TECHNICAL REPORT SUMMARY
SILICA SAND RESOURCES AND RESERVES
OTTAWA OPERATION

LaSalle County, Illinois

Prepared For

U.S. SILICA COMPANY

Katy, Texas

By

John T. Boyd Company

Mining and Geological Consultants

Pittsburgh, Pennsylvania

Report No. 3076.019

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Attention: Mr. Terry Lackey
Mining Director

Subject: Technical Report Summary
Silica Sand Resources and Reserves
Ottawa Operation
LaSalle County, Illinois

Ladies and Gentlemen:

The John T. Boyd Company (BOYD) was retained by U.S. Silica Company (U.S. Silica) to complete an independent technical assessment of the silica sand resource and reserve estimates for the Ottawa Operation as of December 31, 2022.

This technical report summary: (1) summarizes material technical and geoscientific information for the subject mining property, (2) provides the conclusions of our technical assessment, and (3) provides a statement of silica sand resources and reserves for the Ottawa Operation.

Respectfully submitted,

JOHN T. BOYD COMPANY
By:

John T. Boyd II
President and CEO

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LETTER OF TRANSMITTAL

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GLOSSARY OF ABBREVIATIONS AND DEFINITIONS

000	:	Thousand(s)
$	:	US dollar(s)
%	:	Percent or percentage
AMSL	:	Above mean sea level
API	:	American Petroleum Institute
ARO	:	Asset Retirement Obligations
ASP	:	Average Selling Price
ASTM	:	ASTM International (formerly American Society for Testing and Materials)
BNSF	:	BNSF Railway Company
BOYD	:	John T. Boyd Company
CapEx	:	Capital expenditures
Constant Dollar	:	A monetary measure that is not influenced by inflation and used to compare time periods. Sometimes referred to as “real dollars”.
CSX	:	CSX Transportation
DCF	:	Discounted Cash Flow
Discount Rate	:	A rate of return used to discount future cash flows based on the return investors expect to receive from their investment.
EBIT	:	Earnings before interest and taxes
EBITDA	:	Earnings before interest, taxes, depreciation, and amortization
Frac Sand	:	*See “Proppant Sand”*
ft	:	Foot/feet
HDPE	:	High-density polyethylene
IDNR	:	Illinois Department of Natural Resources

Indicated Silica Sand Resource	:	That part of a silica sand resource for which quantity and quality are estimated based on adequate geological evidence and sampling. The level of geological certainty associated with an indicated silica sand 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. Because an indicated silica sand resource has a lower level of confidence than the level of confidence of a measured silica sand resource, an indicated silica sand resource may only be converted to a probable silica sand reserve.
IEMA	:	Illinois Emergency Management Agency
ILEPA	:	Illinois Environmental Protection Agency
Inferred Silica Sand Resource	:	That part of a silica sand resource for which quantity and quality are estimated based on limited geological evidence and sampling. The level of geological uncertainty associated with an inferred silica sand 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. Because an inferred silica sand resource has the lowest level of geological confidence of all silica sand resources, which prevents the application of the modifying factors in a manner useful for evaluation of economic viability, an inferred silica sand resource may not be considered when assessing the economic viability of a mining project, and may not be converted to a silica sand reserve.
IRR	:	Internal rate-of-return
ISO		International Organization for Standardization
ISP	:	Industrial and Specialty Products
lb	:	Pound
LOM	:	Life-of-Mine
Measured Silica Sand Resource	:	That part of a silica sand resource for which quantity and quality are estimated based on conclusive geological evidence and sampling. The level of geological certainty associated with a measured silica sand resource is sufficient to allow a qualified person to apply modifying factors, as defined herein, in sufficient detail to support detailed mine planning and final evaluation of the economic viability of the deposit. Because a measured silica sand resource has a higher level of confidence than the level of confidence of either an indicated silica sand resource or an inferred silica sand resource, a measured silica sand resource may be converted to a proven silica sand reserve or to a probable silica sand reserve
Mesh	:	A measurement of particle size often used in determining the size distribution of granular material.
Mineral Reserve	:	*See “Silica Sand Reserve”*

Mineral Resource	:	*See "Silica Sand Resource"*
Modifying Factors		The factors that a qualified person must apply to indicated and measured silica sand resources and then evaluate to establish the economic viability of silica sand reserves. A qualified person must apply and evaluate modifying factors to convert measured and indicated silica sand resources to proven and probable silica sand reserves. These factors include but are not restricted to: mining; processing; infrastructure; economic; marketing; legal; environmental compliance; plans, negotiations, or agreements with local individuals or groups; and governmental factors. The number, type and specific characteristics of the modifying factors applied will necessarily be a function of and depend upon the mineral, mine, property, or project.
MSHA	:	Mine Safety and Health Administration. A division of the U.S. Department of Labor
NPV	:	Net Present Value
O&G	:	Oil and Gas
Probable Silica Sand Reserve	:	The economically mineable part of an indicated and, in some cases, a measured silica sand resource.
Production Stage Property	:	A property with material extraction of silica sand reserves.
Proppant Sand	:	Proppant (frac) sand is a naturally occurring, high silica content quartz sand, with grains that are generally well rounded and exhibit high compressive strength characteristics relative to other proppant sand. It is utilized as a prop or "proppant" in unconventional shale frac well completions.
Proven Silica Sand Reserve	:	The economically mineable part of a measured silica sand resource which can only result from conversion of a measured silica sand resource.
PSI	:	Pounds per square inch
QP	:	Qualified Person

Qualified Person : An individual who is:

1. A mineral industry professional with at least five years of relevant experience in the type of mineralization and type of deposit under consideration and in the specific type of activity that person is undertaking on behalf of the registrant; and

2. An eligible member or licensee in good standing of a recognized professional organization at the time the technical report is prepared. For an organization to be a recognized professional organization, it must:

    a. Be either:
        i. An organization recognized within the mining industry as a reputable professional association; or
        ii. A board authorized by U.S. federal, state, or foreign statute to regulate professionals in the mining, geoscience, or related field;
    b. Admit eligible members primarily based on their academic qualifications and experience;
    c. Establish and require compliance with professional standards of competence and ethics;
    d. Require or encourage continuing professional development;
    e. Have and apply disciplinary powers, including the power to suspend or expel a member regardless of where the member practices or resides; and
    f. Provide a public list of members in good standing.

ROM : Run-of-Mine. The processing feed material, including silica sand and any inseparable waste, excavated from the mine.

SEC : U.S. Securities and Exchange Commission

Silica Sand Reserve : Silica sand reserve is an estimate of tonnage and grade or quality of indicated and measured silica sand 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 silica sand resource, which includes diluting materials and allowances for losses that may occur when the material is mined or extracted.

Silica Sand Resources	:	Silica sand resource is 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. A silica sand resource is a reasonable estimate of mineralization, taking into account relevant factors such as cut-off grade, likely mining dimensions, location or continuity, that, with the assumed and justifiable technical and economic conditions, is likely to, in whole or in part, become economically extractable. It is not merely an inventory of all mineralization drilled or sampled.
S-K 1300	:	Subpart 1300 and Item 601(b)(96) of the U.S. Securities and Exchange Commission's Regulation S-K
SPCC	:	Spill Prevention, Controls and Countermeasure
Ton	:	Short Ton. A unit of weight equal to 2,000 pounds
U.S. Silica	:	U.S. Silica Company, its parent company (U.S. Silica Holdings, Inc.) and its consolidated subsidiaries as a combined entity.

1.0 EXECUTIVE SUMMARY

1.1 Introduction

U.S. Silica's Ottawa Operation is an active surface silica sand mining and processing operation that has been in existence for over 100 years.

BOYD prepared this technical report summary for U.S. Silica in support of their disclosure of silica sand reserves for the Ottawa Operation in accordance with Subpart 1300 and Item 601(b)(96) of the SEC's Regulation S-K (S-K 1300). The purpose of this report is threefold: (1) to summarize material technical and geoscientific information for the subject mining property, (2) to provide the conclusions of our technical assessment, and (3) to provide a statement of silica sand resources and/or reserves for the Ottawa Operation.

Information used in our assessment was obtained from: (1) files provided by U.S. Silica, (2) discussions with U.S. Silica personnel, (3) records on file with regulatory agencies, (4) public sources, and (5) nonconfidential information in BOYD's possession.

