**	**93**
Probable	611	867	346	188	123	90	689	275	149	98	72
Proved + Probable	**3,317**	**692**	**524**	**375**	**283**	**225**	**452**	**369**	**270**	**206**	**164**

RPS estimates that Albemarle will require a working interest share capital investment of US$1.0 to US$1.4 billion to develop the Proved reserves, and no additional capital to develop the Probable reserves. These estimates are in Constant 2024 dollars and are exclusive of abandonment and reclamation costs.

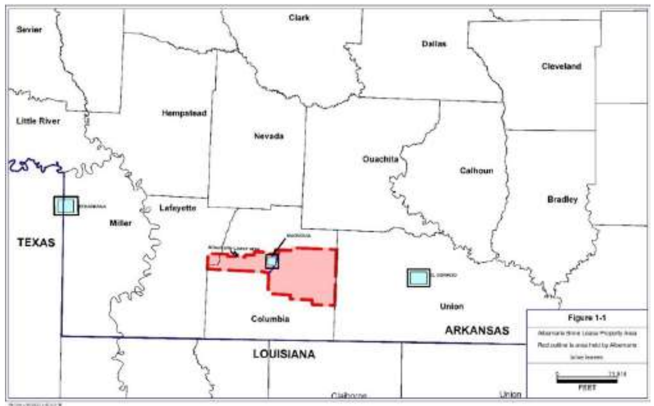


Figure 1-1: Albemarle Magnolia Field Location Map

The body of this report contains an evaluation of the bromine reserves tonnages together with net present value and cash flow forecasts for the Magnolia, Arkansas bromine field. Included in the analysis reported here is a discussion of recent activities, key reservoir and economic issues and RPS' rationale for the reserves evaluations.

This assessment has been conducted within the context of RPS's understanding of the effects of mineral resource extraction legislation, taxation and other regulations that currently apply to this property.

Albemarle has made a representation to RPS as to the validity and accuracy of the data supplied for this evaluation. RPS does not attest to property title or financial interest relationship for any of the appraised properties.

It should be clearly understood that any work program may be subject to significant amendment as a consequence of future results in both the subject and adjacent areas. Mineral exploration and development is a risky and speculative venture, and the actual outcome of work programs cannot be predicted with certainty or reliability.

The net present values reported herein do not necessarily reflect fair market values of the property evaluated.

2 INTRODUCTION

In June 2016, the US Securities Exchange Commission (“SEC” or “Commission”) proposed revisions to its disclosure requirements for properties owned or operated by mining companies, to provide a more comprehensive understanding of a registrants’ mining properties. Then in June 2018, after a consultation process, including receiving and considering over 60 comment letters on the proposed revisions from various parties, the SEC put in place the amended statutory disclosure and reporting requirements of mineral resources and reserves for public companies engaged in mineral extraction activities. These requirements were spelled out in SEC RIN3232-AL81 “Modernization of Property Disclosures for Mining Registrants” Final rule, dated October 31, 2018. As described in the revised rule, the amendments “are intended to provide investors with a more comprehensive understanding of a registrant’s mining properties, which should help them make more informed investment decisions. The amendments also will more closely align the Commissions’ disclosure requirements and pollicises for mining properties with current industry and global regulatory practices and standards.” The rule requires that all publicly traded companies engaged in mineral exploration and production begin reporting for the first fiscal year beginning on or after January 2, 2021.

On September 15, 2022, RPS Canada Limited, (“RPS”) was contracted, by purchase order from Albemarle Corporation (“Albemarle”) to conduct an evaluation of Albemarle’s interests in bromine reserves in the Magnolia producing brine field in central Arkansas, U.S.A., and the Jordan Bromine Company, Jordan, Dead Sea brine extraction operations in Jordan.

To conduct this evaluation, RPS utilized in-house engineering and associated staff, and engaged the services of RESPEC, an associated environmental and mineral engineering consulting firm to play a major role in many of the portions of the assessment and evaluation.

RPS and RESPEC visited the JBC bromine processing plant in August 2023 to inspect and verify that the information provided by Albemarle was accurate. The visit was successful, offering valuable insights into its advanced technology, safety measures, and commitment to environmental standards. Engaging discussions with the plant's management underscored its dedication to efficiency, sustainability, and continuous improvement. This visit confirmed the plant's responsible and eco-friendly bromine production practices, contributing significantly to a comprehensive understanding of its operations.

This report constitutes the final evaluation of the Magnolia, Arkansas brine field bromine reserves. The effective date of this evaluation is December 31, 2023.

3 PROPERTY DESCRIPTION

The Albemarle Corporation Magnolia bromine brine field operations property is located in Columbia County in southwestern Arkansas (Figure 3-1). From the subsurface Smackover formation in this field, Albemarle produces a brine rich in sodium bromide (referred to, throughout this report, as "bromide") from which bromine is extracted. The area shown is the under lease from the landowners for brine production as of the effective date of this evaluation.

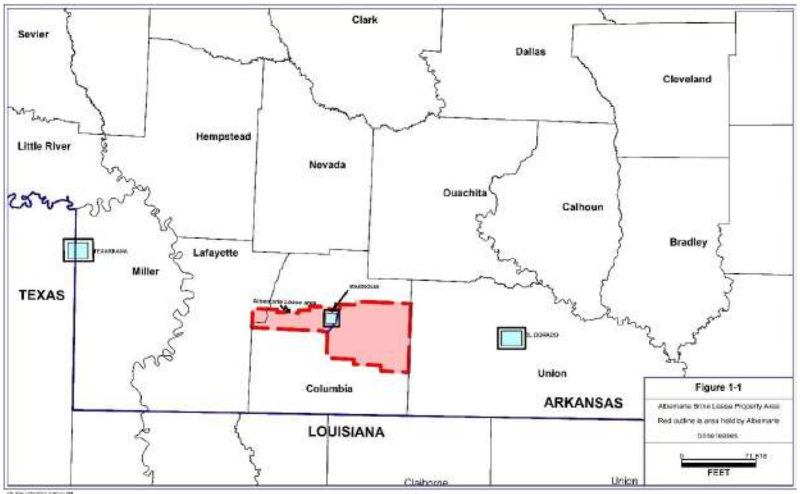


Figure 3-1: Magnolia Field Location Map

The brine field property is centered on the City of Magnolia, Arkansas, which is the county seat of Columbia County and has a population of approximately 12,000 residents. The property is divided into two parts, the South Field and the West Field with the City of Magnolia as the dividing line between the two areas. The area east of the City of Magnolia is referred to by Albemarle as the South Field and the area to the west is referred to as the West Field (Figure 3-2).

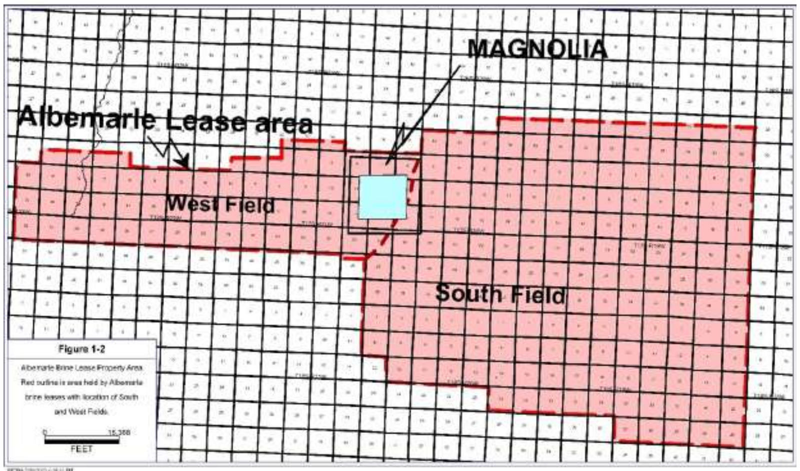


Figure 3-2: Magnolia Field Mapping and Naming

The West Field has a total area of approximately 36,863 acres extending 14.5 miles to the west of the City of Magnolia and is 4 to 5 miles wide (north to south) encompassing parts of Township 17 South, Ranges 21 through 23 West. The South Field has a total area of approximately 104,585 acres that extends 14.5 miles east of Magnolia and is 10 to 12.5 miles wide (north to south) covering all or parts of Townships 16 through 18 South, Ranges 18 through 20 West. The southern edge of the property is approximately 10 miles north of the Arkansas-Louisiana State Line. The property consisting of these two field areas under lease from the landowners by Albemarle Corporation covers approximately 141,448 acres (221 square miles).

The area outlined on the map identified as MSLU is the Magnolia Smackover Lime Unit oilfield in the Magnolia Field operated by White Rock Oil and Gas, LLC where oil was first discovered from the Smackover formation in 1938 (Figure 3-3).

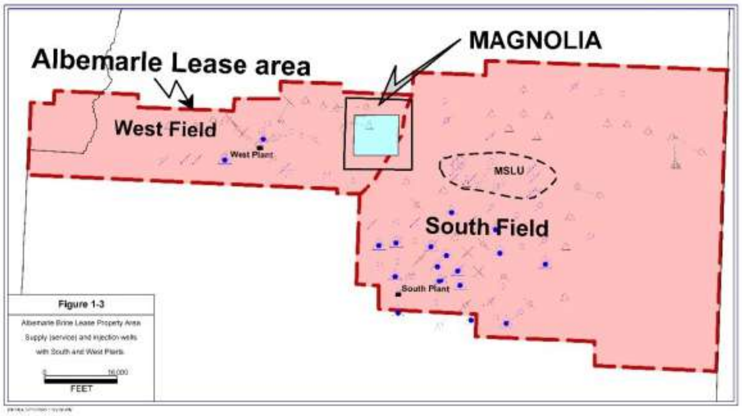


Figure 3-3: Magnolia Field Map showing MSLU Oilfield and Brine Processing Plant locations

The Magnolia oilfield was unitized (a joint operation of several owner/operators of different portions of the reservoir) with the name "MSLU" for secondary recovery and a water flood of the Smackover Formation began in 1945. The produced water (bromine rich) from the oilfield operations is separated, then sent via pipeline to Albemarle's South Plant and processed. Processed brine (depleted in bromine) is sent back to Magnolia Field to be re-injected into the Smackover Formation to continue the secondary recovery operations by White Rock Oil and Gas.

3.1 Property Leases

The area of bromine production operations is comprised of 9,570 individual leases with local landowners, comprising a total area of 99,763 acres. The leases have been acquired over the course of time as field development extended across the field. The production leases are generally of the form of the "Arkansas Form 881/8 Oil, Gas and Mineral Lease (1/8 Gas)" or some derivative thereof. Each of the leases was executed between the parties, with the following terms:

A map showing full sections of the field where Albemarle has lease holdings are shown on map in the following Figure 3-4. Also shown on the map are production, injection and appraisal wells in the area, where the dense clusters of wells show oilfield development contiguous with the brine field operations.

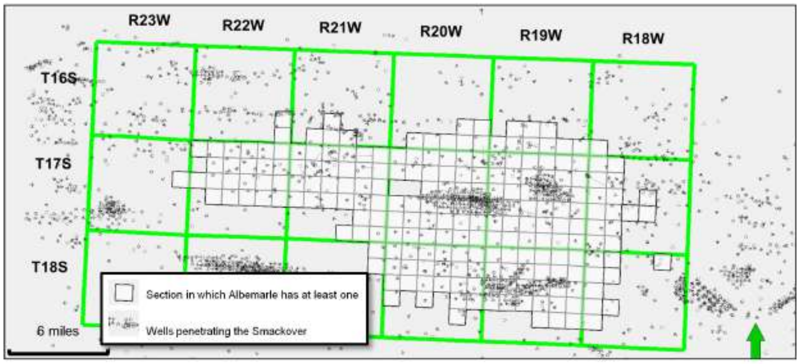


Figure 3-4: Albemarle Magnolia Field Lease Holdings as of December 31, 2021

3.1.1 Burdens on Production:

The production leases include the following burdens:

a) Production Royalties:
- Oil: 12.5% of production
- Gas: 12.5% of gas sales revenues
- Solution gas: 12.5% of gas sales revenues
- Other minerals (except brine and minerals contained in brine): 10% of mineral sales revenue
- Brine: No production royalty

b) Production Lease Licences Fees:
- Lease Years 1, 2, 3,& 4: $1.00 per acre
- Lease Years 4 through 14: $10.00 per acre
- Lease Years 15 onward: $25.00 per acre
- For the purposes of lease licencing fees, the above lease fees have been superseded by the Arkansas Code, Title 15, Subtitle 6, Chapter 76 (15-76-315) which specifies that in lieu of royalty, an annual lease compensation payment of $32.00 per acre payable to the lease owner. This payment amount is indexed to the March 1995 US Producer Price Index for Intermediate Materials, Supplies and Components, then later the Producer Price Index for Processed Goods for Intermediate demand, which specifies that prices and costs are based on a datum cost base as of March 1995 and are escalated annually based on the USA Producer Price Index.

For economic evaluation purposes, production lease licence fees have been included in the fixed field operating costs.

3.1.2 Term of Leases

The term of each lease begins on the effective date of the lease, and, as long as lease rentals are continuing to be paid, continues for a period of 25 years or longer until after a two year period where brine is not injected or produced from/to a well within 2 miles of lease lands area. The Lessee may hold leases after production has been shut in for twelve months by continuing the shut-in lease rental payments and hold the leases for a maximum of three years.

4 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

4.1 Topography

The topography of the area is characterized by rolling hills with five stream valleys that cut north-south across the Albemarle Lease Property (Figure 4-1).

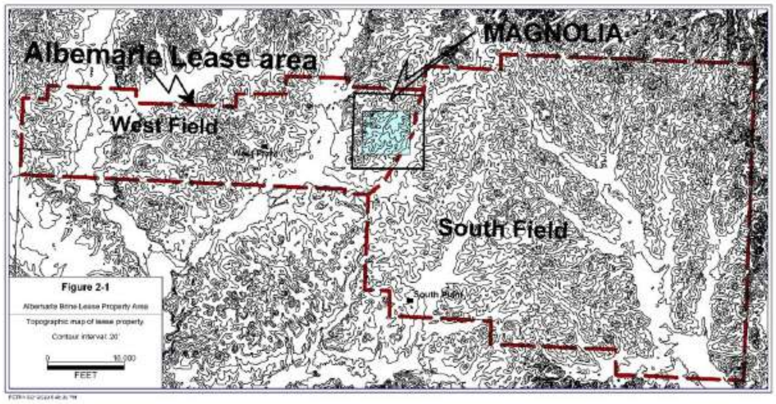


Figure 4-1: Magnolia Field Topography

There is approximately 100 to 200 feet of relief from the stream valleys to the hill tops. The elevations range from 180 feet to 360 feet with some hilltops over 400 feet above sea level. The City of Magnolia with an area of 13.27 square miles is located on one of the hilltops and is centered between the West Field and the South Field. The land area outside of the city is very rural, with vegetation being mostly pine trees on sandy hills with hard wood trees predominantly in the stream valleys. The bromine mineral deposit being extracted by Albemarle Corporation is found in the subsurface waters and is pumped through well bores to the surface and then sent to the main plants for processing by pipeline, therefore the surface pumps, pipelines and tanks would be affected by any changes in the topography. The topographic features and conditions on the surface are taken into consideration for the building of pipelines, roads and well site locations when planning the drilling of a development well to extract the bromine. The stream valleys and the cultural features of the City of Magnolia create challenges topographically for the necessary surface work required of any future development projects in those areas.

4.2 Accessibility

Magnolia is located in southwest Arkansas, north of the center of Columbia County. The average altitude of the area is 336 ft above mean sea level. The surrounding region is a mix of dense forest, farm prairies, and low rolling hills.

The area includes extensive areas of loblolly-shortleaf pine forests. Despite its gently sloping terrain and areas of relatively rich soil, it is a region dominated by forests and forestry-related activities rather than by agriculture. Both pine and hardwood products are harvested in this region where the forest industry is particularly significant.

Magnolia is located about 50 miles east of Texarkana, about 135 miles south of Little Rock, and about 75 miles northeast of Shreveport, Louisiana.

Adjacent counties to Columbia County are Nevada County (north), Ouachita County (northeast), Union County (east), Claiborne Parish, Louisiana (southeast), Webster Parish, Louisiana (south) and Lafayette County (west).

4.2.1 Road Access

A road network consisting of U.S. Routes and local highways provides access to Magnolia.

Primary U.S. Highways in the Magnolia area include the following:

- U.S. Route 82 (US 82)
- U.S. Route 79 (US 79)
- U.S. Route 371
- Arkansas Highway 19 (AR 19 and Hwy. 19)
- Highway 355

Interstates 20, 30 and 49 (I-20, I-30 and I-49), are accessible from Magnolia by way of U.S. Route 371.

4.2.2 Airport Access

The Magnolia Municipal Airport is a public-use airport in Columbia County. It is owned by the city of Magnolia and located three nautical miles southeast of its central business district.

The closest international airports is located in Little Rock, AR, which is approximately 2.5-hours north of Magnolia (approximately 140 miles).

There are regional airports at El Dorado, Arkansas (South Arkansas Regional at Goodwin Field), Texarkana (Texarkana Regional Webb Field) and Shreveport, Louisiana (Shreveport Regional Airport), all within a 70-mile radius of Magnolia.
Rail Access

Union Pacific (UP) and the Louisiana & Northwest Railroad (LNW) provide rail service in Columbia County, Arkansas.

4.3 Climate

The average temperature is 64 °F (18 °C), and the average annual rainfall is 50.3 inches. The winters are mild but can dip into the teens at night and have highs in the 30s and even some 20s but average out around 50. The springs are warm and can be stormy with strong to severe storms and average highs in the mid-70s. Summers are often hot, humid and dry but with occasional isolated afternoon storms, highs in the mid to upper 90s and even 100s. In the fall the temps cool from the 90s and 100s to 80s and 70s. Early fall temperatures are usually in the 80s but can reach 90s and at times have reached 100. Late fall temps fall to 70s and 60s. It is not uncommon to see snow and ice during the winter. It has been known to snow a few times as late as April and as early as November in Magnolia.

Figure 4-2 shows the average temperatures and precipitation at Magnolia, Arkansas.

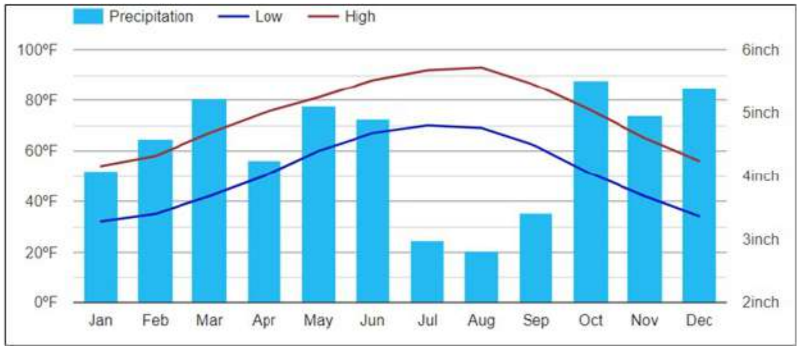


Figure 4-2: Average Temperature and Precipitation at Magnolia, AR

Source: https://www.usclimatedata.com/climate/magnolia/arkansas/united-states/usar0351

4.4 Physiography

Arkansas is divided into two major regions separated by a geologic fall line. The fall line is an imaginary line separating mostly consolidated rock of the Interior Highlands from mainly unconsolidated sediment of the Gulf Coastal Plain. Magnolia is located in the Gulf Coastal Plain Region.

The two major regions are sub-divided into five provinces based on their unique geological characteristics. Magnolia is located in the West Gulf Coastal Plain province, which is characterized by fairly at-lying rock formations and sediment deposited in terraces.

West Gulf Coastal Plain province extends across southern Arkansas. It is located south of the Ouachita Mountains and extends southward to the Gulf of Mexico and eastward to the Mississippi Alluvial Plain. The boundary between the Ouachita Mountains and the Coastal Plain is marked by rapids and waterfalls at points where streams leave the steeply sloping mountains. The eastern boundary of the West Gulf Coastal Plain is the Arkansas River as it extends from Little Rock (Pulaski County) to Pine Bluff (Jefferson County), and then Bayou Bartholomew from Pine Bluff to the Louisiana border. These two waterways separate the West Gulf Coastal Plain from the relatively recent stream deposits of the Mississippi Alluvial Plain.

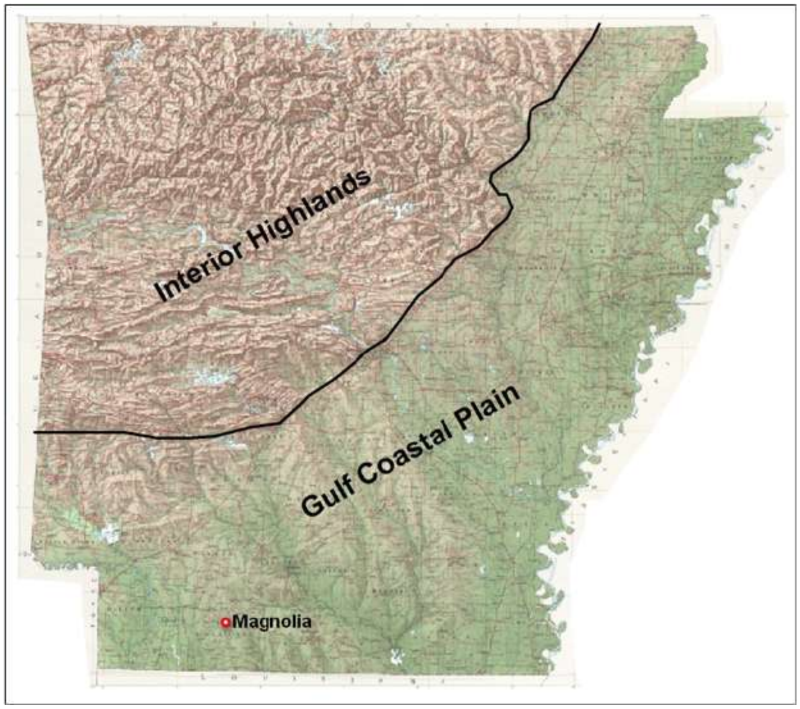


Figure 4-3: Arkansas physiographical regions and location of Magnolia.

Source: Arkansas Geological Survey https://www.geology.arkansas.gov/

5 HISTORY

Oil was first discovered in Arkansas in January of 1921 in the Nacatoch Formation in El Dorado Field, Union County near the site of the current Arkansas Oil and Gas Commission in El Dorado, AR (Figure 5-1). Oil was in demand and prices were good as a result of the First World War. Many discoveries were made in a number of formations in the Upper and Lower Cretaceous afterward with the largest oil field in Arkansas, the Smackover Field being discovered in 1922. By 1925 oil production reached a peak of 275,000 barrels per day and declined to 29,000 barrels per day by 1936[i]. Through the end of 2019, approximately 724 million barrels of oil have produced from many different formations in south Arkansas oil fields.

The Smackover is a geologic formation of limestone and dolomite that is 5000'-10,000' in the subsurface of South Arkansas where it plays an important role in the oil, gas, and brine industries of that area. It is the oldest and deepest oil producing formation in Arkansas and is also thought to be the main source of the oil found in most of the overlying formations in South Arkansas[ii]. Subsequent to seismograph operations in the area in 1935[1], oil was first discovered in 1936 from the Smackover Formation in the Phillips Petroleum Co. Reynolds #1 well at Snow Hill in the Smackover Field in southeastern Ouachita County (Figure 5-1).