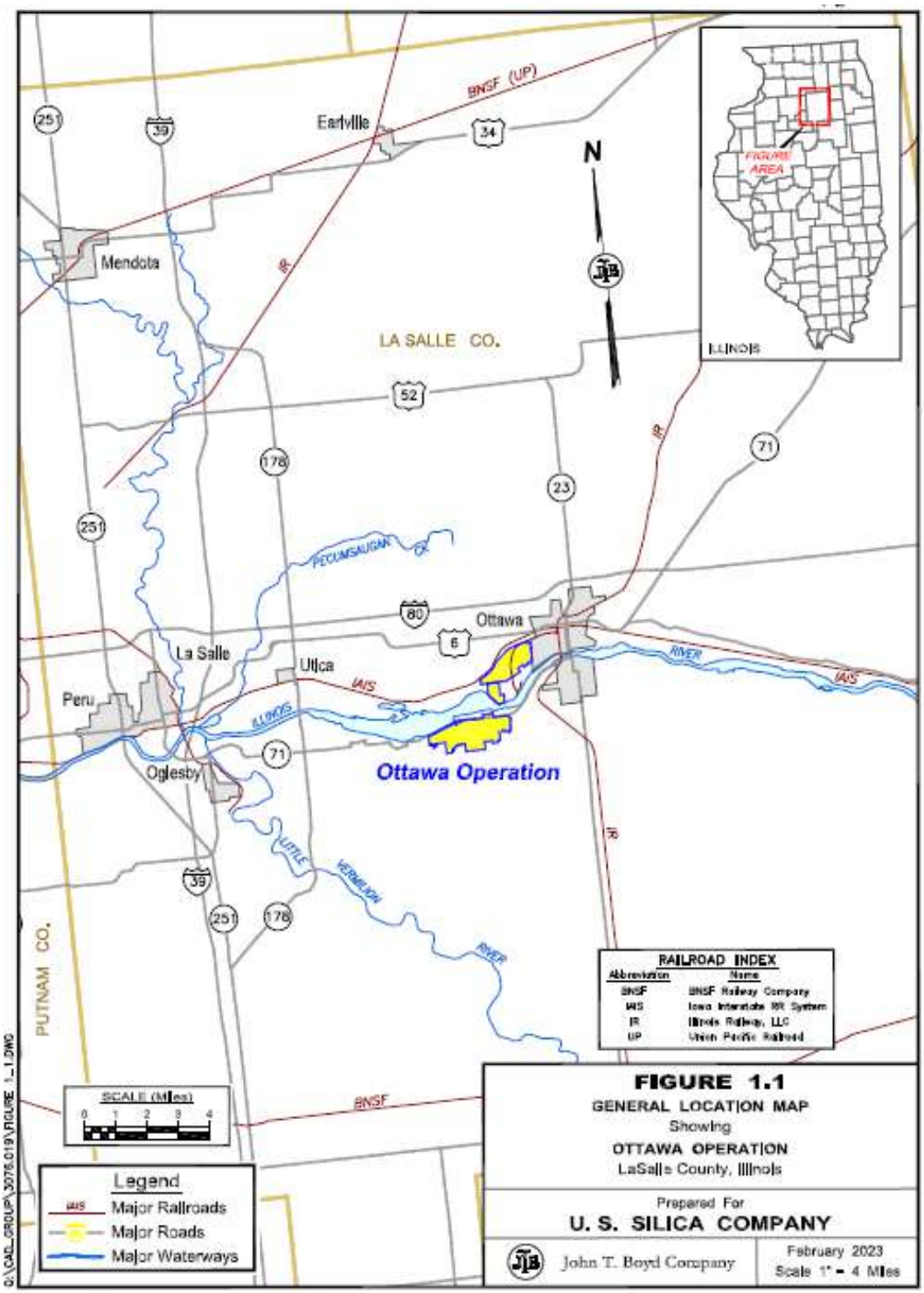
Unless otherwise noted, the effective date of the information, including estimates of silica sand reserves, is December 31, 2022.

Weights and measurements are expressed in the US customary measurement system throughout this report.

1.2 Property Description

U.S. Silica's Ottawa Operation is a surface silica sand mining and processing operation located immediately west of the City of Ottawa in LaSalle County, Illinois. The cities of Chicago and Peoria, Illinois, are located approximately 95 miles east-northeast and 75 miles southwest, respectively, of the Ottawa Operation. The general location of the Ottawa Operation is provided in Figure 1.1, following this page.

The property is bisected by the Illinois River into the North Ottawa and South Ottawa sites. The mine offices, maintenance facilities, processing plant, loadout facilities, and former mining pits are located on the North Ottawa site, while the active (South Ottawa Pit) and future mining areas (West Ottawa and Mississippi Sand Pit) are located on the South Ottawa site. A slurry line driven under the Illinois River connects the two sites, and


BNSF (UP)
Earlville
34
39
251
Mendota
IR
LA SALLE CO.
52
178
23
71
PECUMSAUGAN CK
80
Ottawa
6
La Salle
Utica
IAIS
RIVER
Peru
ILLINOIS
Oglesby
Ottawa Operation
LITTLE VERMILION RIVER
PUTNAM CO.
BNSF
N
ILLINOIS
FIGURE AREA
RAILROAD INDEX
Abbreviation | Name
BNSF | BNSF Railway Company
IAIS | Iowa Interstate RR System
IR | Illinois Railway, LLC
UP | Union Pacific Railroad
SCALE (Miles)
0 1 2 3 4
Legend
Major Railroads
Major Roads
Major Waterways
FIGURE 1.1
GENERAL LOCATION MAP
Showing
OTTAWA OPERATION
LaSalle County, Illinois
Prepared For
U. S. SILICA COMPANY
John T. Boyd Company
February 2023
Scale 1" = 4 Miles
O:\CAD_GROUP\3076.019\FIGURE 1_1.DWG

is used to transport Run-of-Mine (ROM) sand material from South Ottawa to the processing plant.

The Ottawa Operation has mined silica sand exclusively from the St. Peter Sandstone Formation for over 100 years. Within the boundaries of the Ottawa Operation, U.S. Silica wholly owns both surface and mineral rights on all ±2,072 acres. BOYD is not aware of any encumbrances, litigation, or orders which would hinder continued development of the property.

1.3 Geology

The Ottawa Operation's target silica bearing formation is the St. Peter Sandstone, which is a massive formation in areal extent and thickness. Aerially, it extends from Minnesota to Arkansas and from Illinois into Nebraska and South Dakota. On a regional basis, the St. Peter Sandstone ranges in thickness from a few feet to over 1,200 ft, with a general thickness of 100 ft to 200 ft. In northern Illinois, the thickness can be over 300 ft thick.

At the Ottawa Operation, the St. Peter Sandstone is flat lying with no evidence of faulting, and has been eroded to an average thickness of approximately 90 ft. The formation is a white to buff colored, fine- to medium-grained ortho-quartzite. It contains rounded, clear polished sand quartz grains with minor secondary silica and clay cement.

Grain size distribution and iron-staining drives the mine planning. Iron tends to be concentrated near the surface and is visible in orange staining. Iron also increases at the bottom sandstone contact, occurring mostly as pyrite. The deposit is coarser in its top half. Where the upper part of the formation is eroded, multiple mining faces must operate to ensure adequate sand is available to meet product specifications.

In the defined resource areas, the St. Peter Sandstone is overlain by a thin layer of overburden material consisting of clay, sandy gravel, peat, and limestone cap rock.

1.4 Exploration

The St. Peter Sandstone has been extensively explored and mined on the Ottawa Operation. The North Ottawa site was mined out by 2010, and exploration on the South Ottawa site began in the year 2000. U.S. Silica provided data for 225 drill holes, wells, field measurements, and test holes in and around the South Ottawa site. These data were utilized to define the lateral extent, thickness, particle size distribution, and mineralogy of the remaining St. Peter Sandstone reserves at the Ottawa Operation.

BOYD's audit indicates that in general: (1) U.S. Silica has performed extensive drilling and sampling work on the subject property, (2) the work completed has been done by competent personnel, and (3) the amount of data available combined with extensive knowledge and historic production of the St. Peter Sandstone, are sufficient to confirm the thickness, lateral extents, and quality characteristics of the South Ottawa silica sand reserves.

1.5 Silica Sand Resources and Reserves

As shown in Table 1.1, below, U.S. Silica owns approximately 88,000 in place tons of inferred silica sand resources, exclusive of silica sand reserves, at the Ottawa Operation, as of December 31, 2022.

Table 1.1: Ottawa Operation Silica Sand Resources[1]
(as of December 31, 2022)

Classification	In-Place Tons (000)
Inferred	88

Notes:
1. Silica sand resources are reported *in addition to* silica sand reserves.

While these "additional" silica sand resources have not been included in the Ottawa Operation's life-of-mine (LOM) plan, they are considered to have prospects for eventual economic extraction by virtue of their similarity—in terms of demonstrated extraction methods and expected finished product qualities—to those converted to silica sand reserves.

U.S. Silica's estimated surface mineable silica sand reserves for the Ottawa Operation total 78.9 million saleable product tons remaining as of December 31, 2022. The silica sand reserves are fully owned by U.S. Silica and are summarized in Table 1.2, below.

Table 1.2: Ottawa Operation Silica Sand Reserves (as of December 31, 2022)

	Tons (000)	
Classification	Mineable	Saleable
Proven	89,742	77,627
Probable	1,486	1,286
Total	91,228	78,913

The Ottawa Operation has a well-established history of mining, processing, and selling silica sand products into various markets. BOYD has concluded that sufficient studies have been undertaken to enable the silica sand resources to be converted to silica sand reserves based on proposed operating methods and forecasted costs and revenues.

1.6 Operations

1.6.1 Mining

Current mining at the Ottawa Operation takes place on the South Ottawa site, where the St. Peter Sandstone is excavated using conventional surface mining methods. The thin overlying layer of unconsolidated overburden is scraped off and stockpiled in order to expose the St. Peter Sandstone Formation. The mineable sandstone interval is then drilled and blasted in benches ranging from 40 to 75 ft high. An excavator or front-end loader is then used to load the shot and blasted sandstone into articulated haul trucks. The haul trucks deliver raw sand material to a monitor station, where the material is further broken down via high-pressure water jets, that also create a sand slurry. The sand slurry is then pumped through lines that run under the Illinois River to the processing facilities which are located on the North Ottawa site, where processing of the ROM silica sand begins.

Over the past seven years, the operation has mined over 24 million tons of raw sand. During late 2019 and 2020, production fell to match decreased customer demand due to the COVID-19 pandemic from approximately 4 million tons per year to under 2.5 million tons. U.S. Silica's Life-of-Mine (LOM) plan forecasts mining 91.2 million tons of ROM silica sand at a nominal rate of 3.8 million tons per year for the remaining life of the operation.

BOYD reviewed the LOM plans for U.S. Silica's Ottawa Operation to determine whether the plans: (1) utilize generally accepted engineering practices, and (2) align with historical and industry norms. Based on our assessment, it is BOYD's opinion that the forecasted production levels for the Ottawa Operation are reasonable, logical, and consistent with typical sandstone surface mining practices in the St. Peter Sandstone and historical results achieved by U.S. Silica.

1.6.2 Processing

The Ottawa Operation's wet and dry processing plants, along with grinding mills, are located on the north shore of the Illinois River, on the Ottawa North site. The processing facilities also include an ASTM circuit, which is used to produce ASTM 20/30 and ASTM C109 compliant sand for cement and abrasion testing. The Ottawa Operation is the world's only supplier of fully ASTM-compliant sands.

Pumped ROM slurry material from the South Ottawa site arrives at the processing plant, where it is washed to remove fine waste (clay and silt) material, sorted and sized, then dried. At this point, the silica sand is divided into two streams depending on finished product requirements—whole grain sand is sorted and sized again prior to packaging, while ground silica products are milled to produce fine silica powders.

Over its history, the processing plant has been upgraded and expanded several times as needed to meet specific market demands. The plants currently run 24 hours a day, 365 days a year, with a nominal capacity of 3.29 million tons of finished sand per year. Based on our review, it is BOYD's opinion that the processing methods and existing equipment at the plant will be sufficient for the forecasted production levels over the life of the operation.

1.6.3 Other Infrastructure

The Ottawa Operation is supported by various utilities and transportation networks needed to allow processing and transportation of finished silica sands.

Electricity to the North Ottawa site is delivered through an above-ground network that terminates at a substation on the west end of the processing facility, and from there electricity is distributed via several underground and above-ground powerlines.

Initial makeup water is obtained through a series of wells drilled on the South Ottawa site, and recovered and recycled for reuse whenever possible. Potable water is delivered through the City of Ottawa's public water system.

Natural gas is supplied via several underground pipelines.

Tailings from processing consist generally of clays, silts, and very fine sands, which are typically disposed of in old mining pit impoundments. The tailings ponds are currently located east of the processing plant, and are designed to accommodate rejects produced during the next five to ten years of production. At that time, it is expected that mining in the South Ottawa site will have advanced to the West Ottawa Pit, and the mined out South Ottawa Pit will be used for tailings.

Infrastructure to transport finished sand product include three different systems currently in-place at the Ottawa Operation: (1) the Illinois Railway, a former BNSF short line, transports rail cars to and from a CSX interchange located in the City of Ottawa; access from there is then available to several Class 1 railroads – BNSF, Union Pacific, and Norfolk Southern; (2) numerous local, county, and state roadways and highways that are within four miles of the processing facilities; and (3) U.S. Silica also maintains access to several third-party owned barge terminals, which are located on the north shore of the Illinois River, and are all situated on land owned by U.S. Silica.

1.7 Financial Analysis

1.7.1 Market Analysis

The Ottawa Operation is U.S. Silica's largest "blended" operation, supplying various grades of silica sand to both the Oil and Gas (O&G) and the Industrial and Specialty Products (ISP) markets. Their finished silica sand products are used in variety of industrial applications by a large customer base.

U.S. Silica's product sales were materially impacted by the COVID-19 pandemic, with sales dropping precipitously in 2019 due to decreased customer demand. However, their sales volumes and revenues have recovered substantially, and continued growth is expected over the long-term.

1.7.2 Capital and Operating Cost Estimates

The Ottawa Operation's financial performance over the last years is summarized as follows:

- Average realization (selling price) for finished silica sand products increased from $36.91 per ton sold in 2020 to $42.37 per ton sold in 2022.
- Total cash cost of sales also increased from $29.48 per ton sold in 2020 to $32.85 per ton sold in 2022.

- EBITDA margin increased slightly from 20.1% in 2020 to 22.5% in 2022.
- Capital expenditures totaled almost $9.5 million over the last three years, averaging $1.27 per ton sold.

Forward-looking production and unit cost estimates are based on actual past performance and subject to U.S. Silica's customary internal budget review and approvals process. In BOYD's opinion, operating volumes are well-defined and understood, as are mining and processing productivities.

The Ottawa Operation and related facilities are fully developed and should require no near-term major capital investment to maintain full commercial production. Historically, the timing and amount of capital expenditures has been largely discretionary and within U.S. Silica's control. Their budgetary allocations for sustaining and discretionary capital expenditures over the next three years totals $8.3 million. Thereafter, capital expenditures are expected to rise 3% year-over-year from 2025's $2.2 million. BOYD considers the near-term detailed capital expenditure schedule as presented by U.S. Silica to be reasonable and representative of the capital necessary to operate the Ottawa Operation.

Operating cost estimates were developed based on recent actual costs and considering specific operational activity levels and cost drivers. In the near-term, U.S. Silica expects their unit operating costs to stay relatively level (on an uninflated basis). As such, the projected total cash cost of sales over the life of the mine is $32.85 per ton sold. As the operation is in a steady state, BOYD considers the future operating cost estimates to be reasonable and appropriate.

1.7.3 Economic Analysis

An economic analysis of the Ottawa Operation was prepared in-house by U.S. Silica as part of their annual budgeting process. The financial model forecasts future free cash flow from silica sand production and sales over the life cycle of the Ottawa Operation using the annual forecasts of production, sales revenues, and operating and capital costs.

Table 1.3, below, provides a summary of the estimated financial results for remaining life of the Ottawa Operation.

Table 1.3: Financial Results

	Units	Remaining Life of Min Total
Remaining Life	years	25
Production:		
ROM Production	000 tons	91,228
Product Sales	000 tons	78,913
Total Revenues	$ millions	3,343.5
Total Cash Costs of Sales	$ millions	2,592.3
Capital Expenditures	$ millions	78.0
Pre-Tax:		
Cash Flow	$ millions	672.3
$NPV_{12.5}$	$ millions	221.3
After-tax:		
Cash Flow	$ millions	499.2
$NPV_{12.5}$	$ millions	164.9

Table 1.4 summarizes the results of the pre-tax and after-tax discounted cash flows (DCF) and net present value (NPV) analyses for the Ottawa Operation.

Table 1.4: DCF-NPV Analysis

	NPV ($ millions)		
	10%	12.5%	15%
Pre-Tax	262.0	221.3	190.7
After-Tax	195.0	164.9	142.1

The NPV estimate was made for purposes of confirming the economic viability of the reported silica sand reserves and not for purposes of valuing the U.S. Silica, Ottawa Operation, or its assets. Internal rate-of-return (IRR) and project payback were not calculated, as there was no initial investment considered in the financial analysis.

BOYD reviewed the financial model and its inputs in detail, and opined that the model provides a reasonable and accurate reflection of the Ottawa Operation's expected economic performance based on the assumptions and information available at the time of our review.

1.8 Permitting Requirements

Numerous permits are required by federal and state law for mining, processing, and related activities at the Ottawa Operation, which U.S. Silica reports are in place or pending approval. New permits or permit revisions may be necessary from time to time to facilitate future operations. Given sufficient time and planning, U.S. Silica should be able to secure new permits, as required, to maintain its planned operations within the context of current regulations.

U.S. Silica reports having an extensive environmental management and compliance process designed to follow or to exceed industry standards.

Mine safety is regulated by the U.S. Department of Labor's Mine Safety and Health Administration (MSHA). MSHA inspects the facilities a minimum of twice yearly. U.S. Silica's safety record compares favorably with its regional peers.

BOYD is not aware of any regulatory violation or compliance issue which would materially impact the silica sand reserve estimate.

1.9 Conclusions

It is BOYD's overall conclusion that U.S. Silica's estimates of silica sand reserves, as reported herein: (1) were prepared in conformance with accepted industry standards and practices, and (2) are reasonably and appropriately supported by technical evaluations, which consider all relevant modifying factors.

Given the lengthy operating history and status of evolution, residual uncertainty (future risk) for this operation is considered minor under the current and foreseeable operating environment.

It is BOYD's opinion that extraction of the silica sands reported herein is technically, legally, and economically achievable after the consideration of potentially material modifying factors. The ability of U.S. Silica, or any mine operator, to recover all of the reported silica sand reserves is dependent on numerous factors that are beyond the control of, and cannot be anticipated by, BOYD. These factors include mining and geologic conditions, the capabilities of management and employees, the securing of required approvals and permits in a timely manner, future silica sand prices, etc. Unforeseen changes in regulations could also impact performance.

2.0 INTRODUCTION

2.1 Registrant

U.S. Silica is a US-based mining company headquartered in Katy, Texas. The company's common stock is listed on the New York Stock Exchange (NYSE:SLCA). U.S. Silica is actively engaged in the production and marketing of commercial silica sand and performance materials (diatomaceous earth, calcium bentonite clay, calcium montmorillonite clay, and perlite products). Their whole grain silica products are used as frac (proppant) sand for oil and natural gas recovery, and in the manufacture of glass, foundry, and building products. U.S. Silica's performance materials are used in: (1) filtration for foods and beverages, pharmaceuticals, and swimming pools; (2) as additives in paint and coatings, plastics and rubber, and agriculture products; and (3) for bleaching, catalysis and adsorption in edible oil processing, aromatics purification, and industrial and chemical applications. Additional information regarding U.S. Silica can be found on their website: www.ussilica.com.