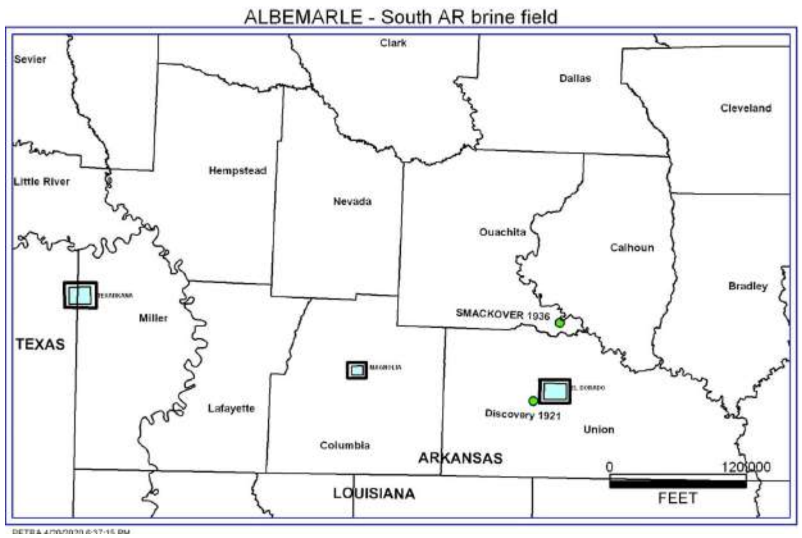


Figure 5-1: Magnolia Field Location Map

A string of Smackover oil field discoveries followed in the next 6 years which include many of the larger fields such as Magnolia, Village, Midway, Buckner, Dorcheat-Macedonia, and Atlanta. These structures were found after the advent of exploration with the use of seismic reflection methods. Exploration, drilling, and production of oil and gas from the Smackover Formation in South Arkansas have continued to the present day.

Brine is formation water that has higher than the usual concentration of dissolved salts, comprised of Ca, Na, K, and Cl and minor amounts of other elements [Bates, 1980]. The brine is produced as a by-product of the oil production in many subsurface reservoirs and generally the brine rate increases as the oil rate decreases throughout the life of a producing well. The Smackover Formation water (brine) is hypersaline containing higher concentrations of the previously mentioned elements as well as many other elements including Bromine (Br). The concentrations of Bromine in the Smackover Formation brine in South Arkansas are unusually high with a range of 1,300-6,800 parts per million[iii].

Bromine is one of four halogen elements along with chlorine, fluorine, and iodine and is a highly corrosive, reddish-brown, volatile liquid that naturally occurs as sodium bromide in seawater with a normal concentration of 60-65 parts per million[iv]. The bromine is generated and released into seawater with the decomposition of seaweed, plankton, and certain mollusks[4,v]. An Arkansas Oil and Gas Commission chemist found that the brine from 4 oil fields producing from the Smackover had concentrations ranging from 4,000-4,600 parts per million, which is much higher than the that found in seawater[4]. The high concentrations of bromine offer the opportunity for the bromine to be extracted commercially from the brine that is pumped from the Smackover Formation in the subsurface of South Arkansas. The brine produced from the Smackover in south Arkansas and to a lesser degree the brine production from wells in Michigan meets nearly one-half of the world's bromine demand annually. In the infancy of the business the largest demand for bromine was to make ethylene dibromide, an additive to gasoline to stop lead build up in engines running on leaded gasoline[vi] [McCoy, 2014]. Today bromine and bromine compounds are used for fire retardant in plastics, water purification, agricultural pesticide products, oil field drilling fluids, and many other products and processes[4].

The Murphy Corporation in El Dorado, AR discovered oil from the Smackover Formation in June of 1950 at Catesville Field, Union Co, AR. In April of 1956, Murphy acting on behalf of Michigan Chemical Corp. applied for a saltwater disposal ("SWD") well to dispose of produced water from four Murphy oil wells producing from the Smackover. The produced water was to be processed through Michigan's El Dorado Bromine Plant, then disposed of into the subject SWD well (Figure 5-2).

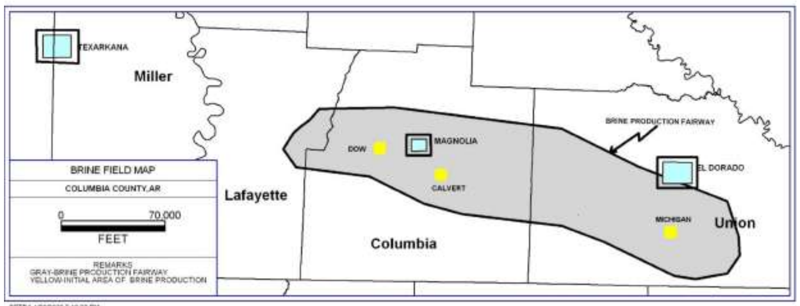


Figure 5-2: Brine Field Map

This was the beginning of the bromine extraction business in Arkansas where Michigan Chemical Corp, J-W Operating, Arkansas Chemical, and Great Lakes Chemical Corp. have been active in the brine business at times over the last 63 years in the El Dorado area. Great Lakes Chemical Corp. (now Lanxess AG) has been active since at least 1963 and currently is the only active operator in the El Dorado area.

In 1965, Brazos Oil and Gas Co. a division of Dow Chemical Co. drilled the first brine supply well near Magnolia, AR approximately 35 miles west of the Michigan Chemical Corp. operations in El Dorado (Figure 3-2). By February of 1967 six additional wells, 4 brine production supply wells and 3 brine injection wells were drilled and completed. These wells were all put into production in April of 1968 and are now called the West Field. In 1987 Ethyl Corporation took over operations of Dow Chemical in the West Field. A total of 36 brine supply and injection have been drilled through 2019 in this field.

In 1969, Bromet, a JV between Ethyl Corporation and Great Lakes Chemical Corp. expanded bromine production approximately 30 miles west of El Dorado and approximately 5 miles south of the town of Magnolia, Arkansas (Figure 5-2). Bromet drilled and completed twenty-three total wells, 18 brine production supply wells and 5 brine injection wells from 1/1968 to 10/1969. These 23 wells, in what is now called the South Field were put into operation by the end of 1969. Great Lakes left the JV in the early 1970s and Ethyl took over as the sole owner until they spun off to Albemarle in 1994. Through 2021 a total of 78 brine supply and injection wells have been drilled in this field.

The total development of these three areas combines to create a 600 square mile fairway of brine production that extends over a two-county area that is 60 miles long and 10 miles wide (Figure 5-2). Based on public records from the Arkansas Oil and Gas Commission (“AOGC”), brine production in Arkansas has averaged approximately 866,100 barrels per day or 316.1 million barrels per year from all operators for the past 10 years. An estimated total of 206 million barrels of brine was produced in 2022. The highest recorded annual production was in 2004 at 389million barrels of brine (Figure 5-3). The total cumulative production of brine from 1979 through 2022 for Arkansas is 12.9 MMbbls. As of the effective date of this report, December 31, 2023, the AOGC does not have any brine production data for the year 2023.

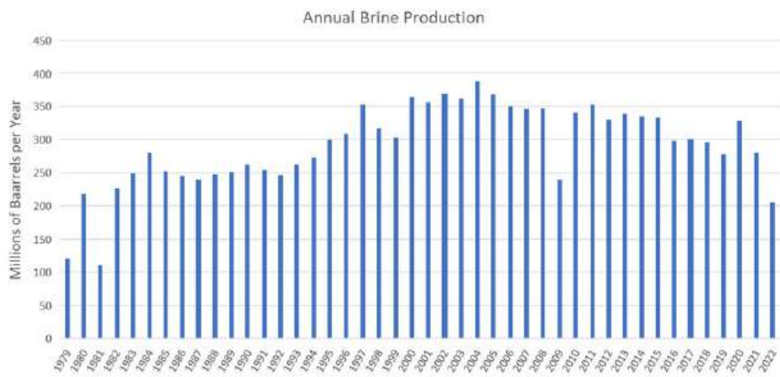


Figure 5-3: Historical Brine Production in South Arkansas

6 GEOLOGICAL SETTING, MINERALIZATION, AND DEPOSIT

6.1 Geologic Setting

The area of interest is located in South Arkansas which is on the north rim of the ancestral Gulf of Mexico. The early framework of the Gulf began with the rifting or parting of the North American Plate from the South American and African plates in Late Triassic Period and continued into the Early and Middle Jurassic Period from about 220 million years ago to 195 million years ago. During this time thick sequences of non marine clastic sediments filled the rifted basins in what is now called the Eagle Mills Formation (Figure 6-1). These initial deposits are predominately composed of red, purplish, greenish gray, or mottled shales, mudstones, and siltstones with some conglomerates and fine to very fine-grained sandstones. They are found around the rim of the Gulf of Mexico from Mexico through Texas, Arkansas, Mississippi, Alabama into Florida. Thicknesses have been recorded for Eagle Mills of over 6900' in South Arkansas[7].

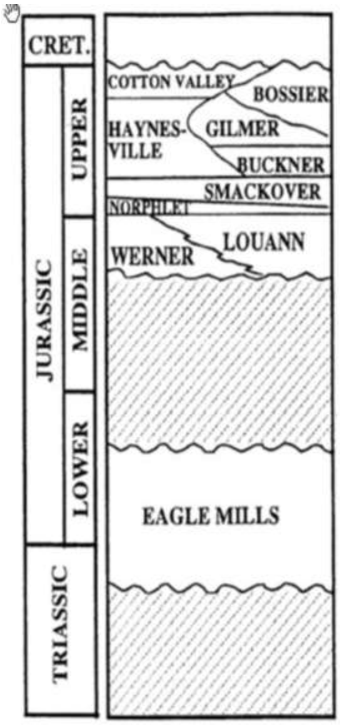
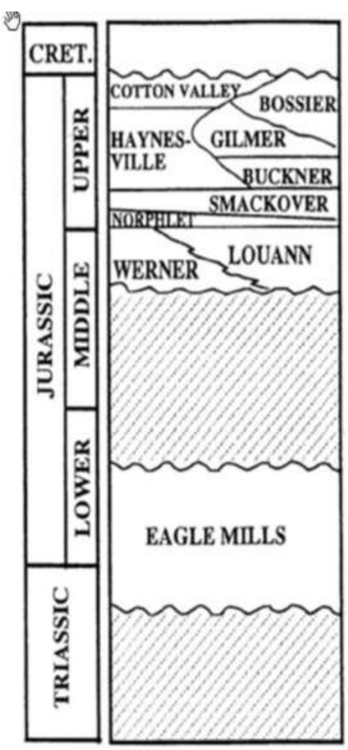


Figure 6-1: Generalized stratigraphic column for the Triassic through Jurassic section in South Arkansas[8,3].

Toward the end of the period of rifting in Middle Jurassic, the Gulf was a broad shallow restricted basin where evaporate deposits of anhydrite in the Werner Formation and thick salt deposits of the Louann Formation accumulated as marine waters periodically spilled into the basin probably across central Mexico[9]. The environment at that time was arid, where the evaporation exceeded the inflow of water with limited to no influx of terrigenous sediments, therefore the marine waters evaporated leaving layer upon layer of salt beds enriched with many other elements found in marine waters. The salt beds are approximately 3000' thick in East Texas and North Louisiana and thin to the north, coming out of the basin to a point of non deposition around the rim of the basin[7]. A fault system developed down dip of the salt around the north rim from Texas through Arkansas and Mississippi into Alabama marking the upper limits of the salt basin. The fault system lies immediately down dip of the Jurassic salt as described of the Mexia-Talco fault system in Texas[x]. This fault system extends northeastward into Arkansas and is identified as the South Arkansas fault system (Figure 6-2). The north limit of the salt in South Arkansas is thought to be up dip to this same system.

The extensive salt deposits were followed by a sea level low stand at the beginning of the Upper Jurassic (Figure 6-1), where sandstones, conglomerates and eolian or wind blown sediments of the Norphlet Formation were deposited directly onto the Louann Formation[11]. This was followed by a prolonged marine transgression or sea level rise that covered most of the present Gulf of Mexico basin. It reworked the upper



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most sandstones of the Norphlet Formation as the water level advanced shoreward over a broad, stable, ramp that dipped gently basinward[12, 7].

The Upper Jurassic sea level rise or transgressive sequence is thought to have progressed rapidly and initiated the production of deep water dark colored carbonate mudstones and shales in the lower sequence (commonly referred to as the "brown dense") of the Smackover Formation[13, 14]. The lower section consists of very thin fairly continuous lamina of clean carbonate mudstones and organic rich clay lamina or layers[12]. This organic rich lamina are thought to be source rocks from which much of hydrocarbons along the north rim of the ancestral Gulf of Mexico were generated[15]. The rise in sea level is thought to have increased rapidly throughout the lower portion of the Smackover, slowing through the middle and reaching a high stand that probably extended through the upper Smackover[14]. There were possibly some minor fluctuations in the sea level in the upper Smackover. The advance of the sea level up the shoreline ramp defines the limit of deposition of the Smackover Formation around the rim of the Gulf of Mexico Basin. In South Arkansas the Smackover Formation is identified in the subsurface as far north as southern Clark County (Figure 6-2).

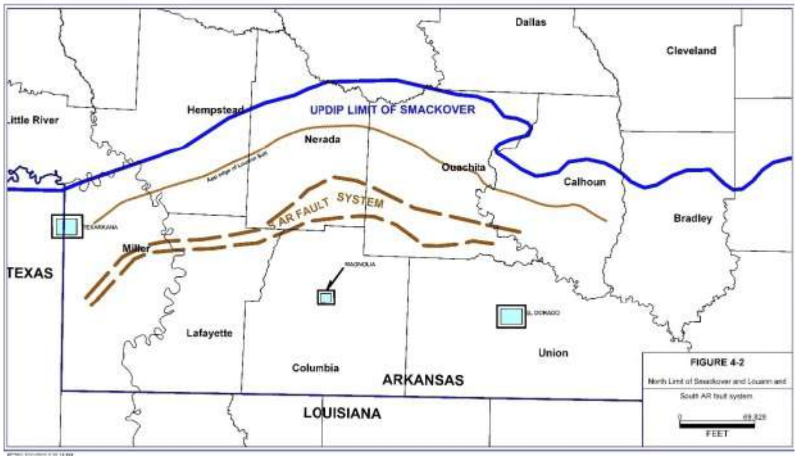

Figure 6-2: Northern Limit of Smackover and Louann and South Arkansas Fault System

The Smackover is divided by some into upper and lower[7] and some separate it into three members: upper, middle and lower with an overall thickness of over 1000' [12,14]. The lower as previously mentioned was deposited in a basinal, deep water setting below any turbulence from wave or storm action. The middle Smackover is that portion of the basin that is subtidal on the steeper part of the shelf between the basinal sediments and the shallow water shoal of the upper member. The sediments in the middle Smackover would be characterized as burrowed peloidal mudstones and burrowed peloidal to skeletal wackestones (mainly carbonate mud with some grains). The upper Smackover sediments commonly referred to as the Reynolds Oolite, were deposited above wave base in a high energy shoal beach system that consists of grainstone and packstones composed predominately of ooids, oncoids and pellets and lacking carbonate mud[16].

The upper Smackover grainstones are the main reservoir for oil, gas and brine deposits due to excellent porosity and permeability in these rocks. The lower and middle Smackover for the most part are lacking these characteristics of good porosity and permeability and are generally non reservoir type rocks. The middle Smackover in some areas will have zones of porosity and permeability development when sediments from the near shore were transported down slope and deposited. These are commonly dolomitized, enhancing the reservoir characteristics, porosity and permeability to the point of potential exploitation for the production of oil, gas or brine if present.

The upper and middle Smackover is a progradational system in that the sediment supply was great enough that the shoal complex of the upper sediments advanced seaward or prograded over the middle Smackover sediments, which in turn prograded over the lower Smackover to create the vertical sedimentary profile of the upper, middle and lower Smackover (Figure 6-3).

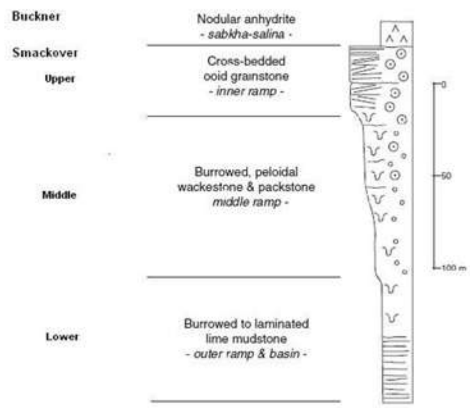

Figure 6-3: Vertical Stratigraphic Profile of the Smackover in Arkansas and Louisiana (modified from Hanford & Baria, 2007[17])

The Buckner Formation (Figure 6-1), which overlays the upper Smackover is composed of anhydrite and shale and was deposited in a restricted lagoonal, bay to tidal flat setting in an arid environment shoreward of the upper Smackover shoal/beach deposits. As the upper Smackover shoal/beach complex prograded seaward the dolomite, anhydrite, and shale of the Buckner followed, prograding over the upper Smackover. Toward the end of the Upper Jurassic, the sea level began a slow steady rise and deposited sandstone and shale of the Haynesville and Cotton Valley Formations that overlay these sediments[14].

6.2 Property Geology

The Smackover Formation is the aquifer that contains the bromine rich brine in South Arkansas and the data through well logs, core analysis and seismic is sufficient to determine its geometry and other characteristics for use in the modeling and resource estimation process. It is present throughout South Arkansas extending to the north edge of Ouachita and Nevada Counties. This line is generally considered the depositional limit of the Smackover in South Arkansas (Figure 6-2).

South of this line is the northern limit of the salt of the Louann Formation, which underlays the Norphlet, and Smackover Formations. The salt increases in thickness from there south across South Arkansas into the salt basins of North Louisiana. Down structural dip of the edge of the Louann is the South Arkansas fault system, which is a prominent graben faulting system that extends from Miller County eastward through southern Nevada and Ouachita Counties. This system basically parallels the up-dip edge of the Louann Formation and is thought to have been initially caused by gravity sliding of the salt toward the basin[xviii]. The graben consists of opposing down thrown faults that create an east-west trending block that is structurally lower within the fault system. The structure of the Smackover Formation is dipping south to southwest at approximately 200 feet per mile, ranging from an elevation of 1000 feet below sea level in the north to 11,500 feet below sea level in the south along the Arkansas-Louisiana state line. The overall thickness of the formation ranges from 14 feet near the up-dip edge of Smackover to over 900 feet in the southern Columbia County. This thinning of the Smackover and of the Norphlet Formation is illustrated on the south to north cross section A-A' from southern Columbia County into Nevada County (Figure 6-4).

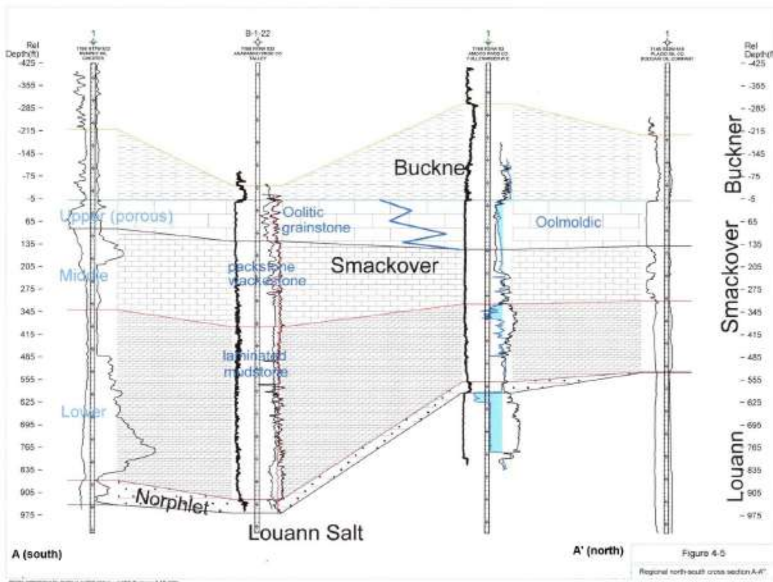

Figure 6-4: North to South Cross Section showing Norphlet and Smackover thinning

The upper Smackover is a thick porous and permeable body of oolitic-oncolitic grainstones composed of ooids, peloids, intraclasts and oncoids and was deposited throughout the area south of the updip limit and is present under the entire area of the Albemarle Property. It occurs at a depth of 7000 to 8500 feet below sea level and is a very good reservoir for the containment and extraction of bromide rich brine (Figure 6-5).

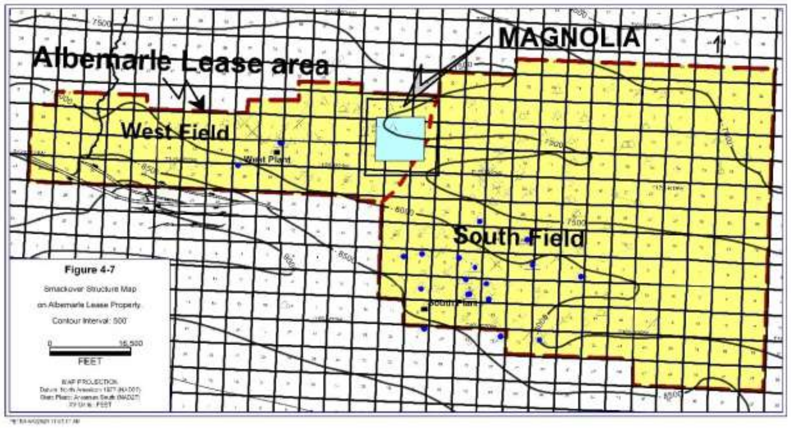

Figure 6-5: Smackover Structure Map

A significant number of wells, drilled to various depths, on and surrounding the Property were evaluated for use in understanding the Property Geology. Of these, several hundred were utilized due their possession of adequate information for this purpose. Information obtained from the wells includes:

- Wireline log data (gamma ray, spontaneous potential, resistivity, density, neutron, and acoustic) were evaluated to extract geological information about the reservoir including lithology, porosity, thickness, and stratigraphy of the Smackover
- Core analysis, where available, provided porosity and permeability data
- N-S and E-W wireline cross-sections of the logs were used to determine variation of geometry in the Smackover across the Property

The upper Smackover across South Arkansas from south to north has three distinctive east-west trends (Figure 6-6).