2.2 Terms of Reference and Purpose

U.S. Silica retained BOYD to complete an independent technical assessment of their internally-prepared silica sand resource and reserve estimates and supporting information for the Ottawa Operation.

BOYD prepared this technical report summary for U.S. Silica in support of their disclosure of silica sand reserves for the Ottawa Operation in accordance with S-K 1300. The purpose of this report is threefold: (1) to summarize material technical and geoscientific information for the subject mining property, (2) to provide the conclusions of our technical assessment, and (3) to provide a statement of silica sand resources and/or reserves for the Ottawa Operation.

BOYD's findings are based on our detailed examination of the supporting geologic and other scientific, technical, and economic information provided by U.S. Silica, as well as our assessment of the methodology and practices applied by U.S. Silica in formulating the estimates of silica sand resources and reserves disclosed in this report. We did not independently estimate silica sand resources or reserves from first principles.

We used standard engineering and geoscience methods, or a combination of methods, that we considered to be appropriate and necessary to establish the conclusions set forth herein. As in all aspects of mining property evaluation, there are uncertainties

inherent in the interpretation of engineering and geoscience data; therefore, our conclusions necessarily represent only informed professional judgment.

The ability of U.S. Silica, or any mine operator, to recover all of the estimated silica sand reserves presented in this report is dependent on numerous factors that are beyond the control of, and cannot be anticipated by, BOYD. These factors include mining and geologic conditions, the capabilities of management and employees, the securing of required approvals and permits in a timely manner, future sand prices, etc. Unforeseen changes in regulations could also impact performance. Opinions presented in this report apply to the site conditions and features as they existed at the time of BOYD's investigations and those reasonably foreseeable.

This report is intended for use by U.S. Silica, subject to the terms and conditions of its professional services agreement with BOYD. We also consent to U.S. Silica filing this report as a technical report summary with the SEC pursuant to S-K 1300. Except for the purposes legislated under US securities law, any other uses of or reliance on this report by any third party is at that party's sole risk.

2.3 Expert Qualifications

BOYD is an independent consulting firm specializing in mining-related engineering and financial consulting services. Since 1943, BOYD has completed over 4,000 projects in the United States and more than 60 other countries. Our full-time staff comprises mining experts in: civil, environmental, geotechnical, and mining engineering; geology; mineral economics; and market analysis. Our extensive experience in silica sand resource and reserve estimation combined with our knowledge of the subject property, provides BOYD an informed basis on which to opine on the reasonableness of the estimates provided by U.S. Silica. An overview of BOYD can be found on our website at www.jtboyd.com.

The individuals primarily responsible for completing this technical assessment and the preparation of this report are by virtue of their education, experience, and professional association considered qualified persons (QPs) as defined in S-K 1300.

Neither BOYD nor its staff employed in the preparation of this report have any beneficial interest in U.S. Silica, and are not insiders, associates, or affiliates of U.S. Silica. The results of our assessment were not dependent upon any prior agreements concerning the conclusions to be reached, nor were there any undisclosed understandings concerning any future business dealings between U.S. Silica and BOYD. This report was prepared in return for fees based upon agreed commercial rates, and the payment for

our services was not contingent upon our opinions regarding the project or approval of our work by U.S. Silica and its representatives.

2.4 Principal Sources of Information

Information used in this assignment was obtained from: (1) files provided by U.S. Silica, (2) discussions with U.S. Silica personnel, (3) records on file with regulatory agencies, (4) public sources, and (5) nonconfidential information in BOYD's possession.

The following information was provided by U.S. Silica:

- Year-end reserve statements and reports for 2021 and 2022.
- Exploration records (e.g., drilling logs and lab sheets).
- Geologic databases of lithology and sand quality.
- Computerized geologic models.
- Mapping data, with:
  - Land ownership boundaries.
  - Infrastructure locations.
  - Easement and right-of-way boundaries.
  - Surveyed topography (surface elevation).
- Mine plans, production schedules, and supporting data.
- Overview of processing operations and detailed flow sheets.
- Copies of mining and operating permits.
- Historical information, including:
  - Production reports.
  - Financial statements.
  - Product sales and pricing.

Information from sources external to BOYD and/or U.S. Silica are referenced accordingly.

The data and work papers used in the preparation of this report are on file in our offices.

2.5 Personal Inspections

A site visit and inspection of the Ottawa Operation was completed on October 18, 2022,
by BOYD's QPs responsible for the preparation of this report. The site visit included: (1) observation of the active mining operations, (2) a tour of the mine site's surface infrastructure, and (3) a tour of the process plant and truck loadouts. BOYD's representatives were accompanied by senior U.S. Silica engineering and management personnel who openly and cooperatively answered questions regarding, but not limited

to: site history; deposit geology; mining and processing operations; near- and long-range mining plans; and silica sand marketing.

2.6 Report Version

The silica sand resources and reserves presented in this Technical Report Summary are effective as of December 31, 2022. The effective (i.e., “as of”) date of the report is December 31, 2022.

This is the third Technical Report Summary filed by U.S. Silica for the Ottawa Operation and supersedes the following previously filed reports:

Westward Environmental; February 2022; Technical Report Summary Ottawa Site, Lasalle County, Illinois.

Westward Environmental; September 2022; Technical Report Summary Ottawa Site, Lasalle County, Illinois.

The user of this document should ensure that this is the most recent disclosure of silica sand resources and reserves for the Ottawa Operation as it is no longer valid if more recent estimates have been issued.

2.7 Units of Measure

The US customary measurement system has been used throughout this report. Tons are short tons of 2,000 pounds-mass. Unless otherwise stated, currency is expressed in US Dollars ($). Historic prices and costs are presented in nominal (unadjusted) dollars. Future dollars values are expressed on a constant (unescalated) basis.

3.0 PROPERTY DESCRIPTION

3.1 Location

U.S. Silica's Ottawa Operation is a surface silica sand mining and processing operation located immediately west of the City of Ottawa in LaSalle County, Illinois. The cities of Chicago and Peoria, Illinois, are located approximately 95 miles east-northeast and 75 miles southwest, respectively, of the Ottawa Operation.

The property is bisected by the Illinois River into the North Ottawa and South Ottawa sites. The mine offices, maintenance facilities, processing plant, loadout facilities, and former mining pits are located on the North Ottawa site, while the active and future mining areas are located on the South Ottawa site. The South Ottawa site includes three defined pits: South Ottawa, where current mining is taking place, and the West Ottawa Pit and the Mississippi Sand Pit (future mining areas). A slurry line driven under the Illinois River connects the two sites, and feeds ROM sand material from South Ottawa to the processing plant.

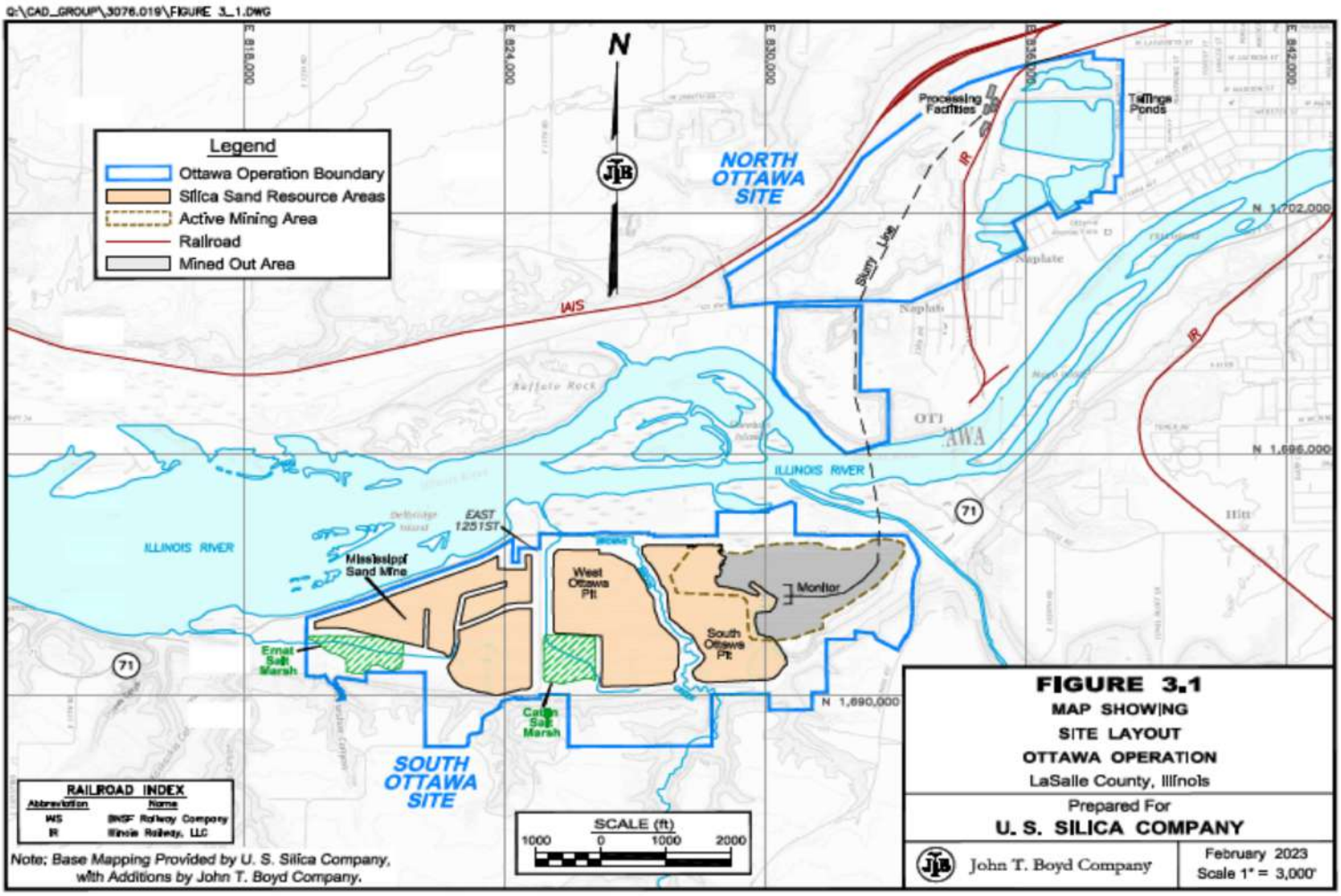
Geographically, the Ottawa Operation's processing plant is located at approximately 41° 20' 45.19" N latitude and 88° 52' 33.11" W longitude. Figures 1.1 (page 1-2) and 3.1, on the following page, illustrate the location and general layout of the Ottawa Operation.