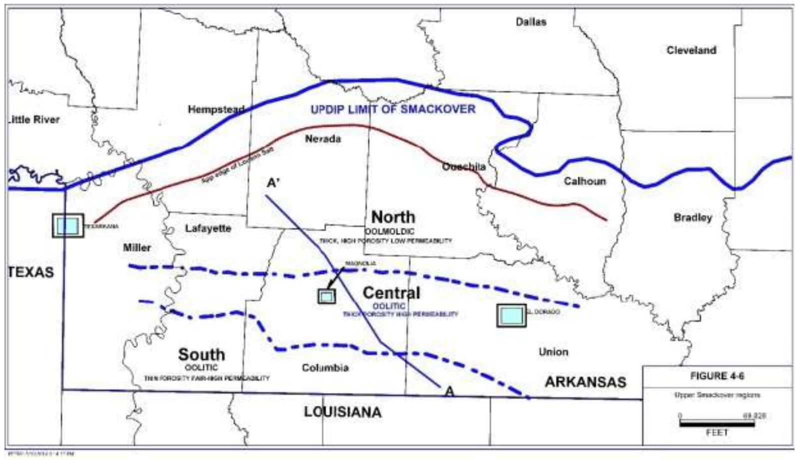

Figure 6-6: Upper Smackover Regions

The upper Smackover in the south region along the Arkansas State Line is generally an oolitic grainstone with relatively thin (less than 30 feet) intervals of sufficient porosity and having fair to high permeability. Many oil fields in this area are trapped stratigraphically. In the central area between the dashed lines, the upper Smackover is an oolitic grainstone having sufficient porosity and high permeability with thicknesses of total porosity that exceed 50 feet. The South Arkansas brine fields of Albemarle and Great Lakes Corporations are located in this area due to the thickness and the permeability of upper Smackover that allow for good reserves and high volume production. Also, located in this central portion are some of the largest oil fields in Arkansas that produce from salt cored anticlines in the Smackover. North of this region, oolitic grainstones were originally deposited in the upper Smackover with thicknesses similar to the central region. After deposition in this area, the oolitic grainstones were diagenetically altered by the dissolution of the ooids and calcite filling of the original pore space contemporaneously[14]. The result of this alteration creates a mold of the ooids that develops into rock with very high porosity (25-35%) and low to very low permeability that is called oolmoldic limestone.

The Smackover is subject to other diagenetic alterations after burial, most commonly the process of dolomitization which generally enhances the porosity and permeability.

The packstone-wackestone interval of the middle Smackover and the laminated mudstone of the lower Smackover both thin from south to north in South Arkansas (Figure 6-4). The middle interval generally has porosity less than 9% in the south region, with some porosity development to the north due to post deposition processes. This is evident in the central region where select intervals two to thirty feet thick in the middle Smackover are dolomitized, which generally enhances the original porosity and permeability of the rock. The laminated mudstones of the lower Smackover have very low porosity over the entire area of south Arkansas.

The environment of deposition of the Smackover is divided into coastal (beach facies), upper foreshore (beach to normal wave base), lower foreshore (normal wave base to storm wave base), subtidal (upper slope), deep subtidal (lower slope) and basinal (deep water, thin flat laminated strata). The upper Smackover grainstones were deposited in the coastal to lower foreshore regime of the coast line, while the middle Smackover packstone-wackestones were deposited on the slope in subtidal waters. These sediments are deposited contemporaneously as clinoforms and prograded seaward over the laminar basinal sediments of the lower Smackover. Fluctuations of the sea level during upper Smackover deposition allowed the clinoforms to stack resulting in very thick, porous and permeable grainstones in the central area where the brinefields are located. The anhydrite and shale of the Buckner Formation were deposited simultaneously behind the coastal region of the upper in lagoons and mudflats as the upper and middle Smackover prograded seaward.

6.3 Mineralization

High concentrations of bromine (Br) are found on Albemarle Corporation Property in South Arkansas. The bromine exists as sodium bromide ("bromide") in the formation waters or brine of the Jurassic age Smackover Formation in the subsurface at a depth of 7000 to 8500 feet below sea level. The bromine on the Property was first mined in 1965 by pumping the brine through well bores that penetrated the Smackover Formation.

The bromine concentrations, from independent sources[19, 3] to 6609 parts per million with an average of 5702 (Figure 6-7).

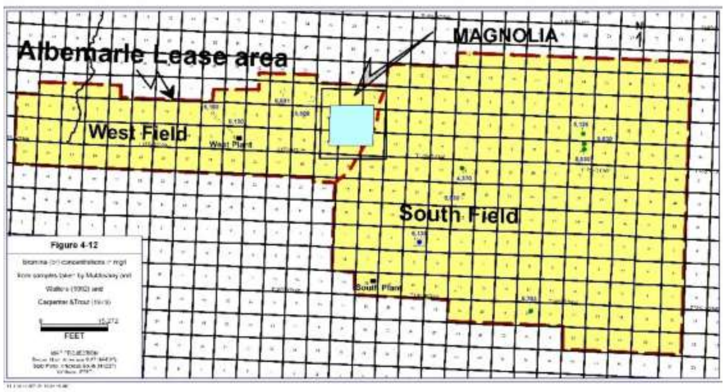

Figure 6-7: Bromine Concentration Map

The samples have good scatter across the Property with concentrations highest in the West Field diminishing slightly to the east in the South Field. These independent samples taken from producing oil or brine wells indicate excellent distribution of the bromine mineralization within the brine on the Property.

The upper and middle Smackover have porosities that range from 1% to over 28% and permeabilities from .1 millidarcy to over 8900 millidarcies. The rock with sufficient porosity ranges in thickness from 35 feet in the southern portion of the South Field to 262 feet in the northern portion of the South Field. Throughout most of the Property the porosity thickness is greater than 100 feet except in the southern half of the South Field where the average is less than 100'. The thick intervals tend to trend east and west following the depositional strike. The connectivity of the porous body of the upper Smackover is very good throughout the Property and can be recognized in the well performance between production and injection wells.

The mineralization occurs within the highly saline Smackover Formation waters or brine where the bromide has an abnormally rich composition. The bromine is more than twice as high as that found in normal evaporated sea water[19]. The bromine mineralization of the brine is distributed throughout the porous intervals of the upper and middle Smackover on the Property. The very good permeability and porosity of the Smackover grainstones provide excellent continuity of the bromine mineralization within the brine.

6.4 Deposit Type

Bromine is a chemical element with an atomic number of 35, an atomic weight of 79.904 and is a member of the halogen elements of the periodic table. It is a deep red noxious liquid that got its name from the Greek word bromos, meaning bad smell or stench[20]. It occurs naturally as soluble and insoluble bromides in the earth's crust and becomes concentrated in seawater from erosion of the crust and deposition into the sea with normal concentrations of 60-65 parts per million of bromine.

The bromine in sea water does not precipitate from sea water during the process of evaporation as does halite and other evaporate minerals, therefore the concentrations of bromine increase over time through the evaporation of the sea water. The brine water found in the Smackover Formation in some areas of South Arkansas contains up to 6600 parts per million or mg/l of bromine. These concentrations are similar to those found in the waters of the Dead Sea, which has over 2400 meters of halite deposits beneath it and is thought to be the main source of the bromine from the dewatering of the halite at depth[19]. Sodium-calcium chloride brines appear to originate as interstitial fluids in evaporates (salt or halite and other evaporites) and are subsequently expelled or dewatered as the result of compaction from the deposition of younger overlying sediments[xxi,xxii]. The bromine rich brine of the Smackover Formation is thought to have originated from the interstitial fluids within the salt deposits of the Louann Formation and expelled upward through faults and fracture into the Smackover during deposition of the Smackover and younger overlying sediments. Moldovanyi and Walters (1992) suggest that the brine may have been further enriched in bromine through the dissolution and recrystallization of the Louann salt by meteoric waters that may have penetrated the Louann through faults of the South Arkansas Fault System releasing more bromine into the waters.

The deposit that occurs on Albemarle Corporation Property is a confined bromine enriched brine deposit. The brine is confined within the porous intervals of the Jurassic Smackover Formation mostly in the upper 300' of the formation. This being the aquifer, it is bounded at the top by the impermeable anhydrite and shale of the Buckner Formation. The base of the aquifer is bounded by impermeable carbonate mudstones and shale in the lower Smackover. There are no lateral boundaries to the east and west as well as to the north. Although no boundary is found on the south side, the porous interval does thin to less than 50 feet just south of the Property boundary.

6.5 Static Geological Model

In order to describe the Magnolia field geology for use in determining in-place bromine volumes, and deriving bromine production forecasts, RPS constructed a three-dimensional (3D) geological model of the reservoir. The geological model grid captures all the data and the knowledge available about the sedimentology, stratigraphy, structure and about the rock characteristics of the Smackover in the Magnolia field. This information was gathered, interpreted, and combined into the Static Geological Model from a variety of sources including:

- Historical Albemarle and publicly available drilling log data
- Historical geological interpretations via contract geologists
- Multiple iterations of clinoform based interpretation of Smackover formation

7 EXPLORATION

7.1 Historical Exploration

Exploration for bromine rich brine preceded the initial brine production, which began in 1965 in the West Field and 1969 in the South Field. Since that time, the two fields have been under development by Albemarle and its predecessors as wells were drilled to add to or extend the infrastructure of both fields to its current day extent. The Property has had many wells drilled to the Smackover Formation in the search for oil and gas over many years. These wells give Albemarle information about the thickness and quality of the permeability and porosity of the Smackover Formation in areas that have not been developed to this point. Regional studies on the Smackover brine in South AR done by Walters and Moldovanyl, 1992 and Carpenter and Trout, 1978, provide information on bromine concentrations from particular wells on the Property and the surrounding area. This information and information regarding the physical characteristics of the Smackover have reduced the need for exploration on the Property.

7.2 Current Exploration

No exploration has been conducted on the property in the past year, and as such, no exploration activity results are included in this report.

8 SAMPLE PREPARATION, ANALYSIS, AND SECURITY

As the Magnolia field is currently on full commercial production, sample preparation, analysis, and security are discussed in Sections 10.1 and 10.3 of this report.

9 DATA VERIFICATION

The data set used in this study was collected from various agencies, from companies and from data generated and collected from Albemarle Corporation's ongoing brine operations. Well logs, core analysis, production, and sampling data were all integrated to produce the mineral resource and reserve estimates. Well logs obtained from the client were compared with those available with the Arkansas Oil and Gas Commission (AOGC) in case of any discrepancy. The different gamma ray curves, density curves, acoustic curves and resistivity curves were compared with the well logs for accuracy. The Smackover subsea elevations were checked and compared with AOGC or Albemarle records for verification. Production data volumes were checked with AOGC records. Sampling of brine and authentication and procedures are described in the Sample Prep, Analysis and Security chapter of this technical report.

Due diligence on the collection of data, the validation of the data and the interpretation of the data has been sufficient to ensure the accuracy for use in this technical report. These available information and the sample or well density are adequate to allow a reasonable estimate of the geometry, tonnage, and continuity of the mineralization to model and establish confidence in the estimation of the mineral resources and mineral reserves of bromine on the Albemarle property found in this report.

10 MINERAL PROCESSING AND METALLURGICAL TESTING

The methods used to test the quality of the brine before it reaches the Magnolia plants are discussed in this chapter. Understanding the quality of the brine before it enters the plant is critical to ensure that the plant feed is consistent. The analytical procedures discussed herein are not typically used in the mining and exploration industry (e.g., geochemical assaying); however, the methods employed are sufficient for Albemarle to run its plants properly and efficiently. Site inspection was not possible because of COVID-19 travel restrictions; therefore, the sampling process has been described by Albemarle.

10.1 Brine Sample Collection

The Magnolia bromine field and production wells and facilities were designed for the explicit purpose of gathering substantial quantities of brine for transport to the central bromine production facilities. Once at the facilities, the bulk brine is processed to produce bromine. Concentration measurements of the bromide salts (hereafter referred to as bromides) are critical to the successful operation of the bromine plants. The brine consistency is critical for forecasting various bromine derivative production, alignment with forecast sales and the overall health of the Albemarle/Magnolia bromine business.

Bromide samples from the Magnolia brine plants are collected in two strategic locations: (1) upstream of the bromine tower and (2) downstream of the bromine tower. Because of the nature of brine collection, the feedbrine (i.e., upstream brine) concentration of bromine remains relatively consistent; however, the concentration does vary as would be expected from brine extracted from the Smackover geologic formation, the source of brine for the Magnolia plants. Feedbrine samples are therefore frequently taken to capture concentration changes and more effectively adjust downstream operating parameters.

Tailbrine (i.e., downstream brine) samples are also taken frequently, primarily to ensure that existing parameters at the bromine tower are set correctly. Magnolia operators collect brine samples multiple times per day and as requested by plant management. The sampling method includes the following steps:

1. Travel to each feedbrine and/or tailbrine sampling area within the plants
2. Slowly open the sample valves to purge out collected debris or stagnant brine to ensure that the samples collected are representative of the actual flow
3. Collect approximately 1 liter of brine within the sample bottle (roughly filling to the bottle’s capacity)
4. Label the sample bottle with the date, time, and name of the operator who collected the sample. The label also indicates if the sample corresponds to feedbrine or tailbrine. Cap the bottle and transport to the on-site analytical laboratory for testing.

Because of the long-established operation of the Magnolia bromine plant, the samples collected at both feedbrine and tailbrine collection sites are only regularly tested for bromide salts. The composition of the feedbrine and tailbrine, in terms of additional salt content outside of the bromide salts, has been very consistent over the last several years of production, and consists of magnesium, sodium, calcium, and potassium chlorides. Density measurements are not frequently taken based on the lack of density change in the brine over time.

10.2 Security

Samples are taken directly from the sampling points to the internal Magnolia quality control (“QC”) laboratory. Samples are verified by the QC laboratory technician and operator during delivery and tracked through an electronic sample monitoring system where samples are given a designated number and the results of analytical tests are posted. Samples are not sent to external laboratories for testing; however, some samples are sent to internal analytical laboratories at different Albemarle sites (primarily the

Process Development Center in Baton Rouge, Louisiana) for various other tests that are immaterial to plant operations but do provide quality assurance as duplicate sample analysis.

A check standard is run for each titration and if the test passes the actual sample is analyzed. If the sample fails, the instrumentation is recalibrated. The laboratory does not hold any internationally recognized certifications.

10.3 Analytical Method

Halogen titration is the current process to measure bromine in brine. This method is widely used across the company for measuring bromine because of its simplicity and no complex machinery/analytical tools are required. The method involves use of different concentrations of chemicals for feedbrine and tailbrine. Firstly, a buffer solution is prepared by adding sodium fluoride and sodium dihydrogen phosphate in deionized water. Clorox bleach is then added, and the solution is heated on a hot plate for 15 minutes. Sodium formate is then added, after which the solution is heated for an additional 5 minutes and then cooled to room temperature. Potassium iodide and sulphuric acid is then added to the solution and then the solution is titrated with sodium thiosulfate until starch endpoint.

It is the QP's opinion that Albemarle's laboratory facilities meet or exceed the industry standard requirements for such facilities and that the implemented practices for the collection and preparation of samples, as well as the methodology followed to carry out the analytical work (including the sample security protocols) are based on industry best practices and, therefore, are adequate for their intended purposes.

The QP has reviewed the analytical method as provided by Magnolia and the method appears to be reasonable and well-established.

11 MINERAL RESOURCE ESTIMATES

All bromine mineral accumulations of economic interest and with reasonable prospects for eventual economic extraction within the Magnolia production lease area are either currently on production or subject to an economically viable future development plan and are classified as reserves. Therefore, there are no additional mineral resource estimates included in this evaluation.

The Magnolia facility has an established record of commercial production and, therefore, the reliability of the economic forecast operation is high. From the technical point of view, the quality of the feed, the expected recoveries and other key factors are well understood, by virtue of many years of operation.

The capital and operational costs correspond to a Class 1 estimate and therefore are also significantly accurate (between -10% and +10%), which minimizes the potential impact of those elements on the prospect of economic recovery. Economic factors have also been discussed at length in various sections of this technical report and it is the QP's opinion that they do not present any significant risk that could jeopardize the expected economic recovery of the operations. Moreover, it is the QP's opinion that no additional studies are required.

12 MINERAL RESERVE ESTIMATES

Bromine mineral reserves estimates have been derived using a reservoir simulation model of the Magnolia Smackover field. The simulation model was built using an industry standard modeling platform, utilizing the static geomodel described earlier in Section 6 of this report. The model was used to forecast brine production in the Albemarle licenced areas using the Albemarle corporate business development plan. This section of the report describes production forecasts and reserves estimate produced by the model.

12.1 Mineral Reserves Classification and Production Forecasts

The production forecast generated by the reservoir simulation model was utilized to generate reserves values as follows:

a. Production forecasts for each of the Proved reserves case and Proved + Probable reserves case (also denoted as “1P” and “2P”, respectively, in this report), were input to an economic evaluation model to determine the commercial viability of production.

b. Both forecasts were generated for fifty years of production.

c. Then, economic models were run out in time to determine the economic limit for the field under each reserve case. The production volumes up to the point of economic limit then constitute the reserves for each case.

12.1.1 Probable Reserves

The fifty-year production forecast generated by the history matched reservoir simulation model, using the Albemarle business plan for future development of the field is considered to be the “most likely” forecast to be realized on the existing licenced area. Therefore, for the purposes of this reserve evaluation, utilizing the definitions of mineral reserves categories, RPS has classified this forecast as the Proved + Probable (“2P”) reserves level.

12.1.2 Proved Reserves

The Proved reserves, by definition, constitute reserves volumes where there is a higher degree of confidence in the forecasts. In generating the production forecasts using a history matched reservoir simulation model, with in turn is based on a geological model built using reservoir geometry and property data from existing wells, the major uncertainties in the forecasts are considered to be related to the reservoir properties at infill drilling locations (locations of the reservoir not yet supported by actual well data.) The uncertainties in reservoir properties are considered to be directly related to the distance of the respective locations from existing well control. For the proved reserves case, to incorporate these uncertainties and reflect them into a production forecast, RPS has discounted the “most likely” forecast derived by the simulation model as follows:

- All existing development wells: Discount forecast by 10%
- For new development wells:
  - For wells within 1 mile of existing well control: discount forecast by 20%
  - For wells within 1 to 2 miles of existing well control: discount forecast by 30%
  - For wells more than 2 miles from existing well control: discount forecast by 40%

12.1.3 Reserves Classified Production Forecasts

The production forecasts derived as described above for the Proved + Probable and Proved reserves cases are shown in the following chart (Figure 12-1):

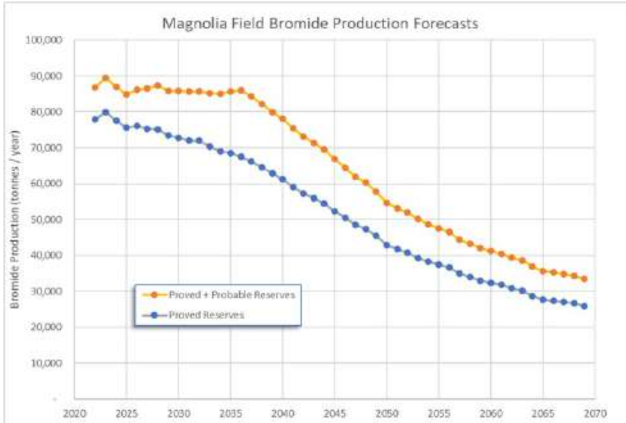

Figure 12-1: Bromide Production forecasts

The cumulative production as of the effective date of this report is 4.21 million tonnes (raw) and 3.95 million tonnes (sales).

The total future forecast production volumes and total ultimate recovery from the leased area of the Magnolia field are summarized in Table 12-1. The Bromine produced by Albemarle is essentially pure elemental Bromine, measured at >99.99% purity.

The cut-off grade is an industry-accepted standard expression used to determine what part of a mineral deposit can be considered a mineral resource. It is the grade at which the cost of mining and processing the ore is equal to the desired selling price of the commodity extracted from the ore.

The considered sales price ranges between USD 1,938 and USD 3,525 per tonne and the operating cost ranges between USD 1,328 and USD 1,992 per tonne, as detailed in Section 18 of this report.

The cut-off grade of the Magnolia operation has been estimated to be at 1,000 ppm. The bromide ion concentration in the brine extracted from the Smackover Formation, which feeds to bromine plants, significantly exceeds the selected cut-off grade.

Table 12-1: Bromine Recovery Factors

	Bromine Recovery		
	Raw Bromine (Million Tonnes)	**Sales Bromine (Million Tonnes)**	**Recovery Factor (%OBIP)***
Albemarle OBIP	8.48		
Cumulative Production	4.21	3.95	50%
Forecast Recovery (1P)	2.71	2.65	32%
Forecast Recovery (2P)	3.26	3.20	38%
Ultimate Recovery (1P)	6.92	6.60	82%
Ultimate Recovery (2P)	7.47	7.15	88%

*Recovery factor calculations (Sales/Raw OBIP) are based on sales production, as the difference between raw and sales volumes is injected back into the reservoir

Being a mature project with significant historical production information, the reliability of the modifying factors for Magnolia are considerably high and therefore the risks associated with those modifying factors are relatively low.

It is the QP's opinion that the material factors that could cause actual results to differ materially from the conclusions, estimates, designs, forecasts or projections, including recovery factors, processing assumptions, cut off grades, etc., are well understood and, due to the nature of the deposit and the established extraction and processing operations, they are unlikely to significantly impact the mineral reserve estimates.

13 MINING METHODS

All bromine mineral extraction is conducted using supply (production) wells, producing brine from the subsurface Smackover Sands aquifer, as described in previous sections of this report. The produced brine is transported from the production wells via underground pipelines to two production processing plant facilities, where the bromine is extracted. The tailwater from the processing plants is transported back to the Magnolia field via underground pipeline, where it is re-injected into the same Smackover Sands aquifer via injection wells, providing reservoir pressure maintenance support to the brine producing operations. Figure 13-1 shows a simplified schematic of the complete system used by Albemarle.

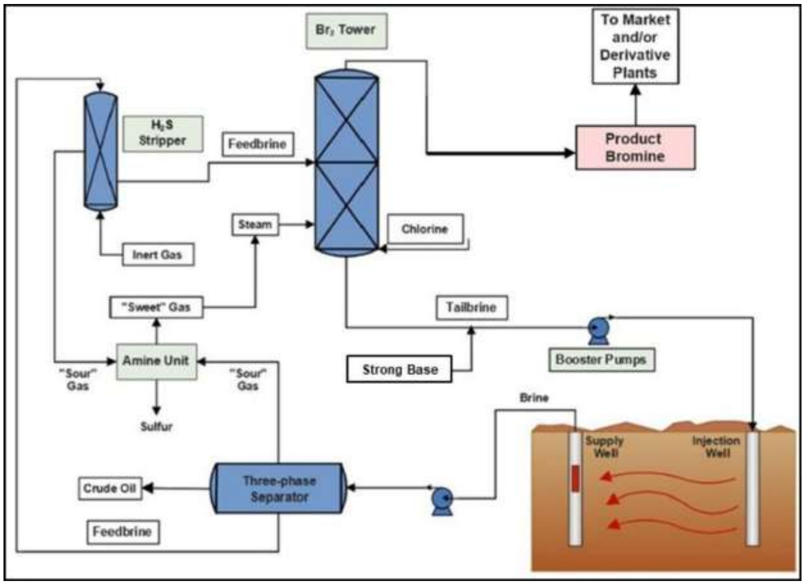

Figure 13-1: Schematic depiction of the bromine extraction and recovery process at Magnolia's South and West Plants

Previous sections of this report explain the importance of the two types of wells included in the brine extraction and reinjection used by Albemarle, namely the brine supply wells and brine injection wells, which are depicted in Figure 13-2.

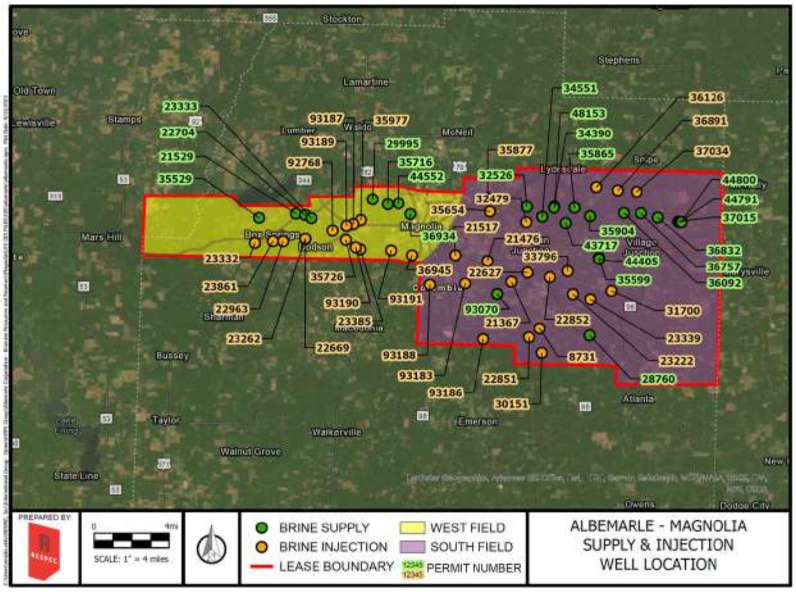

Figure 13-2: Albemarle Magnolia – Supply and Injection Wells

The bromine production process is not a typical mining/mineral processing sequence, however for the purposes of this report, all the steps involved in recovering the brine from the supply wells and its preliminary preparation to be put into the bromine separation plants will be considered “mining” activities, while the processes that takes place inside the bromine plants for the separation of the elemental bromine will be included under the processing and recovery methods.

Figure 13-3 shows a simplified schematic of the portion of the system used by Albemarle to extract the brine from the Smackover formation and prepare it for processing at Albemarle’s bromine plants.

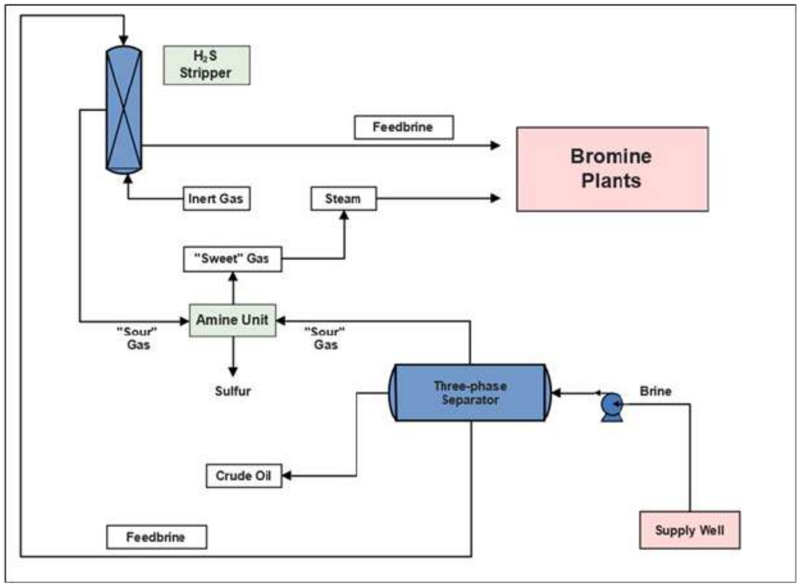

Figure 13-3: Schematic depiction of the brine extraction process at Magnolia's South and West Fields

13.1 Producing Brine at Supply Wells

Brine supply wells ("BSW"s) are utilized to pump brine from the Smackover formation to the surface. Downhole submersible pumps ("DHP"s) are used to elevate flow and pressure from the formation to the surface and are sized based on depth and downhole tubing size to provide an ideal production rate. The key components of the produced brine are chloride salts (primarily calcium and sodium, ~25 %) and bromide salts (sodium, ~1,000-5,000 parts per million ("ppm")). The high chloride-salt content results in the produced brine having a relatively high density (SG = ~1.2).

Figure 13-4 shows all the active Brine Supply Wells in Magnolia operated by Albemarle.

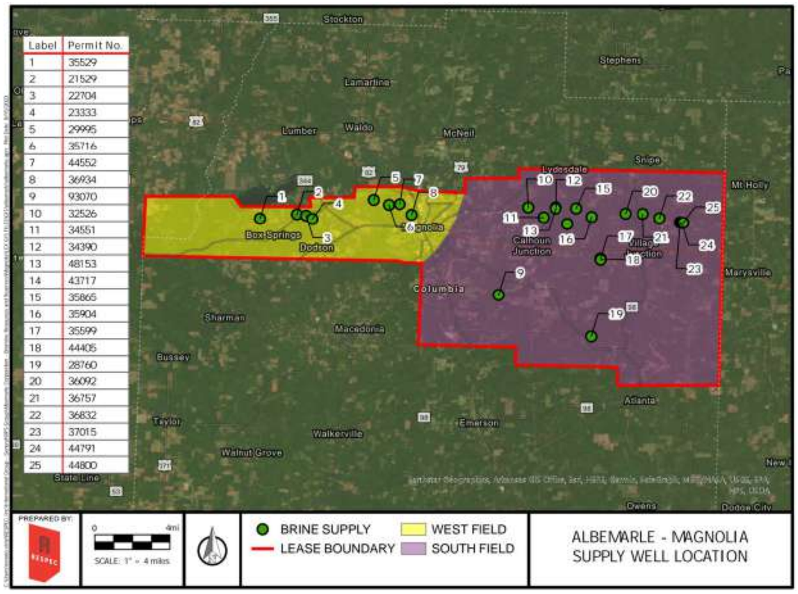

Figure 13-4: Albemarle Magnolia – Brine Supply Wells

After the brine reaches the surface, is processed in the field to remove co-produced oil and natural gas. Co-produced oil is separated into storage and later sales at the well head. Co-produced sour natural gas is fed into a gas handling system for transport to the main plants (South and West) for sweetening (H2S removal) and ultimately combusted as fuel for steam production. The magnitude of co-produced oil and natural gas depends upon location of the well in the field.

13.2 Transporting Brine and Gas from Wellheads to Processing Plants

Upon being discharged from the wellhead booster pumps, the brine flows into a network of pipelines which transports the brine to the main processing plant. A similar, separate system of pipeline transports the produced sour gas from the wellhead to the plant. Both networks operate in parallel in the same right of way ("ROW") to provide efficiency installation and maintenance.

The network of pipelines stretches over tens of miles and is comprised of a combination of both fiber-reinforced plastic ("FRP") and Transite (asbestos-cement) pipeline. Historically, Transite pipelines were used due to their relatively low-cost, availability, and effectiveness. However, since the field has considerably expanded and innovative technology/materials have become available, new pipeline additions use FRP to provide improved protection against leaks, improved compatibility, greater pressure ratings, in addition to overall safety. Ongoing maintenance includes replacing the current Transite pipeline with FRP, particularly closer to the plant.

The sour gas flows through a steel pipeline designed for sour gas service, meeting the demands of the National Association of Corrosion Engineers ("NACE") Standard MR0175 (Petroleum and Natural Gas Industries – Materials for Use in H_2S-containing environments in oil and gas production), and also FRP. Pipeline sizing is determined by flowrate and pressure drops requirements throughout the field.

The pressure with which the brine and gas exit the wellhead is not high enough to flow under natural pressure to the plant. Therefore, there are brine booster facilities as well as natural gas compressor stations to aid in transferring the brine along with gas to the Plants.

13.3 Sour Gas Treatment

Natural gas is usually considered sour if it contains more than 4 ppm by volume of hydrogen sulfide ("H_2S") at standard temperature and pressure conditions.

Amine gas treating, also known as amine scrubbing, gas sweetening and acid gas removal, refers to a group of processes that use aqueous solutions of various alkylamines (commonly referred to simply as amines) to remove H_2S and carbon dioxide ("CO_2") from gases.

At the Magnolia field, the sour gas enters an amine unit as soon as it arrives at the South Plant. This unit is designed to sweeten (remove H_2S) the gas, in order to improve its downstream processing and handling. The amine unit treats the gas using a counter-current absorption process in which the gas flows upwards and a lean amine flows downward. In the absorber, the amine reacts with H_2S and CO_2, removing it from the gas. Nearly all of the H_2S is consumed by the amine.

The sweetened gas, which at this point is primarily methane natural gas and nitrogen, is sent to the boilers for combustion and heat generation

The enriched amine is sent to a stripper unit where steam is directly injected to remove the sour gas from the amine.

Any residual water vapor within the sour gas is condensed/captured in knockout drums and the sour gas, containing nearly all of the H_2S and most of the CO_2, is sent further downstream.

The H_2S rich gas is sent to either a Claus Plant for further conversion to elemental sulfur or to a plant that produces NaHS.

13.4 Life of Mine Production Schedule

The following tables summarize the life of mine production schedule of the project for the 1P (Proved Reserves) and 2P (Proved + Probable Reserves) scenarios. Columns beyond year 2033 have been combined and the values under 2034+ correspond to the sum of the individual figures through year 2069. When applicable, like in the case of well counts, the reported number corresponds to the annual average number of wells between the years 2034 and 2069.

Table 13-1: Life of Mine Production schedule (1P Scenario)

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved (1P)

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	2,651	2,651	2,651	2,651

FULL FIELD GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	140.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.8	154.9	154.4	4,818	6,359
Bromine Production (Sales)	(k Tonne)	86	90	90	89	89	91	90	90	90	90	2,355	3,249

Table 13-2: Life of Mine Production schedule (2P Scenario)

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved + Probable (2P)

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	3,249	3,249	3,249	3,249

FULL FIELD GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	140.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.8	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	86	90	90	89	89	91	90	90	90	90	2,355	3,249
Recovery	(%)	98	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	86	90	90	89	89	91	90	90	90	90	2,355	3,249

14 PROCESSING AND RECOVERY METHODS

This chapter will describe the methods employed by Albemarle to process the bromine-rich brine from and obtain essentially pure (>99.99%) elemental bromine at its South and West Plants.

Figure 14-1 shows a simplified schematic of the portion of the system used by Albemarle to process the bromide-rich brine from the Smackover formation and recover elemental bromine.

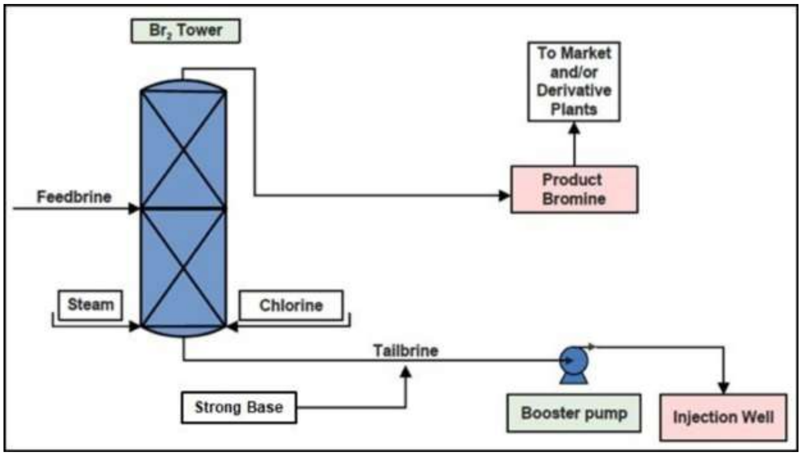

Figure 14-1: Schematic depiction of the bromine recovery process at Magnolia's South and West Plants

14.1 Bromine Production

Feedbrine from the brinefield supply wells in the South Field enters the plant downstream of the DS-7 booster station at a flow rate of between 11,000 and 13,000 gpm. The feedbrine then passes through a hydrogen sulfide (H_2S) stripper that removes the bulk of H_2S. This gas is then sent to the Amine/Claus plant described in previous chapters of this document. The stripped brine flows to the feedbrine tank, which acts as a surge capacity vessel and allows for a small amount of oil removal through extended residence time.

Feedbrine is pumped out of the feedbrine tank to the bromine tower. The feedbrine generally enters the tower with a temperature of 180-190°F.

The main reaction to transform the bromide salts in the feedbrine into bromine consists of the inclusion of chlorine in the tower. Liquid chlorine is brought into place by railcars and vaporized through chlorine vaporizers. The quantity of chlorine necessary is determined by the bromide salt concentration of the feedbrine. The inclusion of chlorine changes the bromide salts to elemental bromine and creates chloride salts within the feedbrine.

In order to strip the bromine from the feedbrine, steam is put into a tower to boil the bromine.

The stripped bromine leaves the tower overhead with water, chlorine, and light natural impurities as a vapor. The vapor stream then goes through a main condenser and secondary condenser, using water as their cooling medium. The condensed fluid out of both exchangers is combined into a phase separator, in which the bromine settles to the bottom as a result of its higher density. At this point of the process, the bromine is classified as "crude" due to the presence of organic impurities, chlorine, and water. The crude bromine drains by gravity and is then pumped to the purification train and derivative plants.

The process described above is the same in the West Plant, with the only difference being the sizing and capacities of the equipment

14.2 Tailbrine Treatment

At the bromine tower, once the bromine has been stripped of its bromine content, the brine is referred to as tailbrine. Normal conversion rates of bromide salts within the tower are over 90%, and sometimes more than 95%.

Considering the existence of acid and residual chlorine and bromine, the pH level of the tailbrine is particularly low and has to be dealt with before disposal.

Soon after passing through a heat recovery system, the tailbrine flows by gravity towards the neutralization tanks where a strong base to adjust the pH. After pH adjustment the tail brine is cooled before being reinjected. There is adequate tail brine surge capacity between the plant and the injection operations.

14.3 Disposing of Tailbrine at Injection Wells

Albemarle currently operates approximately 37 brine injection wells (“BIW”) between the South and West fields. All BIWs inject the tailbrine into the Smackover Formation, the same reservoir zones as the supply wells’ completions.

Figure 14-2 shows all the active BIWs in Magnolia operated by Albemarle.

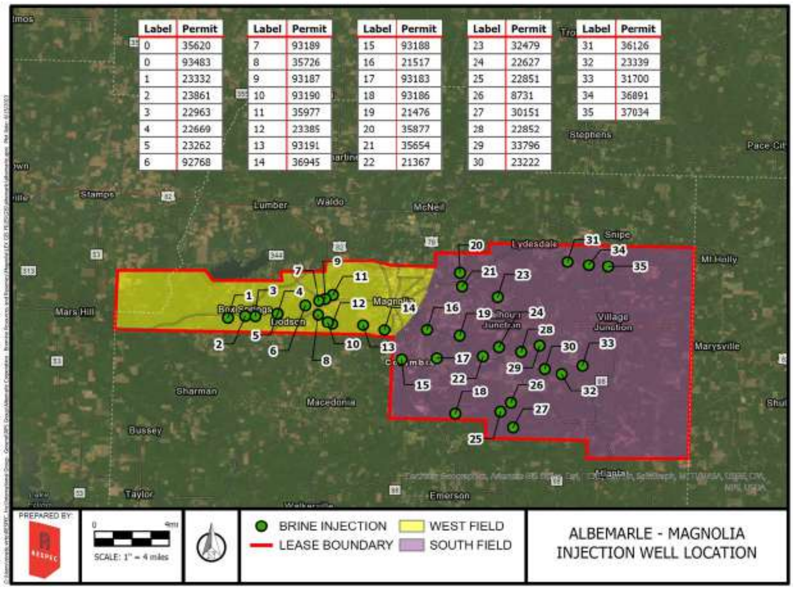

Figure 14-2: Albemarle Magnolia – Brine Injection Wells

In the South Field, tailbrine is pumped from the tailbrine tank into the brinefields with its final destination being 21 injection wells from where it is pumped back into the Smackover Formation for disposal.

15 INFRASTRUCTURE

Albemarle operates two production facilities in Columbia County, Arkansas: The West Plant and the South Plant. The West Plant is located approximately seven miles west of Magnolia, Arkansas. The South Plant is located approximately three miles south of the City of Magnolia. Pipelines run between the two plants and from the plants back to subsurface brine supply (production) wells. The production wells produce bromine rich brine from the Smackover geological formation.

The Magnolia-area operation dates back to 1969 when the Bromet Company began a small bromine extraction operation at a Smackover Brine Formation plot located south of the city along Hwy. 79. The plot is now the site of Albemarle's South Plant.

Ethyl, as the company was later known, in 1987 absorbed Dow Chemical's operation at what is now the West Plant. In 1994, Ethyl's chemical operations were spun off into the Albemarle Corporation.

The principal use of the South Plant is production of flame retardants, bromine, inorganic bromides, agricultural intermediates and tertiary amines, while the West Plant's produces flame retardants and bromine.

15.1 Road and Rail

15.1.1 Roads

The City of Magnolia, the South Plant, and the West Plant are serviced by several roadways. The South plant is accessible via US Route 79 ("US-79") that runs north-south to the City of Magnolia to the north and the State of Louisiana to the south. The West Plant is accessible by US-371 that runs east-west to the City of Magnolia to the east. Additional major thoroughfares in the area include Arkansas Highway 19, 98, 160, and 344. These smaller roads are used for travel to the decentralized well sites around the brinefields.

US-79 is a United States highway in the southern United States. The route is officially considered and labeled as a north-south highway. The highway's northern/eastern terminus is in Russellville, Kentucky, at an intersection with U.S. Highway 68 and KY 80. Its southern/western terminus is in Round Rock, Texas, at an intersection with Interstate 35, ten miles (16 km) north of Austin.

In Columbia county US-79 continues northward from Louisiana into Emerson and then Magnolia, where it has a brief concurrency with US-82 through the city. From there, the route turns to the northeast, through Camden, where it intersects US-278, and Fordyce, in which it has a brief concurrency with US-167.

Figure 15-1 shows the road network that serves the Albemarle plants.

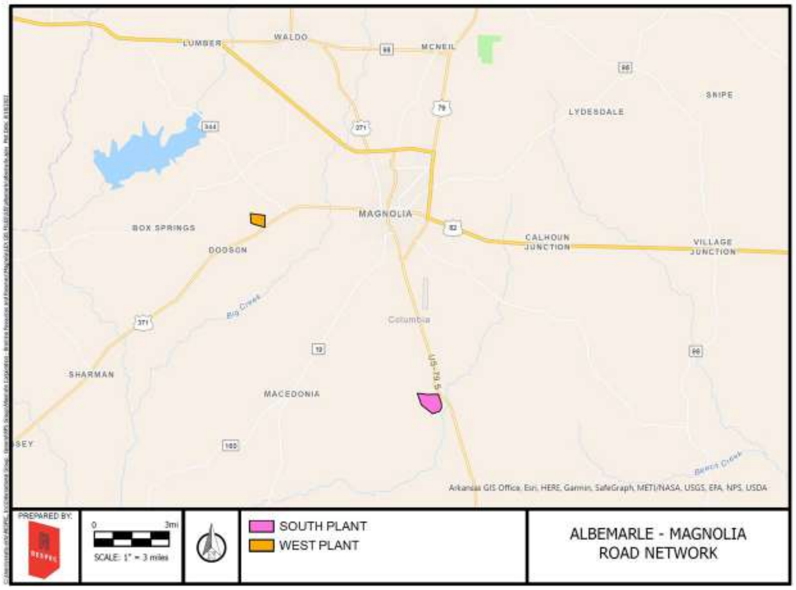

Figure 15-1: Road Network

15.1.2 Rail

Union Pacific ("UP") and the Louisiana & Northwest Railroad ("LNW") provide rail service in Columbia County, Arkansas. UP owns and operates Class I lines nationwide and LNW is a 68-mile, freight short line railroad (Class III). Both Albemarle plants have dedicated rail spurs that provide access to the UP and LNW lines, allowing the transportation of products all over the country.

Figure 15-2 shows the rail network that serves the Albemarle plants.

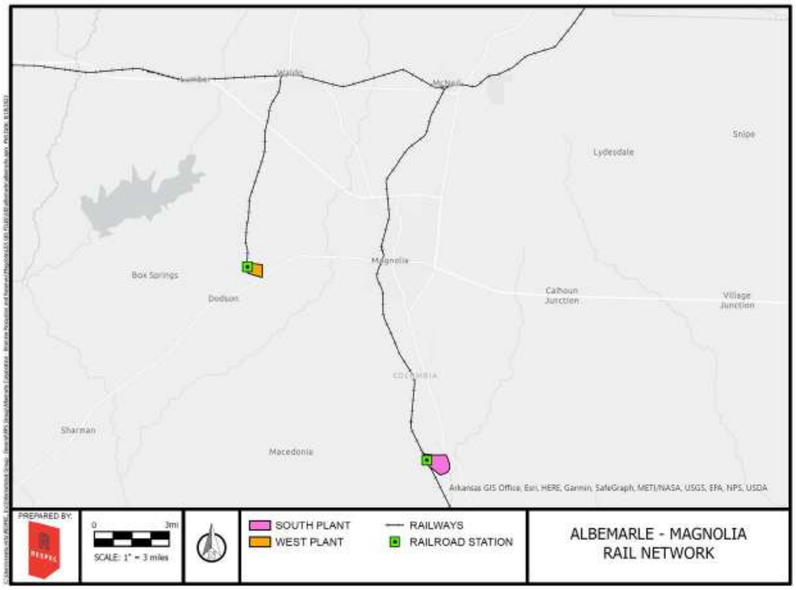

Figure 15-2: Rail Network

15.2 Port Facilities

The closest port is the Port of Houston. Several warehouses in the Houston area stockpile Albemarle finished products for distribution around the country and around the world. Products and supplies that are offloaded in Houston (or other nearby ports including New Orleans), are transported by road to Magnolia via trailer. The port system is not heavily involved in day-to-day production in Magnolia.

15.3 Plant Facilities

15.3.1 Water Supply

Fresh water is supplied to both the South and West plants via Albemarle owned and operated water wells. The wells are drilled into the Sparta Aquifer, a confined aquifer within the Mississippi embayment aquifer system, mostly localized in Arkansas but extending into Louisiana, Mississippi, Missouri, and Tennessee.

The Sparta aquifer is an excellent source of water because of favorable hydrogeologic characteristics. The thickness of the Sparta aquifer in Arkansas ranges from less than 100 feet ("ft") near the outcrop area up to 1,000 ft in the southeastern part of the State. Through most of the aquifer's extent in Arkansas, it is underlain by the Cane River formation and overlain by the Cook Mountain formation. These two formations are low-permeability, fine-grained, clay-rich units that confine flow within the much more permeable sands of the Sparta Sand. Water enters (recharges) the Sparta aquifer from the outcrop areas and adjacent geologic units. The outcrop areas provide hydraulic connection between the aquifer and surface-water sources such as rivers, lakes, and percolation of rainfall. Before development of the aquifer as a water resource (predevelopment), flow in the aquifer was predominantly from the topographically high outcrop areas downdip to the east and southeast. The aquifer in Arkansas County is confined by the Cook Mountain confining unit. Depth to the Sparta aquifer in Arkansas County ranges from 300 to 700 feet below land surface, with thickness varying from 500 to 800 feet.