3.2 Property Rights

U.S. Silica and its predecessors purchased the parcels of land—both surface and mineral rights—that currently comprise the Ottawa Operation at various times in its history to underpin their long-term operational goals. Currently, the Ottawa Operation comprises 68 parcels totaling approximately 2,072 acres of surface and minerals rights fully owned by U.S. Silica, as shown in Table 3.1.

Table 3.1: Property Ownership

Site	Township	Parcels	Acres
North Ottawa	Ottawa	42	857
South Ottawa	South Ottawa	26	1,215
Total		68	2,072


G:\CAD_GROUP\3076.019\FIGURE 3_1.DWG
E 818,000
E 824,000
E 830,000
E 836,000
E 842,000
N
Legend
Ottawa Operation Boundary
Silica Sand Resource Areas
Active Mining Area
Railroad
Mined Out Area
NORTH OTTAWA SITE
Processing Facilities
Tailings Ponds
IAIS
IR
Sturg Line
N 1,702,000
Naplate
Buffalo Rock
OTTAWA
ILLINOIS RIVER
N 1,696,000
71
EAST 1251ST
Mississippi Sand Mine
West Ottawa Pit
Monitor
South Ottawa Pit
Ernst Salt Marsh
Cedar Salt Marsh
N 1,690,000
SOUTH OTTAWA SITE
RAILROAD INDEX
Abbreviation
Name
IAIS
BNSF Railway Company
IR
Illinois Railway, LLC
SCALE (ft)
1000
0
1000
2000
Note: Base Mapping Provided by U. S. Silica Company, with Additions by John T. Boyd Company.
FIGURE 3.1
MAP SHOWING
SITE LAYOUT
OTTAWA OPERATION
LaSalle County, Illinois
Prepared For
U. S. SILICA COMPANY
John T. Boyd Company
February 2023
Scale 1" = 3,000'

3.3 Encumbrances

3.3.1 Fees and Royalties

To maintain ownership of the Ottawa Operation properties, U.S. Silica must pay property taxes to the local government in LaSalle County. To BOYD's knowledge there are no liens against the properties.

It is BOYD's understanding that there are no royalties, overriding or limited royalties, working interests, production payments, net profit interests, or other mineral interests in the Ottawa Operation properties.

3.3.2 Permitting Requirements

Mining and processing activities on the Ottawa Operation properties are regulated by several federal and state laws. As mandated by these laws and regulations, numerous permits are required for mining, processing, and other incidental activities. U.S. Silica reports that necessary permits are in place or applied for to support immediate operations. New permits or permit revisions may be necessary from time to time to facilitate future operations. Given sufficient time and planning, U.S. Silica should be able to secure new permits, as required, to maintain its planned operations within the context of the current regulations. Permitting and permitting conditions are discussed further in Chapter 17 of this report.

In BOYD's opinion, U.S. Silica has demonstrated their ability and cooperation to align their operating plans with any permitting requirements that may be encountered during the normal course of business.

BOYD is not aware of any current material violations or fines imposed by regulators on the Ottawa Operation.

3.3.3 Mining Restrictions

Several natural and man-made features have been identified in and around the South Ottawa site which may limit the mineable areas of the property. As of this report, these features include:

- Setbacks from neighboring properties.
- Illinois Route 71 right-of-way.
- East 1251st Road (Catlin Park Road) right-of-way.
- Catlin Salt Marsh.
- Ernat Salt Marsh.
- Brown's Brook.
- Jurisdictional wetlands and tributaries.
- Archeologically significant sites.

U.S. Silica has included suitable setbacks in their mining plans to avoid disturbing these sensitive areas. As such, these areas have been excluded from the estimates of silica sand resources and reserves presented herein.

3.3.4 Other Significant Factors or Risks

To the extent known to BOYD, there are no other significant factors and risks that may affect access, title, or the right or ability to perform work on the Ottawa Operation property that are not discussed in this report. However, the reported silica sand resources and reserves may be materially impacted by: U.S. Silica's failure to comply with permit conditions and rules; delays in obtaining required government or other regulatory approvals or permits; U.S. Silica's inability to obtain such required approvals or permits; or unforeseen changes in governmental regulations.

4.0 PHYSIOGRAPHY, ACCESSIBILITY, AND INFRASTRUCTURE

4.1 Topography, Elevation, and Vegetation

The Ottawa Operation lies within the Bloomington Ridged Plain division of the Till Plains Section physiographic province of Illinois. This region is generally characterized by low, broad, gently sloping ridges formed by glacial moraines, intertwined with wide regions of relatively flat grasslands.

Surface elevations in and around the property range from approximately 460 ft above mean sea-level (AMSL) near the Illinois River, to over 610 ft AMSL on the southern-most extents of the South Ottawa site where it abuts the Illinois River bluff.

Various streams and waterways are present in the immediate area, which drain into the Illinois River. The Ottawa South site contains several wetlands and almost all areas north of the bluff are located within the flood plain of the Illinois River.

Land cover in the immediate area consists predominantly of a mixture of forest, crop/pastureland, and medium density rural areas outside of the city of Ottawa—which is characterized as a medium-to-high density urban area.

4.2 Accessibility

General access to the Ottawa Operation is via a well-developed network of primary and secondary roads serviced by state and local governments. These roads provide direct access to the mine site and processing facilities and are generally open year-round.

A dedicated rail spur connects the Ottawa Operation to BNSF and CXS Class 1 rail lines located to the north and east of the property. Union Pacific and Norfolk Southern rail lines can be accessed utilizing truck transloading, if necessary.

Due to the operation’s location along the Illinois River, U.S. Silica also leases property to a privately-owned barge terminal, which may also be utilized for transporting finished goods.

4.3 Climate

Climate in and around the Ottawa Operation is characteristic for the midwestern US, with four seasons ranging from very cold and snowy winters to hot and humid summers, with generally milder falls and springs. The average daily high temperatures typically reach above freezing all 12 months of the year, while the low temperatures typically drop below freezing during 7 months of the year. Winter temperatures typically range from 18 degrees Fahrenheit (° F) to 36° F, while summer temperatures usually range from 60° F to 84° F. Average annual precipitation for the area is approximately 37 inches of rain and 21 inches of snow.

In general, the operating season for the Ottawa Operation is year-round. Adverse weather conditions seldom limit mining, processing, and loading operations; however, extreme weather conditions may temporarily impact operations. Periodic flooding is possible during heavy rainfall.

4.4 Infrastructure Availability and Sources

The Ottawa Operation lies within a well-developed region of north-central Illinois and has been operating for over 100 years in a region of mixed industrial and suburban development. The City of Ottawa has a population of almost 19,000 and over 500,000 people live in LaSalle County and the surrounding counites, according to 2021 US Census data.

Finished silica sand products from the Ottawa Operation are mainly transported to customer by rail and supported by U.S. Silica's extensive on-site rail-car loading, storage, and handling facility. Access to a well-maintained network of roads and a barge terminal provide alternative transportation options.
Several regional airports are located within an hour's drive from the Ottawa Operation, and the Chicago O'Hare and Midway international airports are less than two hours away by car.

Reliable sources of electrical power, water, supplies, and materials are readily available. Electrical power is provided to the operation by regional utility companies. Water is supplied by public water services, surface impoundments, or water wells. The Ottawa Operation has an abundance of recycled slurry water and processing water available.

5.0 HISTORY

5.1 Reserve Acquisition

The *United States Silica Sand Company*, a separate entity from U.S. Silica, established the first large-scale silica sand mining operation near the town of Ottawa, on the southern side of the Illinois River in 1894. This company mined the St. Peter Sandstone using a combination of blasting and hydraulic mining, in very much the same manner that the formation is mined today.

Edmund B. Thornton, a competitor to the United States Silica Sand Company, began a local silica sand mining operation on the present day North Ottawa site in 1900 under the name Ottawa Silica Company. By the 1920's, the Ottawa Silica Company had taken over most of the silica sand production in the area, eventually resulting in the Thornton family buying out the United States Silica Sand Company in 1928. The Thornton family continued to own and operate the Ottawa Silica Company until 1986, when the company was sold to Rio Tinto Zinc, a large mining conglomerate based in London.

Rio Tinto Zinc merged the newly acquired Ottawa Silica Company with their Berkely Springs, West Virgina-based Pennsylvania Glass Sand Company in January 1987, forming what is now U.S. Silica.