The water quality of the Sparta is such that it is used as residential potable water in the City of Magnolia and surrounding areas. Three water wells are used to supply potable water to the South plant with a nominal flow of 1000-1200 gallons per minute to supply the whole site. Process requirements, including injection wells are approximately 650 GPD.

Two additional water wells are used to the supply potable water to the West plant, where the demand from the plant is far outstripped by the water capacity of those two wells.

15.3.2 Power Supply

Electricity is provided to the South Plant, West Plant, and brinefields by Entergy Arkansas, LLC (“Entergy”), a utility company that has served Arkansas customers for more than 100 years. Entergy companies serve approximately 715,000 customers in 63 counties and have approximately 3,500 employees in Arkansas. Entergy owns and operates the substation(s) at each property and within the brinefields.

Arkansas ranks among the 10 states with the lowest average retail price for electricity. According to the Energy Information Administration, industrial electricity in Arkansas[xxiii] is approximately 11 percent less expensive than the U.S. average as shown in Figure 15-3, which represents a strategic comparative advantage for industries located in the state.

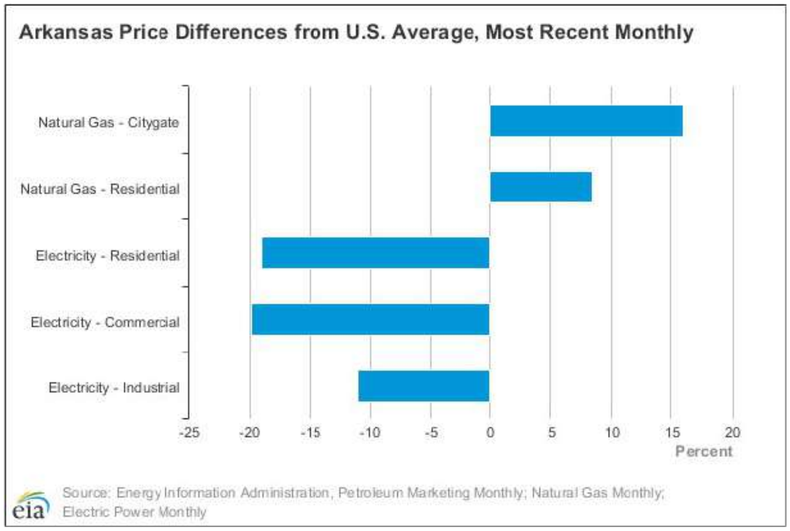

Figure 15-3: Arkansas Energy

115-kV systems are responsible for transmitting power from the larger transmission systems and generation facilities throughout the entire state of Arkansas. Some large industrial customers, such as Albemarle, are served directly from 115-kV systems.

Figure 15-4 shows the main power and distribution lines, as well as the location of the substations that serve the Albemarle plants in Magnolia.

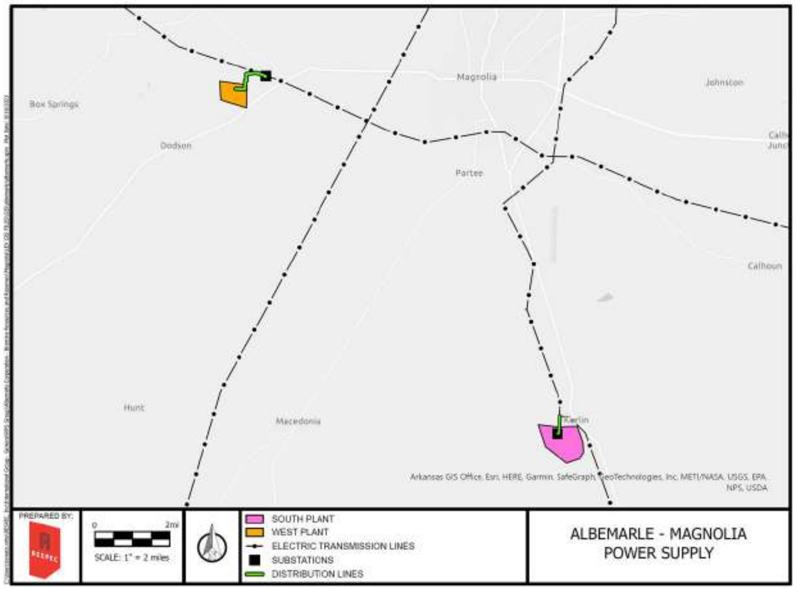

Figure 15-4: Albemarle-Magnolia Power Supply

Most industries need 2,400 to 4,160 volt power supply to run heavy machinery and they usually have their own substation at their facilities, as is the case of Albemarle's South and West Plants.

For the South Plant, there are two transformers within the substation: (1) 20MVA transformer dedicated to the plant itself where approximately 13 MVA is used when the plant is fully operational. The other transformer is a 10 MVA transformer that feeds offsite loads including some brinefield operations, the nearby nitrogen generation plant, and others.

For the West Plant, there are two substations. The Magnolia Dow substation rated at 12.5MVA provides supply to the plant itself where approximately 13 MVA is used when the plant is fully operational. The Magnolia West substation is rated at 27 MVA and feeds offsite loads including some brinefield operations and others.

15.3.3 Brine Supply

The brine produced from the wells is conveyed to the plants via a network of gathering lines with pumps/booster stations as necessary. Depleted brine is returned and injected back into the formation. This process is discussed in detail in the Mining Chapter, Section 13.2.

15.3.4 Waste Steam Management

There are no significant dump sites for the brine/bromine process other than that described in the “Process Description” Section. Various derivative processes have solid waste streams that capture solids via filters. These are collected in localized areas around the plant sites and shipped off site for disposal. Due to the local climate, open air ponds for evaporation are not feasible so there has been an extended focus on stream recycling and process waste minimization over the 50-year lifetime of the Magnolia site.

16 MARKET STUDIES

16.1 Bromine Market Overview

As reported by Technavio [2021][24], a market research company, the global bromine market is expected to grow steadily at a Compound Annual Growth Rate ("CAGR") of around 4.02 percent from 2022-27. One major reason for this trend is the increased demand for plastics. Flame-retardant chemicals use bromine to develop fire resistance. Plastics are widely used in packaging, construction, electrical and electronics items, automotive, and many other industries. The increasing demand for plastics across various end-user industries is driving the demand for flame-retardant chemicals that in turn, will propel the bromine market.

Another trend that is responsible for a growing bromine market forecast is the growth in bromine and bromine derivatives used as mercury-reducing agents. Bromine derivatives are used in reducing mercury emissions from coal combustion in coal-fired power plants. Mercury emissions in the environment is a major concern for public health. The rising health concern along with stringent government regulations may increase global bromine market demand. The increased use of specialty chemicals in various end-use industries such as oil and gas, automobile, pharmaceuticals, and construction will also drive the demand for bromine.

16.1.1 Major producers

The major world producers of elemental bromine are Israel, Jordan, China, and the United States, as shown in Table 16-1. The bromine production from the United States is withheld to avoid disclosing company proprietary data. The world total values exclude the bromine produced in the United States.

Table 16-1: Bromine Production in Metric Tons by Leading Countries (2017-2022)

[Source: USGS Mineral Commodity Summary- Bromine]

Country	2017 (MMt)	2018 (MMt)	2019 (MMt)	2020	2021(e)	2022(e)
Israel	180,000	175,000	180,000	170,000	182,000	180,000
Jordan	100,000	100,000	150,000	84,000	110,000	110,000
China	81,700	60,000	64,000	70,000	70,000	70,000
Japan	20,000	20,000	20,000	20,000	18,000	20,000
Ukraine	4,900	4,500	4,500	4,500	4,500	4,500
India	1,700	2,300	10,000	3,300	5,000	5,000
United States	W	W	W	W	W	W
World Total (Rounded)	**388,000**	**362,000**	**429,000**	**352,000**	**390,000**	**390,000**

(e) estimated
W = withheld.

The prominent players in the global bromine market are Israel Chemicals Limited (Israel), Albemarle Corporation (United States), Chemtura Corporation (United States), Tosoh Corporation (Japan), Tata Chemicals Limited (India), Gulf Resources Inc. (China), TETRA Technologies, Inc. (United States), Hindustan Salts Limited (India), Honeywell International Inc. (United States), and Perekop Bromine (Republic of Crimea). The production from the major global bromine producers is also provided in Table 16-1.

16.2 Major Markets

The global bromine market is dominated by manufacturers who have an extensive geographical presence with massive production facilities, all around the world. Competition among the major players is mostly based on technological innovation, price, and product quality.

According to a report by Market Research Future [2021][25], which forecasts the global bromine market until 2023, the market is divided into five regions: Latin America, the Middle East and Africa, Asia Pacific, North America, and Europe. Among these, Market Research Future [2021][25] predicts that Asia would be the fastest-growing region for bromine consumption because of a growing population and increasing purchasing power in the developing nations. The growth of agriculture and automobile industries in countries such as China and India will also drive the increasing demand for bromine. North America will remain a dominant market, and developed industries such as cosmetics, automobile, and pharmaceuticals will affect the demand for bromine. The European region is expected to experience a moderate growth that will be driven by the cosmetic and automobile industries. The growing oil-and-gas drilling activities in Russia will also contribute to the growth of the bromine market.

16.3 Bromine Price Trend

The price of bromine gradually increased during the period 2014-2021. The price in January 2014 was approximately $2,800 per tonne and in January 2021 it had increased to approximately $5,200 per tonne.

In 2021, the price of bromine significantly increased, reaching a peak of $10,700 per tonne in November. The bromine spot price on the effective date of this report, December 31, 2023, was USD 3,525 per tonne and the overall trend is towards a progressive decrease.

Bromine prices have greatly decreased in the last two years mainly because of reduced demand and an increase in the release of domestic inventories before the close of the financial year. The slow demand for Bromine in industries such as flame-retardant production and other end-use sectors is due to excess inventories in the local market.

The above-described behavior of the market is the product of a combination of factors, including China's decrease in bromine production from brine due to the country's electricity curtailment policy.

Figure 16.1 illustrates the behavior of bromine prices in the period January 2014-December 2023.

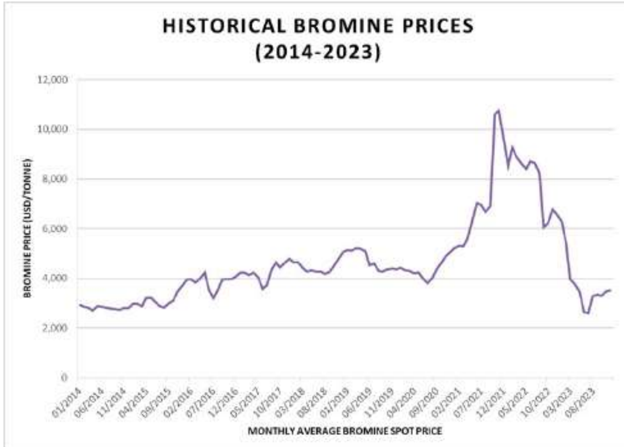

Figure 16-1: Bromine Price Trend as per China Petroleum and Chemical Industry Federation (Price is in US$)[26]

16.4 Bromine Applications

Albemarle produces a variety of substances from bromine [www.albemarle.com]. The specific derivatives produced are not discussed in detail in this technical report for proprietary reasons. The following list illustrate the ways that elemental bromine or bromine derivatives are used in a variety of products:

- Flame Retardants: Bromine is very efficient as a constituent element when used in producing flame retardants; therefore, only a small amount is needed to achieve fire resistance.
- Biocides: Bromine reacts with other substances in water to form bromine-containing substances that are disinfectants and odorless.
- Pharmaceuticals: Bromide ions have the ability to decrease the sensitivity of the central nervous system, which makes them effective for use as sedatives, anti-epileptics, and tranquillizers.
- Mercury Emission Reduction: Bromine-based products are used to reduce mercury emissions from coal-fired power plants.
- Energy Storage: Bromine-based storage technologies are a highly efficient and cost-effective electro-chemical energy storage solution that provides a range of options to successfully manage energy from renewable sources, minimize energy loss, reduce overall energy use and cost, and safeguard supply.
- Water Treatment: Bromine-based products are ideal solutions for water-treatment applications because of bromine's ability to kill harmful contaminants.

- Oil-and Gas Industry Drilling Fluids: Bromine is used in clear brines to increase the efficiency and productivity of oil-and-gas wells.

17 ENVIRONMENTAL STUDIES, PERMITTING, AND PLANS, NEGOTIATIONS, OR AGREEMENTS WITH LOCAL INDIVIDUALS OR GROUPS

17.1 Environment

In 2014, Albemarle officially joined the ENERGY STAR as a partner (the ENERGY STAR program is an initiative of the EPA), by making a fundamental commitment to protect the environment through the continuous improvement in energy performance.

For two straight years, Albemarle facilities have been awarded the Energy Efficiency Award by the American Chemistry Council ("ACC") to high-performing Responsible Care® member companies. Responsible Care® is the chemical manufacturing industry's environmental, health, safety, and security performance initiative, and it helps ACC member companies to enhance their performance and improve the health and safety of their employees, the communities in which they operate, and the environment as a whole.

Already certified by the Wildlife Habitat Council ("WHC") since 2006, Albemarle's Magnolia plants achieved Corporate Lands for Learning ("CLL") certification in 2009.

WHC Conservation Certification programs can be found in 47 U.S. states and 28 countries. This certification is the only standard designed for broad-based biodiversity enhancement on corporate landholdings. It is a continual process by which activities are maintained to offer ongoing benefit to biodiversity and people.

The CLL certification is accredited by the Wildlife Habitat Council, a nonprofit, non-lobbying charitable organization comprised of a group of corporations, conservation organizations, and individuals dedicated to restoring and enhancing wildlife habitat. This designation recognizes the learning opportunities created by Albemarle's commitment to environmental conservation and increasing native biodiversity across Magnolia's 100-acre tract of reforested land and 70-acre artificially created marsh.

Magnolia's South Plant and West Plant have artificial wetlands[27], which meet the needs of numerous wildlife species while also providing an economic and environmentally friendly solution for industrial water treatment.

The Magnolia sites have a wetland mitigation bank, which allows needed wetland permitting if required for any new brine well or pipeline construction that may fall within jurisdictional land.

17.2 Permitting

The purpose of environmental permits is to ensure that businesses and individuals understand and comply with all applicable federal and state environmental standards to protect the air, land, and water.

It is established that the State has primacy in issuing relevant permits for the whole operation of the brine extraction and processing plants. The Environmental Protection Agency ("EPA") has delegated responsibility for many of the regulatory programs under its jurisdiction to the State; these could be Title V Air Permits, underground injection control ("UIC"), National Pollutant Discharge Elimination System ("NPDES"), among others.

The organizations responsible for issuing most of these permits are the Arkansas Department of Energy and Environment ("E&E") and the Arkansas Oil & Gas Commission ("AOGC"). Currently between the two plants there is a combined total of 60 permits obtained from AOGC related to the supply and injection wells used in the brine extraction process.

17.2.1 Division of Environmental Quality (DEQ)

In Arkansas, the regulatory body in the area of environmental protection is the Arkansas Department of Energy and Environment (“E&E”), which absorbed the former Arkansas Department of Environmental Quality (“ADEQ”), which is now named the Division of Environmental Quality (“DEQ”). It was established in 2019 as part of the Transformation and Efficiencies Act of 2019 (Act 910).

The DEQ has four offices, with specific areas of competence:

- **Office of Air Quality**: regulates industries that emit air pollutants.
- **Office of Energy**: works to promote energy efficiency, clean technology, and sustainable strategies that encourage economic development, energy security, and environmental well-being.
- **Office of Land Resources**: regulates activities to ensure that Arkansas's land is protected.
- **Office of Water Quality**: regulates stormwater runoff and industrial discharges.

Albemarle’s operation at Magnolia are regulated by the Office of Air Quality and the Office of Water Quality.

17.2.1.1 Office of Air Quality

The Office of Air Quality consists of four branches: Permits, Compliance, Planning, and Air Quality Analysis, and Enforcement and Asbestos. Each branch of the Office of Air Quality has specific duties and addresses various aspects of the air program. The branches work together to meet Arkansas’s federal obligations under the Clean Air Act; and protect air quality to enhance the lives and health of all Arkansans and visitors to the State, while fostering responsible economic expansion opportunities. Albemarle’s South Plant and West Plants air emissions are regulated by this office.

The Permits Branch issues new permits and permit modifications to existing facilities after reviewing and evaluating permit applications for administrative and technical completeness and ensuring that each application meets regulatory adequacy. The permit is written to meet state and federal regulations to include information on which pollutants are being released, how much may be released, and what kinds of steps the source's owner or operator is taking to reduce pollution. All permits will include a mechanism to demonstrate compliance with the permit conditions. There are two types of air permits: Minor Source and Major Source/Title V.

The Office of Air Quality Compliance Branch’s primary responsibility is to ensure that permitted facilities are operating according to state and federal air pollution regulations. This is accomplished through annual compliance inspections, stack testing, and monitoring of reporting requirements. Compliance inspectors also investigate citizen complaints relative to air pollution.

The Policy & Planning Branch is responsible for developing plans to implement DEQ’s program to protect outdoor air quality in the state in accordance with Arkansas law and the Clean Air Act. The Branch is also responsible for gathering and evaluating information on air quality conditions and emissions of air pollutants in the state. The Branch provides technical expertise to the other branches of the Office of Air Quality and helps to educate the public about air quality issues.

The Asbestos Section is focused on providing assistance and training to office staff, the regulated community, and the general public on asbestos related issues (mainly abatement, stabilization, and remediation).

17.2.1.2 Office of Water Quality

Each of the Office of Water Quality’s four branches, Compliance, Enforcement, Permits, and Water Quality Planning, has different duties. Their common goal is protecting and enhancing Arkansas's waterways.

The Compliance Branch performs compliance inspections at municipal wastewater treatment plants, construction sites, industrial properties, animal waste facilities, and oil and gas drilling sites.

The Enforcement Branch outlines corrective actions, sets corrective action schedules and civil penalties, and monitors instances of noncompliance throughout the state. The branch also oversees DEQ's wastewater licensing program.

The Permits Branch issues a range of individual and general permits. The permits not only set pollution limits but also lay out reporting and other requirements all aimed at preserving water quality.

The Water Quality Planning Branch develops water quality standards for waterways and closely monitors surface water and groundwater across the state.

The Water Office staff maintains a Water Quality Management Plan (WQMP) in accordance with Section 208 of the Clean Water Act. The WQMP is an inventory of point source dischargers and their associated permit limits and other information.

17.2.2 Arkansas Oil and Gas Commission

The mission of the Arkansas Oil and Gas Commission[28] is to prevent waste and encourage conservation of the Arkansas oil, natural gas, and brine resources, to protect the correlative rights associated with those resources, and to respect the environment during the production, extraction, and transportation of those resources.

The Commission's Regulatory Functions are the following:

- Issue permits to drill oil, natural gas, and brine production wells, and other types of exploratory holes.
- Issue authority to operate and produce wells through approval of well completions and recompletions.
- Initial production test to establish production allowable.
- Conduct compliance inspections during drilling process and operational life of well.
- Issue authority to plug and abandon wells to insure protection of freshwater zones and production intervals.
- Issue permits to conduct seismic operations for exploration of oil and natural gas.
- Issue permits to drill and operate Class II UIC (Underground Injection Control) enhanced oil recovery injection wells and saltwater disposal wells.
- Issue permits to drill and operate Class V UIC brine injection wells for the disposal of spent brine fluids following removal of bromine and other minerals.
- Conduct monthly administrative hearings to enforce provisions of the oil and gas statutes and regulations.

17.2.2.1 Underground Injection Control (UIC) Program

In 1974, Congress passed the Safe Drinking Water Act, which required the U.S. Environmental Protection Agency ("EPA") to establish a system of regulations for underground injection activities. The regulations are designed to establish minimum requirements for controlling all injection activities, to provide enforcement authority, and to provide protection for underground sources of drinking water.

In 1982, EPA gave to the State of Arkansas the authority to administer the UIC program[29], and the former Arkansas Department of Energy and Environment's Division of Environmental Quality now named Division of Environmental Quality, became the primary enforcement authority to regulate Class I, Class III, Class IV, Class V (other than spent brine from bromine production wells), and Class VI UIC wells. At present, there are no Class III, Class IV, or Class VI UIC wells in Arkansas.

The Arkansas Oil and Gas Commission (AOGC) regulates Class II UIC wells and Class V bromine-production-related spent brine UIC disposal wells.

Class IV wells are banned by CFR 144.13 and APC&EC Regulation 17, except for EPA- or state-authorized groundwater cleanup actions.

17.2.2.2 Underground Injection Control Well Classes

The Underground Injection Control program[30] consists of six classes of injection wells. Each well class is based on the type and depth of the injection activity, and the potential for that injection activity to result in endangerment of an underground source of drinking water (USDW).

- Class I wells are used to inject hazardous and non-hazardous wastes into deep, isolated rock formations.
- Class II wells are used exclusively to inject fluids associated with oil and natural gas production.
- Class III wells are used to inject fluids to dissolve and extract minerals.
- Class IV wells are shallow wells used to inject hazardous or radioactive wastes into or above a geologic formation that contains a USDW.
- Class V wells are used to inject non-hazardous fluids underground. Most Class V wells are used to dispose of wastes into or above underground sources of drinking water.
- Class VI wells are wells used for injection of carbon dioxide (CO_2) into underground subsurface rock formations for long-term storage, or geologic sequestration.

17.2.3 Albemarle South and West Plant Permits

A detailed examination of the permits issued by the corresponding regulators showed that the Albemarle South and West plants were in full compliance with local, state, and federal regulations and related requirements for their current operations.

Each permit associated with both existing Albemarle plants require a certain issuance time and it varies depending on whether the application is for a renewal or for a new permit. Table 17-1 shows the estimated time it takes for the whole permitting process.

Table 17-1: Typical Processing Times for Modification or Issuance of New Permits

PERMIT	MODIFICATION	NEW APPLICATION
Class I Underground Injection Control (UIC) Well (non-hazardous waste)	≥ 3 mo ≤ 6 mo	≥ 6 mo ≤ 9 mo
NPDES Industrial Wastewater Discharge	≥ 3 mo ≤ 6 mo	≥ 6 mo ≤ 9 mo
Title V Air Operating Permit	≥ 3 mo ≤ 6 mo	≥ 6 mo ≤ 12 mo

Table 17-2 and Table 17-3 show a list of the current active permits corresponding to the South and West plants as well as a brief description of each permit. Voided permits and permits that are pending or under review as of the date of this report were not listed in the tables. The permits listed below are only those shown as “Active” in DEQ data base. The validity of the permits can vary between two and 10 years.