5.2 Exploration and Development

The Ottawa Silica Company was formed over 100 years ago to meet the demands of a small and local market segment. As industry and mass production grew and evolved, the operation did as well, and it began selling silica sand into additional markets, such as glass making, foundry casting, abrasives, building materials, and other segments over the years.

The grinding plant was built in the 1940's to produce ground silica products. This plant utilizes dry ball mills to reduce silica sand grains into fine-ground silica powders for use in various specialty markets for composite glasses, adhesives, fillers, sealants, ceramics, and epoxies.

A significant example of changing markets affecting the Ottawa Operation occurred in the late 1990's and early 2000's, as the use of silica sand in hydraulic fracturing of shales for oil and gas production began to increase drastically. Seeing demands for silica sand shift in their market base and noting what looked to be a growing segment at the

time, U.S. Silica shifted their production strategies to accommodate this market segment. In 2008, development of the Marcellus Shale, and the subsequent additional demand for proppant sands resulted in various expansions being undertaken by U.S. Silica. In order to be able to meet growing demand for proppant sands, the Ottawa Operation expanded its production capacity by 500 thousand tons per year in 2009. Demand for proppant sands continued to increase, and U.S. Silica again expanded the Ottawa operations in 2011 by another 900 thousand tons per year, reaching the present-day production capacity of 3.3 million product tons per year.

Exploration on the South Ottawa site began in 2000 as U.S. Silica began developing strategies in anticipation of having to move production to the south side of the Illinois River. There is no record of any exploration being performed prior to 2000 on the South Ottawa site. Exploration data for the mined-out areas in the North Ottawa site were not reviewed for this report.

The North Ottawa Pit was depleted of mineable sand by 2010, at which time mining operations were moved to the South Ottawa Pit. A slurry line was driven from the eastern portion of the South Ottawa Pit area, under the Illinois River, and to the existing processing plant which is located on the North Ottawa site. Operations continue in the original South Ottawa Pit today.

Again, considering future mine planning needs, U.S. Silica initiated a reserve expansion project in the spring of 2016, with the objective of extending the life of the Ottawa Operation. To this end, U.S. Silica acquired a 314-acre parcel, known as the Mississippi Sand Mine, located adjacent to the western border of the South Ottawa site.

U.S. Silica notes they have continually renovated and updated their facilities in order to improve operational efficiency and better respond to changing market demands. These continuous process improvements have resulted in the operation’s ability to produce multiple types of products using various processing methods (washing, hydraulic sizing, grinding, screening, and blending).

6.0 GEOLOGICAL SETTING, MINERALIZATION, AND DEPOSIT

6.1 Regional Geology

The Ottawa Operation mines and processes material from the St. Peter Sandstone, which is a massive formation in areal extent and thickness. The formation is found principally in the area drained by the Mississippi River and its tributaries, spanning north to south from Minnesota to Arkansas and east to west from Illinois into Nebraska and South Dakota. On a regional basis, the St. Peter Sandstone ranges in thickness from a few feet to over 1,200 ft, with a general thickness of 100 ft to 200 ft. Depths of the sandstone range from a few feet to greater than 10,000 ft.

The St. Peter Sandstone is Middle Ordovician in age (around 460 million years old) and was deposited in an advancing marine shoreline dominated by eolian dune and beach processes. Since the deposition, the formation has experienced several episodes of subsidence and uplift.

Except where it has been removed by erosion, the St. Peter Sandstone covers most of the Illinois Basin at depths varying from a few feet to almost 7,000 ft. The formation outcrops in four principal areas of northern Illinois: (1) the Ottawa-Utica-Millington area, where it outcrops along the Illinois and Fox rivers; (2) the Oregon-Dixon area; (3) the Brookville-Harper area; and (4) the Calhoun County area. In northern Illinois, the thickness of the formation can reach over 300 ft; however, it generally occurs as a 100 ft to 200 ft thick bed. Variations in the thickness of the St. Peter Sandstone are due to post depositional erosion and its highly irregular lower boundary.

The St. Peter Sandstone is a super-mature quartz arenite (≈99% quartz) that consists primarily of well-sorted, fine- to medium-sized, well-rounded quartz grains that are friable or weakly cemented and generally free from clay, carbonates, and heavy minerals. On a regional basis, the formation exhibits grain size that generally ranges from coarser in the upper section to finer in the lower section. As a rule, the lower portion of the formation is fine-grained with iron, alumina, and carbonate contamination increasing with depth.

The St. Peter Formation is an important aquifer as well as a source of high purity silica sand.

6.2 Local Geology

6.2.1 Stratigraphy

Ordovician and Pennsylvanian sedimentary strata comprise the uppermost stratigraphic units underlying the soils in and around the Ottawa Operation. These units primarily include bedrock of, in ascending stratigraphic order, the Prairie du Chien, Ancell, Platteville, and Galena groups of the Ordovician series, and the Pennsylvanian Carbondale Formation. The stratigraphic relationship between these groups is presented in Figure 6.1 as follows.

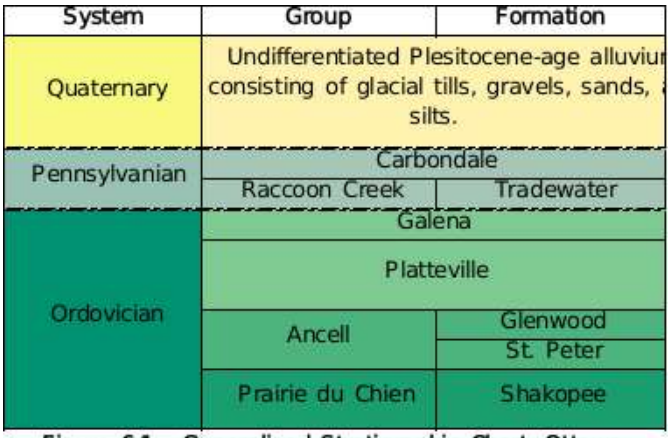


Figure 6.1: Generalized Stratigraphic Chart, Ottawa, Illinois

The following text discusses the strata encountered near Ottawa in ascending depositional order.

Shakopee

The Shakopee Dolomite of the Prairie du Chien Group is composed of argillaceous to pure, very fine-grained dolomite with some thin beds of medium-grained, cross-bedded sandstone, medium-grained dolomite, green to light gray shale, and buff siltstone.

St. Peter

The St. Peter Sandstone unconformably overlies the Shakopee Dolomite formation, and is composed of three members. The lower unit, the Kress Member, consists of chert conglomerate with beds of red and green shale and medium- to coarse-grained sandstone. The remainder of the St. Peter Sandstone is composed of well-rounded, well-sorted, medium- to coarse-grained sandstone of the Tonti and Starved Rock Members,

in depositional order. Locally, the upper part of the St. Peter Sandstone can be poorly consolidated, becoming more consolidated with depth.

Glenwood

The Glenwood Formation is a highly varied unit of poorly sorted sandstone, impure dolomite, and green shale overlying the St. Peter Sandstone. The sandstones have a distinctive bimodal, or “pudding stone,” texture, with medium grains of well-rounded quartz sand, like those of the St. Peter Sandstone, but contained in a matrix of very fine sand and coarse silt. The Glenwood sandstones also contain a variety of heavy minerals, including abundant garnet. This unit is generally not present in the immediate vicinity of the Ottawa Operation but can be found south of the property.

Platteville and Galena

The Platteville and Galena Formations are often combined due to consisting mainly of carbonate sequences of limestone and dolomite. These formations are present south of the Ottawa Operation, but not in the immediate vicinity.

Tradewater and Carbondale

These Pennsylvanian strata are predominantly clastic and contain subordinate amounts of coal and limestone. While this formation is not found at the Ottawa Operation, it comprises the primary near-surface bedrock strata south of the bluffs that border the Illinois River Valley.

Undifferentiated Quaternary Alluvium

Surface geology consists of what is mapped as the Quaternary Age Cahokia Alluvium, an unconsolidated interval of poorly sorted silts, clays, and sand and gravels. Thickness of this unit varies greatly in the region but is very thin within the Illinois River Valley.

6.2.2 Structural Geology

The St. Peter Sandstone at Ottawa lies very near the surface (thereby creating favorable mining conditions) primarily for two reasons. Firstly, one of the most prominent structural features in the Illinois Basin, the La Salle Anticlinorium, has uplifted the sandstone formation from its original depositional position. Secondly, glacial floodwaters of the Late Wisconsin Episode carved the upper reaches of the Illinois River Valley, removing most of strata overlying the St. Peter Sandstone, leaving the sandstone near the land surface as a bedrock bench that is easily identifiable.

On the south bank of the Illinois River, the St. Peter Sandstone forms bluffs and outcrops in the valleys incident to the bluffs from Ottawa to Little Rock, Illinois. In this area, the

overlying formations are principally Pennsylvanian beds, though locally, as at the edge of the bluff in Starved Rock State Park and near Little Rock, the sandstone is bare or is covered with a thin mantle of soil or glacial till.