Table 17-2: Existing Permits for Albemarle South Plant

ALBERMARLE SOUTH / AFIN # 14-00028			
MEDIA	PERMIT TYPE	STATE PERMIT # (IF APPLICABLE)	DESCRIPTION
AIR	Title V	0762-AOP-R29	Authorization to construct, operate and maintain the equipment and/ or control apparatus at the plant.
AIR	Minor Source	1394-A	Authorization to operate a portable flare at the well site during periods of maintenance in the case of brine leak.
WATER-NPDES	Cooling Water	AR0038857	Authorization to discharge to all receiving waters in accordance with conditions set forth in this permit.
SOLID WASTE	Class III Non-Commercial	0175-S	Authorization to construct, maintain and/or operate a Solid Waste Disposal Facility.
SOLID WASTE	Class III Non-Commercial	0251-S3N-R1	Authorization of the Waste Disposal Facility set forth in the original permit renewal application.
WATER-UIC	UIC Class I	0004-UR-3	Non-discharge Water Permit: This permit is for the operation and maintenance of a nonhazardous Class I underground injection Waste Disposal Well.
WATER	Waste Storage	3419-WR-6	Authorization to construct, operate and maintain a facility with no discharge of process waste directly on to waters of the state.
WATER	Brine	2189-WR-8	This is the authorization to operate and maintain storage impoundments and transmission pipelines, consisting of storage and handling of brine and tail brine for and from chemical manufacturing process units, with no discharge of process waste directly on to waters of the state.
WATER	Waste Storage	3532-WR-9	This is the authorization to operate and maintain storage impoundments and transmission pipelines, consisting of storage and handling of wastewater from chemical manufacturing process units, with no discharge of process waste directly on to waters of the state.

Table 17-3: Existing Permits for Albemarle West Plant

ALBERMARLE WEST / AFIN # 14-00011			
MEDIA	PERMIT TYPE	STATE PERMIT # (IF APPLICABLE)	DESCRIPTION
AIR	Minor Source	0779-AR-1	Authorization to operate a portable flare at the well site during periods of maintenance in the case of brine leak
AIR	Minor Source	0882-AR-9	Authorization to construct, operate and maintain the equipment and/ or control apparatus at the plant.
WATER-NPDES	Cooling Water	AR0047635	Authorization to discharge treated sanitary wastewater, non-contact cooling water, boiler blowdown, boiler de-aerator blowdown, and other miscellaneous sources from a facility.
WATER-NPDES	Stormwater	ARR00A588	Authorization to discharge receiving storm water in accordance with conditions set forth in this permit.
WATER	Brine	0690-WR-5	This is the authorization to operate the plant brine pre-treatment and management system.
WATER	Brine	4007-WR-4	This is the authorization to operate and maintain storage impoundments and transmission pipelines, consisting of storage and handling of brine and tail brine for and from chemical manufacturing process units, with no discharge of process waste directly on to waters of the stat

17.2.3.1 Title V Air Permits

The DEQ Office of Air Quality, oversees issuing new permits or renewals for the existing plants. They achieved this after evaluating and reviewing permit applications received to check for compliance with all the requirements and regulations stipulated in Title V of the Clean Air Act. It is a legally enforceable document designed to improve compliance by clarifying what facilities (sources) must do to control air pollution. EPA Region 6 provides oversight for air regulatory programs in Arkansas.

17.2.3.2 Underground Injection Control (UIC) Permits

The Underground Injection Control (“UIC”) program is designed to ensure that fluids injected underground will not endanger drinking water sources. All Class I wells have strict siting, construction, operation and maintenance requirements designed to ensure protection of the uppermost sources of drinking water (“USDW”s). Wells injecting hazardous wastes have siting requirements to show that, with a reasonable degree of certainty, there will be no migration of hazardous constituents from the injection interval. Any Class I wells that dispose of hazardous wastes via injection then they would have to have a no migration petition (which only EPA issues) in addition to an DEQ state permit for injection well operations.

17.2.3.3 National Pollution Discharge Elimination System

The permit program addressing water pollution by regulating point sources that discharge pollutants to waters of the United States is the National Pollutant Discharge Elimination System (“NPDES”), which was created by the Clean Water Act (“CWA”) in 1972. Its objective is achieved by regulating the point sources that discharge pollutants into the waters of the State. These discharges can include discharges from industrial process wastewater discharges and runoff conveyed through a storm sewer system.

17.2.4 Albemarle Well Permits

Albemarle has a total of 62 active well permits corresponding to the Magnolia Operations.

17.2.4.1 Communities

Albemarle Corp. is one of the largest employers in Columbia County[31], with about 375 employees at its two plants in Magnolia and another approximately 200 contractors who work on-site.

Albemarle's advocacy efforts are focused on promoting sustainable solutions to global challenges, supporting its communities and customers, and defending the science upon which its chemistry solutions are based. Societal concerns raised by multiple stakeholders about certain chemicals is of particular concern to Albemarle.

Albemarle has a strong commitment towards sustainability, indicating that it is the cornerstone of its community and stakeholder engagement efforts. The corporation acknowledges that its social license to operate is contingent on the trust and reputation that comes with engagement.

Albemarle regularly engages with many stakeholder groups to maintain strong relationships, share information, and gather feedback.

Most of Albemarle's US sites, including Magnolia, organize Community Advisory Panels ("CAP"s) under the Responsible Care Management System. In these CAPs, site leaders and employees meet regularly with members of the community in order to inform them about their operations and progress on important initiatives as well as to gather feedback and suggestions from local community members.

Albemarle sites also donate funds and volunteer time toward community initiatives, typically with the assistance of the Albemarle Foundation[31], a private endowed charitable (501(c)(3)) entity created in 2007, with the mission of making a positive, sustainable difference in the communities where the corporation operates.

To date, the Albemarle Foundation has granted over $39.5 million into the communities where it operates, in the form of matching gifts, volunteer grants, scholarships, and nonprofit grants.

In 2019, the Albemarle Foundation donated over $250,000 to the Magnolia community for a variety of projects including a park on the town square and Southern Arkansas University's engineering program. Employee's volunteerism includes a youth program called "Play It Safe" to teach outdoor safety, internet safety, fire response, and prom and graduation night safety reminders.

The Albemarle Foundation has also worked closely with Southern Arkansas University (SAU), giving $100,000 over four years to help the engineering program earn accreditation last year from the Accreditation Board for Engineering & Technology (ABET). SAU's Muleriders Kids College, a day camp, also receives Albemarle support.

Albemarle bought the naming rights to the stage in a new "pocket park" on the town square in Magnolia, and it sponsors musical programs at the Magnolia Arts Center.

In 2019 Albemarle conducted a materiality assessment[32], in which some of its key stakeholders helped it to review its environmental, social and governance efforts. The assessment included efforts to identify, assess, and prioritize the main issues on which Albemarle should focus and report.

17.3 Qualified Person's Opinion

The QP opines that the Magnolia facility is operating in conformance with high industrial standards and is comparable with other similar facilities worldwide.

Albemarle's robust Corporate Social Responsibility strategy is targeted at supporting sustainable community development projects and creating and funding sustainable social, cultural, and economic initiatives that service to local and national needs.

An example of good environmental practices in Magnolia is the initiative to convert stormwater captured in an artificial marsh to freshwater for the Albemarle operations, reducing the burden on the local underground aquifer. Albemarle's plants in Magnolia utilize aquatic plants to treat non-contact water and storm water runoff from within the main plant and adjacent areas. This is an innovative and economical solution to treating industrial water using a naturally occurring biological process that does not harm the environment or consume vast amounts of valuable energy resources.

The QP found that the environmental policies implemented by Albemarle at the Magnolia operation met or exceeded the requirements of local and international industry standards.

18 CAPITAL AND OPERATING COSTS

The economic evaluation of the bromine reserves accounts for capital and operating costs for the Magnolia field operations as well as the mineral processing operations at the West and South plants. Cost forecasts were based on data supplied by Albemarle, including corporate P&L statements for Bromine operations from 2014 through 2023, annual historical production data from 2013 through 2023, business plan forecasts for 2021 through 2027. All cost estimates and forecasts are shown in real 2024 USD terms.

The Albemarle operation is a mature project which has been in commercial production for years. The accuracy of the capital and operating cost estimates used in the technical report are based on best industry practices and detailed historical information from the operation; therefore, they correspond to an AACE International Class 1 Estimate (AACE International Recommended Practice No. 18R-97).

As indicated by AACE, “Class 1 estimates are typically prepared to form a current control estimate to be used as the final control baseline against which all actual costs and resources will now be monitored for variations to the budget, and form a part of the change/variation control program. They may be used to evaluate bid checking, to support vendor/contractor negotiations, or for claim evaluations and dispute resolution.”

Typical accuracy ranges for Class 1 estimates are -3% to -10% on the low side, and +3% to +15% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Albemarle’s capital and operating cost estimates have an accuracy of -10% to +10%.

18.1 Capital Costs

Capital costs required to produce the bromine reserves have been forecast based on analysis of historical field and plant capital costs, the Company’s field development plans, and the Company’s associated capital budget forecast. RPS estimates that Albemarle will require a working interest share capital investment of US$1.0 to US$1.4 billion to develop the Proved and Probable reserves.

18.1.1 Development Drilling Costs

The cost for drilling new development production (BSW) and injection (BIW) wells have been estimated based on actual costs incurred by Albemarle when drilling their last two BSWs, which were drilled in 2019 and 2021.

18.1.2 Development Facilities Costs

No further facilities/plant capital has been included in the business plan. No facilities capital costs have been included in the economic analysis.

18.1.3 Plant Maintenance Capital (Working Capital)

Albemarle historically spends maintenance capital costs to cover ongoing well and plant upgrades in order to maintain production and processing operations, and to conduct workovers and pump replacements on the producing wells in the field. Albemarle’s five year budget plan forecasts includes a schedule of maintenance capital from which RPS has estimated the following capital costs:

- Production (source) well workovers: $400k per workover
  - One workover on each production well every two years
- Process plant maintenance capital: $18.9 million per year

18.2 Operating Costs

The operating costs required for the production of brine and processing the brine to obtain bromine reserves have been forecast based on analysis of historical field and plant operating costs, the Company's field development plans, and the Company's associated operating budget forecast. The field and plant operating costs are combined for each of the West Field and Plant and the South Field and Plant. The operating cost estimates shown are based on the approximate midpoint of a range of uncertainty associated with each estimate.

18.2.1 Plant and Field Operating Costs

In evaluating the historical operating cost data, RPS has split operating costs into fixed and variable components to allow forecasting with variable product volumes, variable producing well counts, and variable injection well counts. Fixed costs include all costs not directly related to production/injection volumes and well counts, including annual lease payments on the multiple leased licence areas. Producing well variable costs include base costs for routine field operations which would vary depending on producing well count, but do not include production well workover costs, which have been included in maintenance capital. Injection well variable costs include the base well costs plus an amount to cover costs of regular acid stimulation treatments in order to maintain injectivity. Operating costs have some uncertainty associated with them, typically +/- 10% in a given year. Total operating costs for the Magnolia operation are forecast to be in the range of US$1,328 - US$1,992 per tonne of elemental bromine.

1.3.1 General and Administrative Costs

Albemarle's historical expenditures on general, sales, R&D, and administrative costs have been reviewed and analyzed for the past six years, with a fractional portion of total corporate G&A costs being allocated to the elemental bromine sales business and incorporated into the economic analysis.

1.3.2 Abandonment and Reclamation Costs

RPS has estimated abandonment and reclamation costs as follows:

18.2.1.1 Well Abandonments:

Albemarle includes well abandonment cost estimates in its operating costs forecasts of $185k per well for each production and injection well, plus $50k per well for site reclamation for a total of $235k per well. This cost estimate, which has been reviewed and adopted by RPS for this analysis, covers all rig and operations cost to remove all downhole tubing and equipment, set a plug over the producing formation plug, cement the well to surface, remove the wellhead and surface flowline equipment, decommission all subsurface flowlines, and reclaim the well site to original purpose use.

18.2.1.2 Plant Abandonments

Albemarle does not include plant decommissioning, abandonment, and reclamation in its business plan for the two Magnolia bromine plants. The rationale for this plan is that the active commercial activity of both plants is planned to survive the field abandonment, and the plants will continue in operation sourcing bromine and other possible feedstock materials.

On this basis, RPS has not included plant abandonment costs in its economic evaluation.

The following tables contain details on Albemarle's annual capital by major components and operating costs by major cost centers for the 1P (Proved Reserves) and 2P (Proved + Probable Reserves) scenarios. Columns beyond year 2033 have been combined and the values under 2034+ correspond to the sum of the individual figures through year 2069. When applicable, like in the case of well counts, the reported number corresponds to the annual average number of wells between the years 2034 and 2069.

Table 18-1: Summary of Operating and Capital Expenses (1P Scenario)

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation
CASHFLOW FORECAST CASE: Real 2024$
FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved (1P)

FULL FIELD GROSS PRODUCTION													
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Production	(k Tonne)	81	82	82	81	80	80	79	78	78	77	1,910	2,706
COMPANY SHARE CASHFLOW													
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Operating Costs													
Field and Plant Opex	($MM/yr)	71.7	72.0	71.9	71.6	71.0	71.3	70.8	70.5	70.3	70.0	2,135.6	2,847
G&A	($MM/yr)	35.1	35.2	35.2	35.1	35.1	35.1	35.0	35.0	34.9	34.9	1,190.7	1,541
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**106.8**	**107.3**	**107.1**	**106.7**	**106.1**	**106.5**	**105.8**	**105.5**	**105.2**	**104.8**	**3,359.6**	**4,421**
Operating Cash Income Before Tax	**($MM/yr)**	**177.2**	**181.2**	**180.2**	**177.1**	**173.8**	**176.0**	**171.9**	**169.7**	**167.7**	**165.8**	**3,362.0**	**5,103**
Capital Costs													
Field	($MM/yr)	4.2	4.4	4.4	4.8	4.6	4.8	4.8	4.6	5.2	5.0	165.2	212
Plant	($MM/yr)	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital Costs	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.8**	**21.8**	**21.6**	**22.2**	**22.0**	**775.9**	**992**

Table 18-2: Summary of Operating and Capital Expenses (2P Scenario)

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation
CASHFLOW FORECAST CASE: Real 2024$
FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved + Probable (2P)

FULL FIELD GROSS PRODUCTION													
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Production	(k Tonne)	90	91	92	91	91	93	91	91	92	92	2,404	3,317
COMPANY SHARE CASHFLOW													
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Operating Costs													
Field and Plant Opex	($MM/yr)	75.6	76.1	76.3	76.1	75.9	76.8	76.3	76.3	76.5	76.6	2,353.9	3,117
G&A	($MM/yr)	35.8	35.9	36.0	35.9	35.9	36.0	36.0	36.0	36.0	36.0	1,227.8	1,587
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**111.4**	**112.1**	**112.3**	**112.1**	**111.8**	**112.8**	**112.3**	**112.3**	**112.5**	**112.6**	**3,615.0**	**4,737**
Operating Cash Income Before Tax	**($MM/yr)**	**204.1**	**209.1**	**210.6**	**208.1**	**206.3**	**213.0**	**208.4**	**209.5**	**209.9**	**210.6**	**4,640.6**	**6,938**
Capital Costs													
Field	($MM/yr)	4.2	4.4	4.4	4.8	4.6	4.8	4.8	4.6	5.2	5.0	165.2	212
Plant	($MM/yr)	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital Costs	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.8**	**21.8**	**21.6**	**22.2**	**22.0**	**775.9**	**992**

19 ECONOMIC ANALYSIS

An economics model has been used to forecast cash flow from bromine production and processing operations to derive a net present value for the bromine reserves. As there is uncertainty associated with the input capital and operating cost estimates, the approximate midpoint of the range of uncertainty has been used as an input to the cash flow forecasts, in order to develop a single deterministic cash flow forecast and valuation for each of the reserve categories. Cash flows have been generated using annual forecasts of production, sales revenues, operating costs and capital costs. The cash flow model can generate forecasts in either “nominal dollar” (money of the day) or “real dollar” (2024$) terms. The salient features of the cash flow model include:

19.1 Burdens on Production

The production leases include the following burdens:

a. Production Royalties:
   - Oil: 12.5% of production
   - Gas: 12.5% of gas sales revenues
   - Solution gas: 12.5% of gas sales revenues
   - Other minerals (except brine and minerals contained in brine): 10% of mineral sales revenue
   - Brine: No production royalty
b. Production Lease Licences Fees:
   - Lease Years 1, 2, 3, & 4: $1.00 per acre
   - Lease Years 4 through 14: $10.00 per acre
   - Lease Years 15 onward: $25.00 per acre
   - For the purposes of lease licencing fees, the above lease fees have been superseded by the Arkansas Code, Title 15, Subtitle 6, Chapter 76 (15-76-315) which specifies that in lieu of royalty, an annual lease compensation payment of $32.00 per acre payable to the lease owner. This payment amount is indexed to the March 1995 US Producer Price Index for Intermediate Materials, Supplies and Components, then later the Producer Price Index for Processed Goods for Intermediate demand, which specifies that prices and costs are based on a datum cost base at March 1995 and are escalated annually based on the USA Producer Price Index.

Production lease licence fees have been included in the fixed field operating costs.

19.2 Bromine Market and Sales

Bromine produced from the Magnolia field is marketed and sold as both elemental bromine, as well as a constituent in a number of derivative products. The market value of the elemental bromine produced has been estimated from the historical records of elemental bromine sales revenues which the Company has supplied for analysis. Based on discussions with the Company, RPS has generated cash flow cases based on China Spot bromine price at December 31, 2023, with discounts of 0%, 15%, 30%, and 45% (Table 19-1) applied in order to produce a range of estimated values for the reserves. Prices are held flat for the full life of the production forecasts.

Table 19-1: Price Forecast Summary

Bromine Price Forecasts $/tonne			
Spot	Spot less 15%	Spot less 30%	Spot less 45%
$3,520	$2,990	$2,460	$1,940

19.3 Capital Depreciation

Albemarle depreciates capital on a unit of production ("UOP") basis. Based on the historical depreciation from the Albemarle PL statements, utilizing data from 2016 to 2020, RPS has utilized a UOP capital depreciation rate of $154/tonne

19.4 Income Tax

Albemarle has advised RPS that its combined state and federal tax rate on income is 23.2%. RPS has utilized this rate in the economic cash flow calculations.

19.5 Economic Limit

Using the bromine production forecasts, and above estimates of capital, operating, and G&A costs, RPS forecasts cash flow until the operating cash income becomes negative. At this point the field is deemed to have reached its economic limit of production. At that point, the field assumed to be shut in. In the following year of the cash flow forecast, all remaining production and injection wells are assumed to be abandoned, and the appropriate abandonment costs applied. The plant is assumed to not be abandoned, as per advice from Albemarle that the plant will continue operations, processing alternate bromine feedstock sources after the abandonment of the Albemarle field, and therefore no plant abandonment and reclamation costs are applied.

19.6 Cash Flow and Net Present Value Estimates

With the above inputs, RPS has generated cash flow forecasts for the Proved and Proved + Probable reserves cases. The economic viability of the reserves is such that in both the Proved (1P) and Proved + Probable (2P) reserves cases, the economic limit is reached beyond 2069, which is the end of the production forecast. Therefore, for the integrity of this cash flow analysis, the field abandonment costs are applied in the year after the end of the production forecast, i.e., in 2070. Cash flow forecasts were run in real 2024$ terms. The results are summarized in the following tables:

Table 19-2: Albemarle Working Interest Bromine Reserves as of December 31, 2023 – Spot Prices

Albemarle Working Interest Bromine Reserves
as of December 31, 2023
Spot Price Forecast

	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**4,110**	**1,956**	**1,157**	**779**	**567**	**3,054**	**1,463**	**870**	**587**	**427**
Probable	611	1,835	932	640	511	440	1,432	721	493	392	337
Proved + Probable	**3,317**	**5,946**	**2,887**	**1,797**	**1,290**	**1,007**	**4,487**	**2,184**	**1,363**	**979**	**764**

Table 19-3: Albemarle Working Interest Bromine Reserves as of December 31, 2022 – Spot Prices less 15%

Albemarle Working Interest Bromine Reserves as of December 31, 2023 Spot Price Forecast less 15%											
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**2,682**	**1,497**	**996**	**740**	**589**	**1,957**	**1,107**	**742**	**553**	**441**
Probable	611	1,513	603	327	214	157	1,185	472	256	168	123
Proved + Probable	**3,317**	**4,194**	**2,100**	**1,323**	**954**	**746**	**3,142**	**1,579**	**998**	**721**	**564**

Table 19-4: Albemarle Working Interest Bromine Reserves as of December 31, 2022 – Spot Prices less 30%

Albemarle Working Interest Bromine Reserves as of December 31, 2023 Spot Price Forecast less 30%											
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**1,253**	**838**	**592**	**450**	**362**	**860**	**601**	**432**	**331**	**267**
Probable	611	1,190	474	257	169	124	937	373	203	133	97
Proved + Probable	**3,317**	**2,443**	**1,312**	**849**	**619**	**486**	**1,797**	**974**	**634**	**463**	**364**

Table 19-5: Albemarle Working Interest Bromine Reserves as of December 31, 2022 – Spot Prices less 45%

Albemarle Working Interest Bromine Reserves as of December 31, 2023 Spot Price Forecast less 45%											
	Mineral Reserves ('000 tonnes)	Net Present Value Before Tax					Net Present Value After Tax				
		0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)	0% ($MM)	5% ($MM)	10% ($MM)	15% ($MM)	20% ($MM)
Proved	**2,706**	**-175**	**179**	**188**	**160**	**135**	**-237**	**95**	**121**	**108**	**93**
Probable	611	867	346	188	123	90	689	275	149	98	72
Proved + Probable	**3,317**	**692**	**524**	**375**	**283**	**225**	**452**	**369**	**270**	**206**	**164**

Per the NPV estimate analysis, the 10% discounted NPV of the Magnolia project is estimated to be between $188.0 million and $1.16 billion for Proved reserves and between $375.0 million and $1.79 billion for Proved + Probable reserves as of December 31, 2023, demonstrating that the operations are economic and supporting the estimation of reserves. The following Figure 19-1 and Figure 19-2 show the full distribution of the NPV range for each price forecast for Proved and Proved plus Probable reserves.

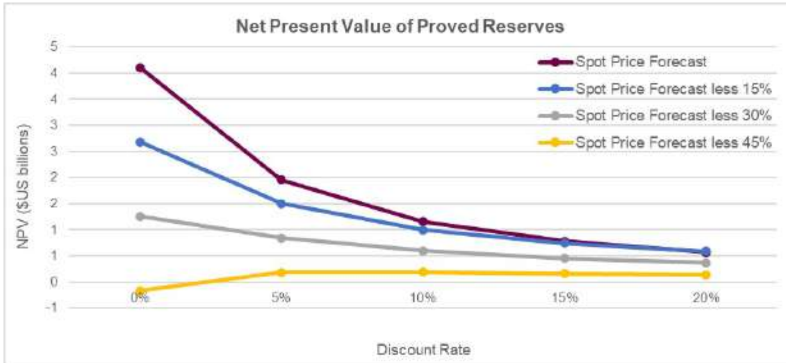

Figure 19-1: Net Present Value Distribution of Proved Reserves by Price Forecast

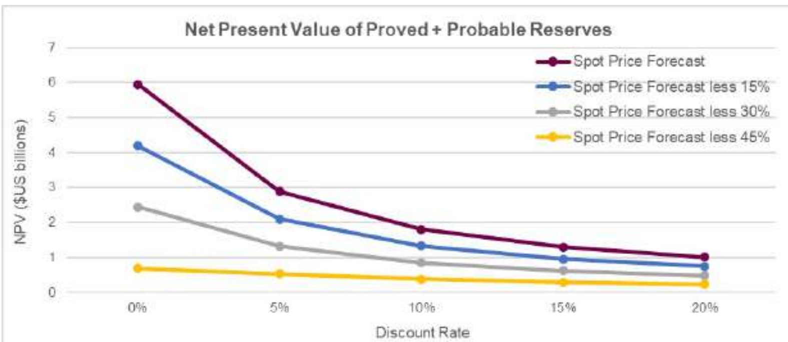

Figure 19-2: Net Present Value Distribution of Proved + Probable Reserves by Price Forecast

Summaries of the cash flow analysis on an annual basis are shown in the following tables. Columns beyond year 2033 have been combined and the values under 2034+ correspond to the sum of the individual figures through year 2069. When applicable, like in the case of well counts, the reported number corresponds to the annual average number of wells between the years 2034 and 2069.