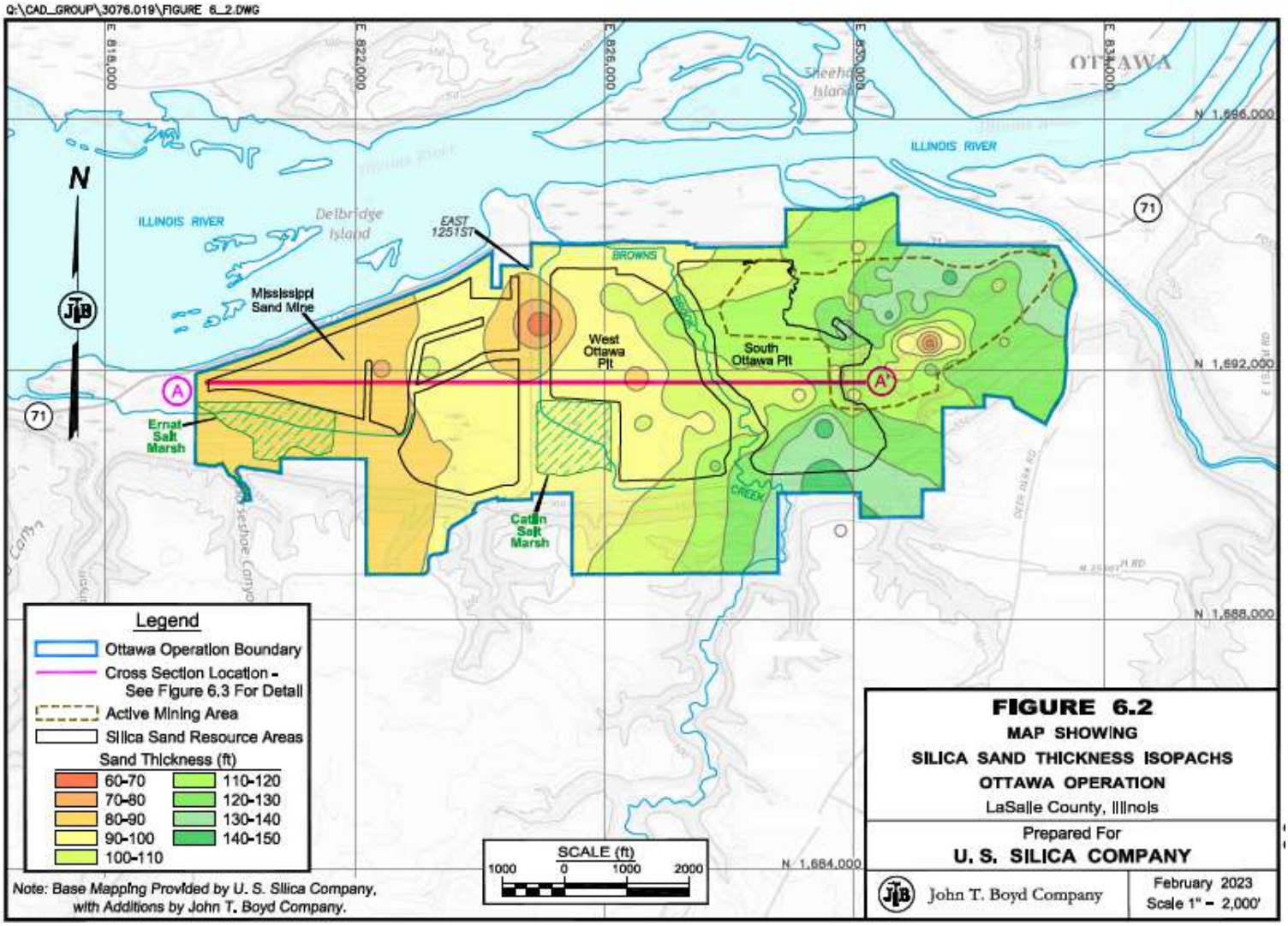
6.3 Property Geology

The St. Peter Sandstone is the only strata of economic interest at the Ottawa Operation, and is very uniform in depositional nature and continuity throughout much of the surrounding region. BOYD considers the subject silica sand deposit to be of low geologic complexity. Furthermore, the geology of the St. Peter Sandstone is well understood after a lengthy history of commercial operations at Ottawa.

Within the defined resource boundaries, the St. Peter Sandstone exhibits: (1) low depth of cover, (2) lateral continuity, (3) a minimum thickness of 70 ft, (4) gentle dipping, and (5) minimal faulting. Figure 6.2, following this page, provides a map of the St. Peter Sandstone thickness. A cross-section through the deposit is provided in Figure 6.3.

The two members of the St. Peter Sandstone—the coarser-grained upper Starved Rock and finer-grained lower Tonti members—are easily identifiable and separable during mining and can be blended as required to meet product specifications. Deleterious materials such as iron (which manifests as orange staining) are easily removed during mining and processing. The sandstone unit is covered by a thin layer of overburden that is generally less than 20 ft thick.

The Ottawa Operation’s sands are generally characterized by a high silica content, high roundness and sphericity, white coloration, and lack of deleterious material. The sandstone is very weakly cemented, allowing it to be mined hydraulically without the need for crushing, which retains the well-rounded grain shape. Because of the monocrystalline structure, these sands have superior grain strength when compared to other silica sands and are suitable for pressure applications generally up to the 9,000-pounds per square inch (psi) range. These characteristics are responsible for the market popularity of the Ottawa Operation’s silica sand products.


Q:\CAD_GROUP\3076.019\FIGURE 6_2.DWG
E 818,000
E 822,000
E 826,000
E 830,000
E 834,000
N 1,696,000
N 1,692,000
N 1,688,000
N 1,684,000
OTTAWA
ILLINOIS RIVER
Delbridge Island
EAST 1251ST
BROWNS
Mississippi Sand Mine
West Ottawa Plt
South Ottawa Plt
Ernat Salt Marsh
Catlin Salt Marsh
A
A'
71
N
Legend
Ottawa Operation Boundary
Cross Section Location - See Figure 6.3 For Detail
Active Mining Area
Silica Sand Resource Areas
Sand Thickness (ft)
60-70
70-80
80-90
90-100
100-110
110-120
120-130
130-140
140-150
SCALE (ft)
1000 0 1000 2000
Note: Base Mapping Provided by U. S. Silica Company, with Additions by John T. Boyd Company.
FIGURE 6.2
MAP SHOWING
SILICA SAND THICKNESS ISOPACHS
OTTAWA OPERATION
LaSalle County, Illinois
Prepared For
U. S. SILICA COMPANY
John T. Boyd Company
February 2023
Scale 1" = 2,000'

Q:\CAD_GROUP\3076.019\FIGURE 6_3.DWG

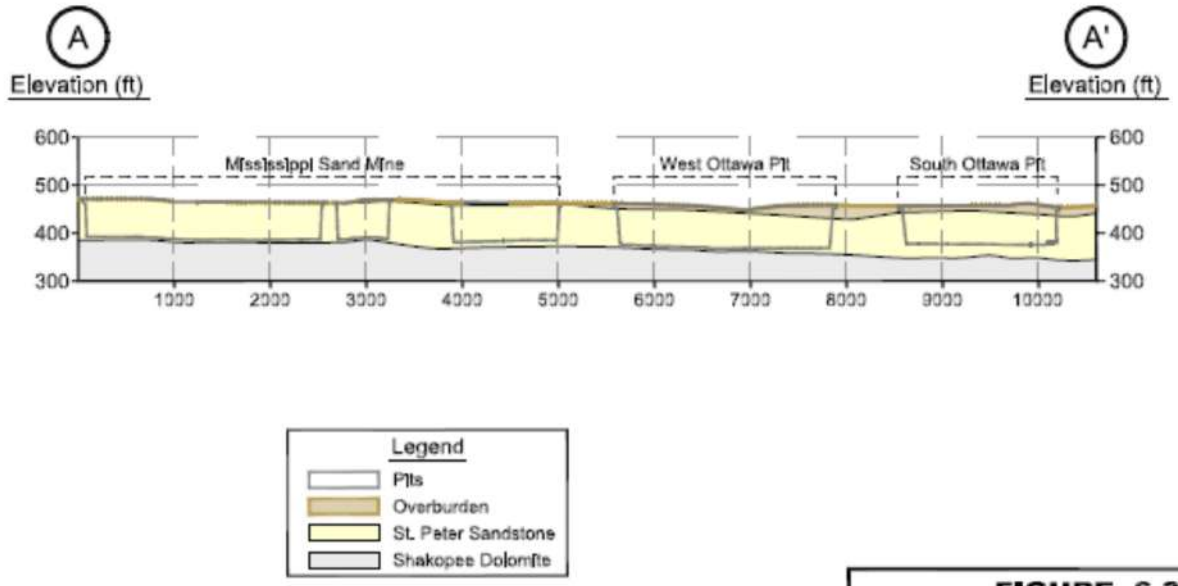


FIGURE 6.3
CROSS SECTION A - A'
OTTAWA OPERATION
LaSalle County, Illinois

Prepared For
U. S. SILICA COMPANY

Horizontal 1" = 1,000'
Vertical 1" = 200'
Vertical Exaggeration 5X

John T. Boyd Company

February 2023
Scales As Shown

Note : See Figure 6.2 For Cross Section Location.

7.0 EXPLORATION DATA

7.1 Background

The Ottawa Operation has an extensive history, over 100 years, of mining and producing of finished silica sand from the St. Peter Sandstone. The Ottawa North site was depleted of silica sand reserves by 2010, by which time operations had commenced at the Ottawa South site. All of the silica sand reserves reported herein are contained within the planned mining areas of the Ottawa South site.

BOYD was provided source records (drilling logs, testing results, and core photographs) and a database compiling the results 225 drill holes, wells, field measurements, and test holes located in and around the South Ottawa site. Records indicate that these exploration data were collected between 2000 and 2014.

An overview of U.S. Silica's exploration and sampling standardized procedures was also provided, which summarizes methodologies and techniques utilized during the various exploration programs completed at the Ottawa Operation.