Table 19-6: Annual Cash Flow Summary – Proved Reserves – Spot Prices

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved (1P)

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	2,706	2,706	2,706	2,706

PRESENT VALUE - COMPANY SHARE (Million US$) Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	9,524	3,985	2,227	1,461	1,050
Net Revenue	9,524	3,985	2,227	1,461	1,050
Operating Costs, G&A & Aband.	4,421	1,672	885	566	402
Operating Income	5,103	2,316	1,343	896	649
Capital Costs	992	361	186	117	82
Cash Flow Before Tax (CFBT)	4,110	1,956	1,157	779	567
Tax Payable	1,089	495	288	192	139
Cash Flow After Tax (CFAT)	3,054	1,463	870	587	427

PRODUCT PRICES (US$) Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Annual Average 2034+
Bromine	(US$/Kg)	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52

FULL FIELD GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	146.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	81	82	82	81	80	80	79	78	78	77	1,910	2,706
Recovery	(%)	96	98	98	98	96	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	78	81	80	79	78	79	77	77	76	76	1,870	2,651

COMPANY SHARE CASHFLOW Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	284.0	288.5	287.3	283.8	279.9	282.5	277.7	275.2	273.0	270.7	6,721.0	9,524
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	284.0	288.5	287.3	283.8	279.9	282.5	277.7	275.2	273.0	270.7	6,721.0	9,524
Operating Costs													
Field and Plant Opex	($MM/yr)	71.7	72.0	71.9	71.6	71.0	71.3	70.8	70.5	70.3	70.0	2,135.6	2,847
G&A	($MM/yr)	35.1	35.2	35.2	35.1	35.1	35.1	35.0	35.0	34.9	34.9	1,190.7	1,541
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**106.8**	**107.3**	**107.1**	**106.7**	**106.1**	**106.5**	**105.8**	**105.5**	**105.2**	**104.8**	**3,359.6**	**4,421**
Operating Cash Income Before Tax	**($MM/yr)**	**177.2**	**181.2**	**180.2**	**177.1**	**173.8**	**176.0**	**171.9**	**169.7**	**167.7**	**165.8**	**3,362.0**	**5,103**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.6	4.8	4.8	5.2	5.0	165.2	212
Plant	**($MM/yr)**	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.6**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	156.1	159.8	158.8	155.3	152.3	154.5	150.1	148.0	145.6	143.9	2,586.1	4,110
Income Tax	**($MM/yr)**	38.1	38.9	38.7	38.0	37.3	37.8	36.9	36.4	36.0	35.6	715.6	1,089
Cash Flow After Tax	**($MM/yr)**	**118.1**	**120.8**	**120.1**	**117.3**	**115.0**	**116.7**	**113.2**	**111.6**	**109.6**	**108.3**	**1,903.9**	**3,054**

Table 19-7: Annual Cash Flow Summary – Proved Reserves – Spot Prices less 15%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot -15%
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved (1P)

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	2,706	2,706	2,706	2,706

PRESENT VALUE - COMPANY SHARE (Million US$) Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	8,095	3,735	2,291	1,643	1,288
Net Revenue	8,095	3,735	2,291	1,643	1,288
Operating Costs, G&A & Aband	4,421	1,844	1,070	748	578
Operating Income	3,674	1,895	1,221	895	707
Capital Costs	992	398	225	155	118
Cash Flow Before Tax (CFBT)	2,682	1,497	996	740	589
Tax Payable	758	393	254	187	148
Cash Flow After Tax (CFAT)	1,957	1,107	742	553	441

PRODUCT PRICES (US$)												
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Annual Average 2034+
Bromine	(US$/Kg)	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99

FULL FIELD GROSS PRODUCTION													
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	81	82	82	81	80	80	79	78	78	77	1,910	2,706
Recovery	(%)	98	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	78	81	80	79	78	79	77	77	76	76	1,870	2,651

COMPANY SHARE CASHFLOW													
Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	241.4	245.2	244.2	241.2	237.9	240.1	236.0	233.9	232.0	230.1	5,713.4	8,095
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	241.4	245.2	244.2	241.2	237.9	240.1	236.0	233.9	232.0	230.1	5,713.4	8,095
Operating Costs													
Field and Plant Opex	($MM/yr)	71.7	72.0	71.9	71.6	71.0	71.3	70.8	70.5	70.3	70.0	2,135.6	2,847
G&A	($MM/yr)	35.1	35.2	35.2	35.1	35.1	35.1	35.0	35.0	34.9	34.9	1,190.7	1,541
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**106.8**	**107.3**	**107.1**	**106.7**	**106.1**	**106.5**	**105.8**	**105.5**	**105.2**	**104.8**	**3,359.6**	**4,421**
Operating Cash Income Before Tax	**($MM/yr)**	**134.6**	**137.9**	**137.1**	**134.5**	**131.9**	**133.7**	**130.2**	**128.5**	**126.8**	**125.2**	**2,353.8**	**3,674**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.6	4.8	4.8	5.2	5.0	165.2	212
Plant	**($MM/yr)**	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.6**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	113.5	116.6	115.7	112.7	110.3	112.1	108.5	106.7	104.6	103.3	1,577.9	**2,682**
Income Tax	**($MM/yr)**	28.2	28.9	28.7	28.2	27.6	28.0	27.2	26.8	26.5	26.1	481.7	**758**
Cash Flow After Tax	**($MM/yr)**	**85.4**	**87.7**	**87.0**	**84.6**	**82.7**	**84.1**	**81.2**	**79.8**	**78.1**	**77.1**	**1,129.6**	**1,957**

Table 19-8: Annual Cash Flow Summary – Proved Reserves – Spot Prices less 30%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation	**CASHFLOW FORECAST CASE:** Real 2024$	**FIELD:** Magnolia	
OPERATOR: Albemarle Corporation	**PRICE FORECAST:** Spot -30%	**WORKING INTEREST:** 100.0%	
	ANNUAL COST INFLATION: 0.0%	**RESERVES CLASS:** Proved (1P)	
	EFFECTIVE DATE OF ANALYSIS: 12/31/2023		

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	2,706	2,706	2,706	2,706

PRESENT VALUE - COMPANY SHARE (Million US$) Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	6,667	3,076	1,887	1,353	1,059
Net Revenue	6,667	3,076	1,887	1,353	1,059
Operating Costs, G&A & Abandt	4,421	1,644	1,070	748	578
Operating Income	2,245	1,235	817	605	481
Capital Costs	992	398	225	155	118
Cash Flow Before Tax (CFBT)	1,253	838	592	450	362
Tax Payable	426	240	161	120	95
Cash Flow After Tax (CFAT)	860	601	432	331	267

PRODUCT PRICES (US$) Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Annual Average 2034+
Bromine	(US$/Kg)	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46

FULL FIELD GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	148.2	146.9	3,893	5,353
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,208	5,748
Bromine Production	(k Tonne)	81	82	82	81	80	80	79	78	78	77	1,910	2,706
Recovery	(%)	96	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	78	81	80	79	78	79	77	77	76	76	1,870	2,651

COMPANY SHARE CASHFLOW Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	198.8	201.9	201.1	198.6	196.0	197.7	194.4	192.6	191.1	189.5	4,705.2	6,667
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	198.8	201.9	201.1	198.6	196.0	197.7	194.4	192.6	191.1	189.5	4,705.2	6,667
Operating Costs													
Field and Plant Opex	($MM/yr)	71.7	72.0	71.9	71.6	71.0	71.3	70.8	70.5	70.3	70.0	2,135.6	2,847
G&A	($MM/yr)	35.1	35.2	35.2	35.1	35.1	35.1	35.0	35.0	34.9	34.9	1,052.3	1,403
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**106.8**	**107.3**	**107.1**	**106.7**	**106.1**	**106.5**	**105.8**	**105.5**	**105.2**	**104.8**	**3,359.8**	**4,421**
Operating Cash Income Before Tax	**($MM/yr)**	**92.0**	**94.7**	**94.0**	**91.9**	**89.9**	**91.3**	**88.6**	**87.2**	**85.8**	**84.6**	**1,345.5**	**2,245**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.6	4.8	4.8	5.2	5.0	144.0	191
Plant	**($MM/yr)**	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.6**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	71.0	73.3	72.6	70.2	68.3	69.7	66.8	65.4	63.7	62.7	569.7	**1,253**
Income Tax	**($MM/yr)**	18.3	18.9	18.7	18.3	17.8	18.1	17.6	17.3	17.0	16.7	247.8	**426**
Cash Flow After Tax	**($MM/yr)**	52.7	**54.4**	**53.9**	**51.9**	**50.5**	**51.6**	**49.2**	**48.1**	**46.7**	**45.9**	**355.2**	**860**

Table 19-9: Annual Cash Flow Summary – Proved Reserves – Spot Prices less 45%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation	**CASHFLOW FORECAST CASE:** Real 2024$	**FIELD:** Magnolia
OPERATOR: Albemarle Corporation	**PRICE FORECAST:** Spot -45%	**WORKING INTEREST:** 100.0%
	ANNUAL COST INFLATION: 0.0%	**RESERVES CLASS:** Proved (1P)
	EFFECTIVE DATE OF ANALYSIS: 12/31/2023	

RESERVES

		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	2,706	2,706	2,706	2,706

PRESENT VALUE - COMPANY SHARE (Million US$)

Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	5,238	2,417	1,482	1,063	832
Net Revenue	5,238	2,417	1,482	1,063	832
Operating Costs, G&A & Aband	4,421	1,844	1,070	748	578
Operating Income	817	576	412	315	254
Capital Costs	992	398	225	155	118
Cash Flow Before Tax (CFBT)	-175	179	188	160	135
Tax Payable	95	87	67	52	43
Cash Flow After Tax (CFAT)	-237	95	121	108	93

PRODUCT PRICES (US$)

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Annual Average 2034+
Bromine	(US$/Kg)	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94

FULL FIELD GROSS PRODUCTION

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25		
Injection Wells		27	25	25	25	25	25	25	25	25	25		
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	81	82	82	81	80	80	79	78	78	77	1,910	2,706
Recovery	(%)	98	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	78	81	80	79	78	79	77	77	76	76	1,870	2,651

COMPANY SHARE CASHFLOW

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	158.2	158.7	158.0	156.1	154.0	155.4	152.7	151.4	150.1	148.9	3,696.9	5,238
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	158.2	158.7	158.0	156.1	154.0	155.4	152.7	151.4	150.1	148.9	3,696.9	5,238
Operating Costs													
Field and Plant Opex	($MM/yr)	71.7	72.0	71.9	71.6	71.0	71.3	70.8	70.5	70.3	70.0	2,135.6	2,847
G&A	($MM/yr)	35.1	35.2	35.2	35.1	35.1	35.1	35.0	35.0	34.9	34.9	1,190.7	1,541
Abandonment and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**108.8**	**107.3**	**107.1**	**106.7**	**106.1**	**106.5**	**105.8**	**105.5**	**105.2**	**104.8**	**3,359.6**	**4,421**
Operating Cash Income Before Tax	**($MM/yr)**	**49.4**	**51.4**	**50.9**	**49.4**	**47.9**	**48.9**	**46.9**	**45.9**	**44.9**	**44.0**	**337.3**	**817**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.6	4.8	4.8	5.2	5.0	165.2	212
Plant	**($MM/yr)**	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.6**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	28.4	30.0	29.5	27.6	26.3	27.3	25.1	24.1	22.7	22.1	-438.6	**-175**
Income Tax	**($MM/yr)**	8.4	8.8	8.7	8.4	8.1	8.3	7.9	7.7	7.5	7.3	13.8	**95**
Cash Flow After Tax	**($MM/yr)**	**19.9**	**21.2**	**20.8**	**19.2**	**18.2**	**19.0**	**17.2**	**16.4**	**15.2**	**14.7**	**-419.1**	**-237**

Table 19-10: Annual Cash Flow Summary – Proved + Probable Reserves – Spot Prices

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved + Probable (2P)

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	3,317	3,317	3,317	3,317

PRESENT VALUE - COMPANY SHARE (Million US$) Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	11,675	5,251	3,161	2,237	1,736
Net Revenue	11,675	5,251	3,161	2,237	1,736
Operating Costs, G&A & Aband	4,737	1,966	1,138	793	611
OCBT	6,938	3,285	2,022	1,444	1,125
Capital Costs	992	398	225	155	118
Cash Flow Before Tax (CFBT)	5,946	2,887	1,797	1,290	1,007
Tax Payable	1,492	707	435	311	242
Cash Flow After Tax (CFAT)	4,487	2,184	1,363	979	766

PRODUCT PRICES (US$) Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Annual Average 2034+
Bromine	(US$/Kg)	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52	$3.52

FULL FIELD GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	90	91	92	91	91	93	91	91	92	92	2,404	3,317
Recovery	(%)	96	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	86	90	90	89	89	91	90	90	90	90	2,355	3,249

COMPANY SHARE CASHFLOW Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	315.5	321.2	322.8	320.2	318.0	325.8	321.7	321.8	322.4	323.2	8,461.0	11,675
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	315.5	321.2	322.8	320.2	318.0	325.8	321.7	321.8	322.4	323.2	8,461.0	11,675
Operating Costs													
Field and Plant Opex	($MM/yr)	75.6	76.1	76.3	76.1	75.8	76.8	76.3	76.3	76.5	76.6	2,353.9	3,117
G&A	($MM/yr)	35.8	35.9	36.0	35.9	35.8	36.0	36.0	36.0	36.0	36.0	1,227.8	1,587
Abandonmnet and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**111.4**	**112.1**	**112.3**	**112.1**	**111.8**	**112.8**	**112.3**	**112.3**	**112.6**	**112.6**	**3,615.0**	**4,737**
Operating Cash Income Before Tax	**($MM/yr)**	**204.1**	**209.1**	**210.6**	**208.1**	**206.8**	**213.0**	**209.4**	**209.5**	**209.9**	**210.6**	**4,846.8**	**6,938**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.6	4.8	4.8	5.2	5.0	165.2	212
Plant	**($MM/yr)**	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.6**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	183.1	187.8	189.1	186.4	185.2	191.5	187.7	187.7	187.8	188.7	4,070.7	**5,946**
Income Tax	**($MM/yr)**	44.0	45.1	45.4	44.9	44.6	45.9	45.1	45.1	45.2	45.4	1,041.3	**1,492**
Cash Flow After Tax	**($MM/yr)**	**139.1**	**142.7**	**143.7**	**141.5**	**140.7**	**145.6**	**142.5**	**142.6**	**142.5**	**143.3**	**3,042.7**	**4,487**

Table 19-11: Annual Cash Flow Summary – Proved + Probable Reserves – Spot Prices less 15%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation
OPERATOR: Albemarle Corporation

CASHFLOW FORECAST CASE: Real 2024$
PRICE FORECAST: Spot -15%
ANNUAL COST INFLATION: 0.0%
EFFECTIVE DATE OF ANALYSIS: 12/31/2023

FIELD: Magnolia
WORKING INTEREST: 100.0%
RESERVES CLASS: Proved + Probable (2P)

RESERVES		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	3,317	3,317	3,317	3,317

PRESENT VALUE - COMPANY SHARE (Million US$) Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	9,924	4,464	2,888	1,902	1,475
Net Revenue	9,924	4,464	2,888	1,902	1,475
Operating Costs, G&A & Aband	4,737	1,966	1,138	793	611
OCBT	5,186	2,497	1,548	1,109	864
Capital Costs	992	398	225	155	118
Cash Flow Before Tax (CFBT)	4,194	2,100	1,323	954	746
Tax Payable	1,086	524	325	233	182
Cash Flow After Tax (CFAT)	3,142	1,579	998	721	564

PRODUCT PRICES (US$) Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Annual Average 2034+
Bromine	(US$/Kg)	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99	$2.99

FULL FIELD GROSS PRODUCTION Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	90	91	92	91	91	93	91	91	92	92	2,404	3,317
Recovery	(%)	96	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	88	90	90	89	89	91	90	90	90	90	2,355	3,249

COMPANY SHARE CASHFLOW Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	268.2	273.0	274.4	272.2	270.8	277.0	273.5	273.5	274.1	274.7	7,192.3	9,924
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	268.2	273.0	274.4	272.2	270.8	277.0	273.5	273.5	274.1	274.7	7,192.3	9,924
Operating Costs													
Field and Plant Opex	($MM/yr)	75.6	76.1	76.3	76.1	75.8	76.8	76.3	76.3	76.5	76.6	2,353.9	3,117
G&A	($MM/yr)	35.8	35.9	36.0	35.9	35.9	36.0	36.0	36.0	36.0	36.0	1,227.8	1,587
Abandonmnet and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**111.4**	**112.1**	**112.3**	**112.1**	**111.8**	**112.8**	**112.3**	**112.3**	**112.6**	**112.6**	**3,615.0**	**4,737**
Operating Cash Income Before Tax	**($MM/yr)**	**156.8**	**160.9**	**162.1**	**160.1**	**158.9**	**164.1**	**161.2**	**161.2**	**161.6**	**162.2**	**3,577.3**	**5,186**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.8	4.8	4.8	5.2	5.0	165.2	212
Plant	**($MM/yr)**	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.8**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	135.7	139.6	140.7	138.4	137.3	142.6	139.4	139.5	139.4	140.2	2,801.5	**4,194**
Income Tax	**($MM/yr)**	33.0	33.9	34.1	33.7	33.5	34.6	33.9	34.0	34.0	34.2	746.9	**1,086**
Cash Flow After Tax	**($MM/yr)**	**102.8**	**105.7**	**106.6**	**104.6**	**104.0**	**108.0**	**105.5**	**105.5**	**105.4**	**106.0**	**2,088.0**	**3,142**

Table 19-12: Annual Cash Flow Summary – Proved + Probable Reserves – Spot Prices less 30%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation	**CASHFLOW FORECAST CASE:** Real 2024$	**FIELD:** Magnolia
OPERATOR: Albemarle Corporation	**PRICE FORECAST:** Spot -30%	**WORKING INTEREST:** 100.0%
	ANNUAL COST INFLATION: 0.0%	**RESERVES CLASS:** Proved + Probable (2P)
	EFFECTIVE DATE OF ANALYSIS: 12/31/2023	

RESERVES

		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	3,317	3,317	3,317	3,317

PRESENT VALUE - COMPANY SHARE (Million US$)

Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	8,172	3,676	2,212	1,566	1,215
Net Revenue	8,172	3,676	2,212	1,566	1,215
Operating Costs, G&A & Aband	4,737	1,966	1,138	793	611
OCBT	3,435	1,710	1,074	773	604
Capital Costs	992	398	225	155	118
Cash Flow Before Tax (CFBT)	2,443	1,312	849	619	486
Tax Payable	679	341	215	155	122
Cash Flow After Tax (CFAT)	1,797	974	634	463	364

PRODUCT PRICES (US$)

Year		**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**Annual Average 2034+**
Bromine	(US$/Kg)	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46	$2.46

FULL FIELD GROSS PRODUCTION

Year		**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034+**	**Total**
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	90	91	92	91	91	93	91	91	92	92	2,404	3,317
Recovery	(%)	96	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	88	90	90	89	89	91	90	90	90	90	2,355	3,249

COMPANY SHARE CASHFLOW

Year		**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034+**	**Total**
Bromine Gross Sales Revenue	($MM)	220.9	224.8	226.0	224.1	223.0	228.1	225.2	225.2	225.7	226.2	5,923.1	8,172
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	220.9	224.8	226.0	224.1	223.0	228.1	225.2	225.2	225.7	226.2	5,923.1	8,172
Operating Costs													
Field and Plant Opex	($MM/yr)	75.6	76.1	76.3	76.1	75.8	76.8	76.3	76.3	76.5	76.6	2,353.9	3,117
G&A	($MM/yr)	35.8	35.9	36.0	35.9	35.9	36.0	36.0	36.0	36.0	36.0	1,227.8	1,587
Abandonmnet and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**111.4**	**112.1**	**112.3**	**112.1**	**111.8**	**112.8**	**112.3**	**112.3**	**112.6**	**112.6**	**3,615.0**	**4,737**
Operating Cash Income Before Tax	**($MM/yr)**	**109.4**	**112.8**	**113.6**	**112.1**	**111.2**	**115.3**	**112.9**	**113.0**	**113.2**	**113.7**	**2,308.1**	**3,435**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.8	4.8	4.8	5.2	5.0	165.2	212
Plant	**($MM/yr)**	16.8	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.0**	**21.4**	**21.4**	**21.8**	**21.6**	**21.8**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	88.4	91.4	92.3	90.3	89.7	93.7	91.2	91.2	91.0	91.7	1,532.2	**2,443**
Income Tax	**($MM/yr)**	22.0	22.7	22.9	22.6	22.4	23.2	22.7	22.8	22.8	22.9	452.4	**679**
Cash Flow After Tax	**($MM/yr)**	**66.4**	**68.7**	**69.4**	**67.8**	**67.3**	**70.5**	**68.4**	**68.4**	**68.2**	**68.8**	**1,113.2**	**1,797**

Table 19-13: Annual Cash Flow Summary – Proved + Probable Reserves – Spot Prices less 45%

SUMMARY OF BROMINE FIELD RESERVES, PRODUCTION AND CASHFLOW

COMPANY: Albemarle Corporation	**CASHFLOW FORECAST CASE:** Real 2024$	**FIELD:** Magnolia
OPERATOR: Albemarle Corporation	**PRICE FORECAST:** Spot -45%	**WORKING INTEREST:** 100.0%
	ANNUAL COST INFLATION: 0.0%	**RESERVES CLASS:** Proved + Probable (2P)
	EFFECTIVE DATE OF ANALYSIS: 12/31/2023	

RESERVES

		Total Field Gross	Total Field Net	Company Share Gross	Company Share Net
Bromine	(K Tonnes)	3,317	3,317	3,317	3,317

PRESENT VALUE - COMPANY SHARE (Million US$)

Discount Rate:	0%	5%	10%	15%	20%
Gross Revenue	6,421	2,888	1,738	1,231	955
Net Revenue	6,421	2,888	1,738	1,231	955
Operating Costs, G&A & Aband	4,737	1,966	1,138	793	611
OCBT	1,684	922	600	438	344
Capital Costs	992	398	225	155	118
Cash Flow Before Tax (CFBT)	692	524	375	283	225
Tax Payable	273	158	105	78	61
Cash Flow After Tax (CFAT)	452	369	270	206	164

PRODUCT PRICES (US$)

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Annual Average 2034+
Bromine	(US$/Kg)	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94	$1.94

FULL FIELD GROSS PRODUCTION

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Production Wells		21	22	22	24	23	23	24	24	26	25	-	-
Injection Wells		27	25	25	25	25	25	25	25	25	25	-	-
Annual Gross Production & Injection													
Brine Production	(MMbbl)	137.0	145.1	148.3	148.4	142.4	146.7	148.1	149.5	148.2	146.9	4,474	5,935
Brine Injection	(MMbbl)	149.4	155.4	155.6	155.5	152.7	152.7	154.0	155.6	154.9	154.4	4,818	6,359
Bromine Production	(k Tonne)	90	91	92	91	91	93	91	91	92	92	2,404	3,317
Recovery	(%)	98	98	98	98	98	98	98	98	98	98	98	98
Bromine Production (Sales)	(k Tonne)	88	90	90	89	89	91	90	90	90	90	2,355	3,249

COMPANY SHARE CASHFLOW

Year		2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034+	Total
Bromine Gross Sales Revenue	($MM)	173.5	176.7	177.5	176.1	175.2	179.2	176.9	177.0	177.3	177.8	4,653.9	6,421
Production Royalty	($MM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Sales Revenue	($MM)	173.5	176.7	177.5	176.1	175.2	179.2	176.9	177.0	177.3	177.8	4,653.9	6,421
Operating Costs													
Field and Plant Opex	($MM/yr)	75.6	76.1	76.3	76.1	75.8	76.8	76.3	76.3	76.5	76.6	2,353.9	3,117
G&A	($MM/yr)	35.8	35.9	36.0	35.9	35.9	36.0	36.0	36.0	36.0	36.0	1,227.8	1,587
Abandonmnet and Reclamation	($MM/yr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33
Total Opex, G&A, Abex	**($MM/yr)**	**111.4**	**112.1**	**112.3**	**112.1**	**111.8**	**112.8**	**112.3**	**112.3**	**112.5**	**112.6**	**3,615.0**	**4,737**
Operating Cash Income Before Tax	**($MM/yr)**	**62.1**	**64.6**	**65.2**	**64.1**	**63.5**	**66.4**	**64.7**	**64.7**	**64.8**	**65.2**	**1,038.9**	**1,684**
Capital Costs													
Field	**($MM/yr)**	4.2	4.4	4.4	4.8	4.6	4.6	4.8	4.8	5.2	5.0	165.2	212
Plant	**($MM/yr)**	16.6	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	610.7	780
Total Capital	**($MM/yr)**	**21.8**	**21.4**	**21.4**	**21.8**	**21.6**	**21.6**	**21.8**	**21.8**	**22.2**	**22.0**	**775.9**	**992**
Cash Flow Before Tax	**($MM/yr)**	41.1	43.2	43.9	42.3	41.9	44.8	42.9	42.9	42.7	43.2	263.0	**692**
Income Tax	**($MM/yr)**	11.0	11.5	11.7	11.4	11.3	11.9	11.6	11.6	11.6	11.7	158.0	**273**
Cash Flow After Tax	**($MM/yr)**	**30.1**	**31.7**	**32.2**	**30.9**	**30.6**	**32.9**	**31.4**	**31.4**	**31.1**	**31.6**	**138.4**	**452**

20 ADJACENT PROPERTIES

20.1 Brine Producing Properties

Immediately east of the Albemarle property, in the west-southwestern portion of Union County, Arkansas, is a brine production venture operated by Great Lakes Chemical Corporation (“GLCC”) out of El Dorado, Arkansas. GLCC produces brine from the Smackover Formation through wells with depths ranging from 7400 feet to 8700 feet. The characteristics of the Smackover Formation are similar to those found to the west in Columbia County. GLCC has been producing brine in Union County since at least 1963. It has a plant located in El Dorado and is the only active operator in Union County currently producing brine.

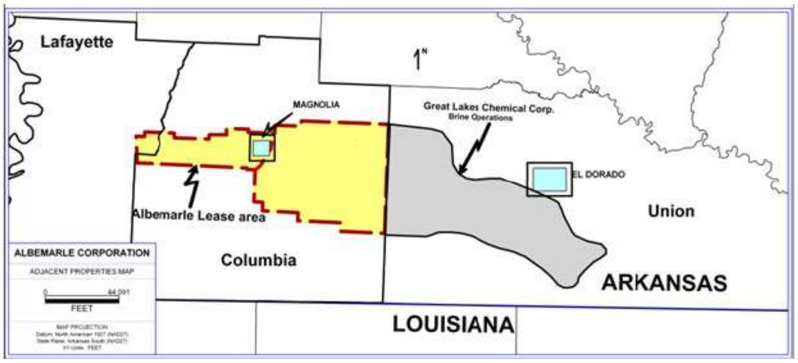

Figure 20-1: Adjacent Properties

20.2 Oil Producing Properties

There are both active and inactive oil fields within and adjacent to the Albemarle Magnolia Field property. The active oil fields within the outline of the property are Atlanta, Pine Tree, Village, Magnolia, Kerlin, and Columbia. All of these active fields, with the exception of the Pine Tree field produce reservoir fluids from horizons shallower than the Smackover Formation. Magnolia, Atlanta, and Pine Tree Fields all produce from the Smackover Formation with Magnolia being the most significant producing field within the confines of the Albermarle property. Two other oil fields in the area, the Big Creek and Kilgore Lodge Fields are inactive and have not produced in many years.

The active oil fields immediately adjacent to the Albemarle Property include McKamie-Patton, Grayson, Dorcheat-Macedonia, and Mt. Holly. These are all very mature fields that produce oil from the Smackover Formation. Dorcheat-Macedonia Field is the largest field outside the property outline with most of the current oil production coming from horizons above the Smackover. Oil production from Mt. Vernon Field ceased a few years ago and is currently inactive.

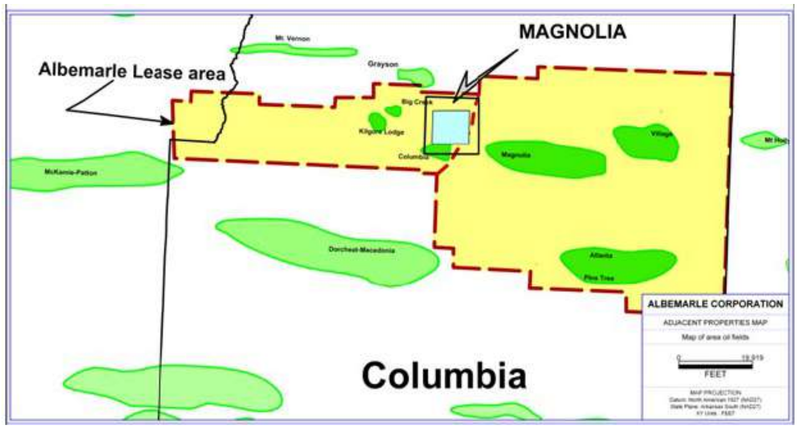

Figure 20-2: Adjacent Oil Fields

21 OTHER RELEVANT DATA AND INFORMATION

This section is intentionally left blank, as there is no additional relevant data and information to be included in this section.

22 INTERPRETATION AND CONCLUSIONS

- The Albemarle Magnolia Field bromide production and processing operations in Columbia County, Arkansas, USA represent an ongoing viable commercial source of bromine, both historically and for the future.
- The portion of the Magnolia field, under bromide production lease contracts to Albemarle contains an original bromide in place ("OBIP") resource of 13.6-15.0 million tonnes, of which Albemarle's working interest share is 10.2-11.2 million tonnes.
- Albemarle operates two bromide processing plants which extract the bromine from the raw bromide production, which results in an overall bromide sales production to bromide raw production ratio averaging about 92.8% over life.
- The Smackover formation can be vertically subdivided into the upper Smackover, EOD 0-5, historically known as the Reynolds Oolite, and the lower Smackover, EOD 7-9, sometimes split into middle and lower in the literature. The reserves estimated in this report have been confined to the upper Smackover due to technology limitations. Based on current understanding, there may be additional volumes in the lower Smackover, which will likely require advanced technologies to unlock.
- The cumulative bromine production forecast to the effective date of this report (December 31, 2023) has been 4.21 million tonnes (raw) and 3.95 million tonnes (bromine sales), which represents 38% of Albemarle's share of original bromide in place under leased areas.
- The Magnolia field is forecast to continue to produce bromide until 2069, with continued development of the proved and probable reserves.
- The forecast production of sales bromide is 2,706 thousand tonnes for the Proved reserves case, plus an additional 611 thousand tonnes of Probable reserves, for a total Proved plus Probable reserves of 3,317 thousand tonnes. The ultimate recovery at the end of this forecast represents a bromide recovery factor of 98% for both the 1P and 2P cases.
- To maintain field bromide productivity and fully exploit the future reserves, in addition to maintaining the current production and processing operations, Albemarle will require an estimated capital investment of US$1.0 to $1.4 billion to develop the Proved reserves, with no additional capital required to develop the Probable reserves. These estimates are in Constant 2024 dollars and are exclusive of abandonment and reclamation costs.

23 RECOMMENDATIONS

The qualified persons contributing to this evaluation report offer the following recommendations:

1. Continue to operate the Magnolia field and bromine extraction plants with due regard to all environmental, safety, and social responsibility standards followed to date
2. Continue to assess future field development opportunities on the leased bromine lands, including opportunities for outstep drilling to optimize overall bromine recovery efficiency.
3. Implement a full electronic land and lease database management system to replace the current manual paper-based land records systems.
4. Maintain and update the geological static models if/when additional drilling data becomes available and continue to monitor the Magnolia field brine production reservoir performance utilizing reservoir simulation modeling technology to optimize production performance of the reservoir.

24 RELIANCE ON INFORMATION PROVIDED BY THE REGISTRANT

This report is based on information from a variety of sources, including data available in the public domain, various technical and commercial reference materials, and also information provided by the registrant. The sections of this report for which rely upon information provide by the registrant to a significant degree are summarized in the following table:

All such information provided by the registrant has been reviewed for consistency and deemed to be reasonable and reliable by the qualified persons conducting this evaluation.

Table 24-1: Reliance on Information Provided by the Registrant

Category	Report Item/ Portion	Disclose why the Qualified Person considers it reasonable to rely upon the registrant
Property Description	Section 3	The registrant holds the information on lease ownership. The QP crossed checked this information with lease information in the public domain.
Sample Processing, Analysis, and Security	Section 8 and Section 10.2	The registrant has sampling procedures in place, the description of which was accepted by the QP.
Data Verification	Section 9	Well logs, core analysis, production and sampling data on the project are owned by the registrant and were relied upon by the QP, in concert with using like data available in the public domain.
Mineral Processing and Metallurgical Testing	Section 10	The processing and testing methods used for the Magnolia operations were obtained from the registrant, then reviewed and deemed reasonable by the QP.
Mining Methods	Section 13	The brine extraction and bromine processing system and operations data is all proprietary to the registrant. This data was obtained by the QP from the registrant and deemed to be reasonable and reliable information.
Processing and Recovery Methods	Section 14	The brine extraction and bromine processing system and operations data is all proprietary to the registrant. This data was obtained by the QP from the registrant and deemed to be reasonable and reliable information.
Marketing information	Section 16.1	Market overview information obtained from Technavio, a market research company with expertise in the field.
Major Producers	Section 16.2	Major producer information was sourced from USGS Mineral Commodity Summary for Bromine. The USGS is considered by the QP as a reliable source of such data. The USGS canvasses very thoroughly the world mineral markets and its commodity specialists gather first-hand information from both producers and consumers of minerals.
Major Markets	Section 16.3	Information on major markets was sourced from Market Research Future, a source considered as reliable by the QP, as well as of gather publicly available market indicators.
Bromine Applications	Section 16.5	Albemarle provided information on bromine applications which was reviewed by the QP and considered reasonable. The QP also reviewed the public domain in order to obtain general information on bromine applications.

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ALBEMARLE CORPORATION
INCENTIVE-BASED COMPENSATION RECOVERY POLICY

Section 1. *Purpose*. The purpose of this Albemarle Corporation (the "*Corporation*") Incentive-Based Compensation Recovery Policy (this "*Policy*") is to enable the Corporation to recover Erroneously Awarded Compensation if the Corporation is required to prepare an Accounting Restatement. This Policy is intended to comply with the requirements set forth in Listed Corporation Manual Section 303A.14 of the corporate governance rules of the New York Stock Exchange (the "*Listing Rule*") and shall be construed and interpreted in accordance with such intent. Unless otherwise defined in this Policy, capitalized terms shall have the meaning ascribed to such terms in Section 2. This Policy shall become effective on December 1, 2023. Where the context requires, reference to the Corporation shall include the Corporation's subsidiaries and affiliates (as determined by the Committee in its discretion).

Section 2. *Definitions*. For purposes of this Policy, the following terms shall have the following meaning:

"*Accounting Restatement*" means an accounting restatement due to the material noncompliance of the Corporation with any financial reporting requirement under the securities laws, including any required accounting restatement to correct an error in previously issued financial statements that is material to the previously issued financial statements, or that would result in a material misstatement if the error were corrected in the current period or left uncorrected in the current period.

"*Accounting Restatement Date*" means the earlier to occur of: (i) the date the Board, a committee of the Board, or the officer or officers of the Corporation authorized to take such action if the Board action is not required, concludes, or reasonably should have concluded, that the Corporation is required to prepare an Accounting Restatement; and (ii) the date a court, regulator, or other legally authorized body directs the Corporation to prepare an Accounting Restatement.

"*Board*" means the board of directors of the Corporation.

"*Code*" means the U.S. Internal Revenue Code of 1986, as amended. Any reference to a section of the Code or regulation thereunder includes such section or regulation, any valid regulation or other official guidance promulgated under such section, and any comparable provision of any future legislation or regulation amending, supplementing, or superseding such section or regulation.

"*Erroneously Awarded Compensation*" means, upon an Accounting Restatement, the amount of Incentive-Based Compensation previously received that exceeds the amount of Incentive-Based Compensation that otherwise would have been received had it been determined based on the restated amounts in such Accounting Restatement, and must be computed without regard to any taxes incurred or paid by the relevant Executive Officer; provided, however, that for Incentive-Based Compensation based on stock price or total stockholder return, where the amount of Erroneously Awarded Compensation is not subject to mathematical recalculation directly from the information in an Accounting Restatement: (i) the amount of Erroneously Awarded Compensation must be based on a reasonable estimate of the effect of the Accounting Restatement on the stock price or total stockholder return upon which the Incentive-Based Compensation was received; and (ii) the Corporation must maintain documentation of the determination of that reasonable estimate and provide such documentation to the Stock Exchange.

"*Executive Officer*" means the Corporation's president, principal financial officer, principal accounting officer (or if there is no such accounting officer, the controller), any vice-president of the Corporation in charge of a principal business unit, division, or function (such as sales, administration, or finance), any other officer who performs a policy-making function, or any other person who performs similar policy-making functions for the Corporation, including any person identified as an executive officer pursuant to Item 401(b) of Regulation S-K under the U.S. Securities Act of 1933, as amended. An executive officer of the Corporation's parent or subsidiary is deemed an "Executive Officer" if the executive officer performs such policy making functions for the Corporation.

"*Financial Reporting Measure*" means any measure that is determined and presented in accordance with the accounting principles used in preparing the Corporation's financial statements, and any measure that is derived wholly or in part from such measure; provided, however, that a Financial Reporting Measure is not required to be presented within the Corporation's financial statements or included in a filing with the U.S. Securities and Exchange Commission to qualify as a "Financial Reporting Measure." For purposes of this Policy, "Financial Reporting Measure" includes, but is not limited to, stock price and total stockholder return.

"*Incentive-Based Compensation*" means any compensation that is granted, earned, or vested based wholly or in part upon the attainment of a Financial Reporting Measure.

"*Stock Exchange*" means the national stock exchange on which the Corporation's common stock is listed.

Section 3. *Application*. This Policy applies to all Incentive-Based Compensation received by a person: (a) on or after October 2, 2023, and beginning service as an Executive Officer; (b) who served as an Executive Officer at any time during the performance period for such Incentive-Based Compensation; (c) while the Corporation had a class of securities listed on a national securities exchange or a national securities association; and (d) during the three completed fiscal years immediately preceding the Accounting Restatement Date. In addition to such last three completed fiscal years, the immediately preceding clause (d) includes any transition period that results from a change in the Corporation's fiscal year within or immediately following such three completed fiscal years; provided, however, that a transition period between the last day of the Corporation's previous fiscal year end and the first day of its new fiscal year that comprises a period of nine to twelve months shall be deemed a completed fiscal year. For purposes of this Section 3, Incentive-Based Compensation is deemed received in the Corporation's fiscal period during which the Financial Reporting Measure specified in the Incentive-Based Compensation award is attained, even if the payment or grant of the Incentive-Based Compensation occurs after the end of that period. Incentive-Based Compensation that is subject to both a Financial Reporting Measure vesting condition and a service-based vesting condition shall be considered received when the relevant Financial Reporting Measure is achieved, even if the Incentive-Based Compensation continues to be subject to the service-based vesting condition.

Section 4. *Recovery Requirement*. Upon an Accounting Restatement, the Corporation must recover, reasonably promptly, Erroneously Awarded Compensation, in amounts determined pursuant to this Policy. The Corporation's obligation to recover Erroneously Awarded Compensation is not dependent on if or when the Corporation files restated financial statements. Recovery under this Policy with respect to an Executive Officer shall not require the finding of any misconduct by such Executive Officer or such Executive Officer being found responsible for the accounting error leading to an Accounting Restatement. Upon an Accounting Restatement, the Corporation shall satisfy the Corporation's obligations under this Policy to recover any amount owed from any applicable Executive Officer by exercising its sole and absolute discretion in how to accomplish such recovery. The Corporation's recovery obligation pursuant to this Section 4 shall not apply to the extent that the Committee, or in the absence of the Committee, a majority of the independent directors serving on the Board, determines that such recovery would be impracticable and:

(a) The direct expense paid to a third party to assist in enforcing this Policy would exceed the amount to be recovered. Before concluding that it would be impracticable to recover any amount of Erroneously Awarded Compensation based on expense of enforcement, the Corporation must make a reasonable attempt to recover such Erroneously Awarded Compensation, document such reasonable attempt(s) to recover, and provide that documentation to the Stock Exchange; or

(b) Recovery would likely cause an otherwise tax-qualified retirement plan, under which benefits are broadly available to employees of the registrant, to fail to meet the requirements of Section 401(a)(13) or Section 411(a) of the Code.

Section 5. *Administration*. This Policy shall be administered by the Compensation Committee of the Board (the "*Committee*") unless the Board determines to administer this Policy itself. The Committee has full and final authority to make all determinations under this Policy. All determinations and decisions made by the Committee pursuant to the provisions of this Policy shall be final, conclusive and binding on all persons, including the Corporation, its affiliates, its stockholders and Executive Officers. Any action or inaction by the Committee with respect to an Executive Officer under this Policy in no way limits the Committee's actions or decisions not to act with respect to any other Executive Officer under this Policy or under any similar policy, agreement or arrangement, nor shall any such action or inaction serve as a waiver of any rights the Corporation may have against any Executive Officer other than as set forth in this Policy.

Section 6. *Prohibition on Indemnification and Insurance Reimbursement*. The Corporation is prohibited from indemnifying any Executive Officer or former Executive Officer against the loss of Erroneously Awarded Compensation. Further, the Corporation is prohibited from paying or reimbursing an Executive Officer for purchasing insurance to cover any such loss.

Section 7. *Required Policy-Related Filings*. The Corporation shall file all disclosures with respect to this Policy in accordance with the requirements of the Federal securities laws, including disclosures required by U.S. Securities and Exchange Commission filings.

Section 8. *Acknowledgement*. Each Executive Officer shall sign and return to the Corporation, within 30 calendar days following the later of (i) the effective date of this Policy first set forth above or (ii) the date the individual becomes an Executive Officer, the Acknowledgement Form attached hereto as Exhibit A, pursuant to which the Executive Officer agrees to be bound by, and to comply with, the terms and conditions of this Policy.

Section 9. *Committee Indemnification*. Any members of the Committee, and any other members of the Board who assist in the administration of this Policy, shall not be personally liable for any action, determination or interpretation made with respect to this Policy and shall be fully indemnified by the Corporation to the fullest extent under applicable law and Corporation policy with respect to any such action, determination or interpretation. The foregoing sentence shall not limit any other rights to indemnification of the members of the Board under applicable law or Corporation policy.

Section 10. *Severability*. The provisions in this Policy are intended to be applied to the fullest extent of the law. To the extent that any provision of this Policy is found to be unenforceable or invalid under any applicable law, such provision shall be applied to the maximum extent permitted, and shall automatically be deemed amended in a manner consistent with its objectives to the extent necessary to conform to any limitations required under applicable law.

Section 11. *Amendment; Termination*. The Board may amend this Policy from time to time in its sole and absolute discretion and shall amend this Policy as it deems necessary to reflect the Listing Rule. The Board may terminate this Policy at any time.

Section 12. *Other Recovery Obligations; General Rights*. To the extent that the application of this Policy would provide for recovery of Incentive-Based Compensation that the Corporation recovers pursuant to Section 304 of the Sarbanes-Oxley Act or other recovery obligations, the amount the relevant Executive Officer has already reimbursed the Corporation will be credited to the required recovery under this Policy. This Policy shall not limit the rights of the Corporation to take any other actions or pursue other remedies that the Corporation may deem appropriate under the circumstances and under applicable law. To the maximum extent permitted under the Listing Rule, this Policy shall be administered in compliance with (or pursuant to an exemption from the application of) Section 409A of the Code.

Section 13. *Successors*. This Policy is binding and enforceable against all Executive Officers and their beneficiaries, heirs, executors, administrators or other legal representatives.

Section 14. *Governing Law; Venue*. This Policy and all rights and obligations hereunder are governed by and construed in accordance with the internal laws of the State of Delaware, excluding any choice of law rules or principles that may direct the application of the laws of another jurisdiction. All actions arising out of or relating to this Policy shall be heard and determined exclusively in the Court of Chancery of the State of Delaware or, if such court declines to exercise jurisdiction or if subject matter jurisdiction over the matter that is the subject of any such legal action or proceeding is vested exclusively in the U.S. Federal courts, the U.S. District Court for the District of Delaware.

EXHIBIT A

ALBEMARLE CORPORATION
INCENTIVE-BASED COMPENSATION RECOVERY POLICY

ACKNOWLEDGEMENT FORM

By signing below, the undersigned acknowledges and confirms that the undersigned has received and reviewed a copy of the Albemarle Corporation (the "*Corporation*") Incentive-Based Compensation Recovery Policy (the "*Policy*").

By signing this Acknowledgement Form, the undersigned acknowledges and agrees that the undersigned is and will continue to be subject to the Policy and that the Policy will apply both during and after the undersigned's employment with the Corporation. Further, by signing below, the undersigned agrees to abide by the terms of the Policy, including, without limitation, by returning any Erroneously Awarded Compensation (as defined in the Policy) to the Corporation to the extent required by, and in a manner consistent with, the Policy. Further, by signing below, the undersigned agrees that the terms of the Policy shall govern upon any inconsistency between the Policy and the terms of any employment agreement to which the undersigned is a party, or the terms of any compensation plan, program or agreement under which any compensation has been granted, awarded, earned or paid.

EXECUTIVE OFFICER

____
Signature

____
Print Name

____
Date