7.2 Exploration Procedures

7.2.1 Drilling

Drill holes on the Ottawa South site were completed using various drilling procedures based on specific goals and data needs at various stages of planning and developing the Ottawa Mine. Drilling methods utilized to delineate the sub-surface geology include diamond core drilling, rotosonic drilling, and rotary auger drilling techniques. The various exploration campaigns completed, in addition to outcrop mapping, site surveys, and review of United States Geological Survey and Illinois State Geological Survey mapping, serve as the basis for evaluating the extents and geologic continuity of the St. Peter Sandstone underlying the Ottawa South site.

BOYD's review of the reported methodologies and procedures indicate the exploration data obtained and utilized by U.S. Silica for the South Ottawa site were carefully and professionally collected, prepared, and documented, conforming with general industry standards, and are appropriate for use of evaluating and estimating silica sand resources and reserves.

7.2.2 Sand Quality Sampling

The Ottawa Operation's sand quality sampling procedures followed standard industry practices, based on the information provided and discussions held with U.S. Silica personnel. With a preference to utilize diamond core drilling methodologies, the general procedures for sampling during any of the exploration programs, are as follows:

- Recovered drill cores are placed into core boxes and labeled with drill hole name, down hole footage, and recorded thicknesses for each recovered core.
- Cores are geologically logged and photographed, with characteristics of the overall stratigraphy recorded while being boxed. This allowed U.S. Silica to alter pre-determined drilling depths as the program progressed, in order to ensure the entire target strata were sampled and collected.
- Boxed core samples were transported by U.S. Silica to one of their two internal laboratories—located in Berkeley Springs, WV and Katy, TX—where they were checked in and split into 5-ft sample intervals for preparation and testing.
- Details on the expansion property exploration sampling techniques were not provided by Mississippi Sands to U.S. Silica. However, available archival core samples were examined by U.S. Silica personnel, and the 5-ft sample intervals examined seemed to be representative of the local geology. These samples were originally tested at a third-party (Bowser-Morner, Inc.) laboratory in Dayton, Ohio. U.S. Silica obtained samples of the available archival drilling cores and transported and performed their own testing at one of their internal laboratories prior to finalizing the acquisition of the Mississippi Sands property.

U.S. Silica maintained control of exploration core samples throughout the entirety of each drilling campaign, from the point of logging and boxing of recovered cores in the field, to transportation and delivery of core samples to their internal laboratories, through performing preparation and analyses on each of the samples.

Available testing results were reviewed by BOYD during our assessment, and our review of the field and sampling procedures noted above showed that the general description and sampling work were conducted to appropriate standards. Based on the stated standards, both in the field and in the laboratory, BOYD considers the sample preparation and analytical procedures were adequate for the purposes of evaluating and estimating silica sand resources and reserves at the Ottawa Operation.

7.2.3 Sand Testing

Samples obtained from the exploration campaigns completed at the Ottawa Operation were taken to one of the company's in-house laboratories, where they were prepared and analyzed for particle size distribution analyses. Samples were split and prepared

following standardized company procedures—U.S. Silica's ISO 9001 Quality System of Corporate Analytical Procedures—to ensure analytical consistency throughout each of the various exploration campaigns. These procedures are designed to closely match the operational capabilities of the Ottawa Operation's processing plant.

Preparation of each sample consisted of initially splitting the recovered core in half using a chisel and hammer. One half of the core is placed back into the core boxes which are then stored for archival purposes, while the other half of the core is further prepared and processed for lab testing purposes.

Analysis samples were then crushed, quartered, and mixed to create a uniform and representative mixture of the core interval, and are then divided into 1,000-to-5,000-gram samples, depending on the type and amount of testing to be performed. The desired sample size is then run through various crushing techniques to disaggregate the sand grains and fine materials as much as possible before beginning the washing and scrubbing procedures.

An approximately 1,500-gram sample is then obtained and washed before being run through a scalping procedure to remove coarse (+16-mesh size for proppant sand product testing; +30-mesh size for industrial product testing) particles. This process primarily removes the oversize "coarse waste" size fraction, leaving behind the material that would typically be washed in the wet processing plant. The remaining material is weighed and labeled as a "washed sample".

The washed sample is further prepared by simulating the wet processing plant conditions, which consist of placing a sample into scrubbers for three minutes, rinsing and decanting, and then drying to arrive at a "scrubbed sample", which represents material that the wet processing plant would prepare before being run through a drying plant.

The scrubbed samples are then dried and analyzed following API/ISO standards for particle size distribution analysis and then API RP 19C/ISO-13503-2 standard testing for proppant materials used in fracturing and gravel-packing operations.

7.2.4 Other Exploration Methods

There were not any other methods of exploration (such as airborne or ground geophysical surveys) reported for the Ottawa Operation.

7.3 Exploration Results

7.3.1 Summary of Exploration

A total of 225 drill holes were completed in and around the South Ottawa area. The distribution of these drill holes is shown on Figure 7.1, on the next page.

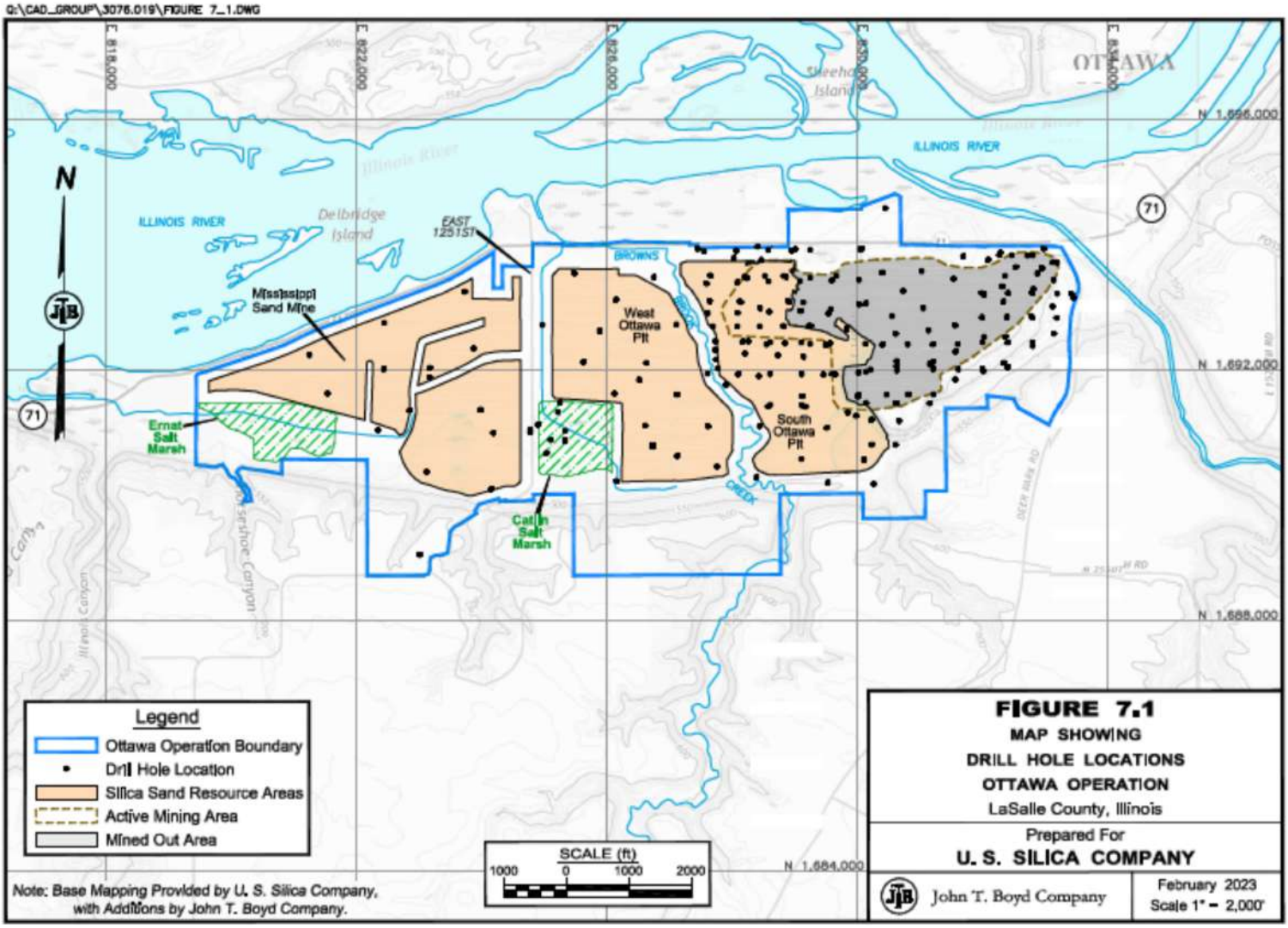
As mentioned, the 225 drill holes include a variety of drill holes, wells, field measurements, and test holes. BOYD's review determined that 102 holes penetrated the full depth of the St. Peters Sandstone and were supported by suitable lithologic and sand quality records. Lithologic data from many of the shorter holes (i.e., those which did not penetrate the entire thickness of the sandstone strata), we used to estimate the thickness of the overburden material over the South Ottawa site.

General descriptive statistics for the St. Peter Sandstone, and overburden material are provided in Table 7.1, below.

Table 7.1: Descriptive Statistics, Stratigraphic Interval Thickness

	Interval Thickness (feet)	
	Overburden	St. Peter Sandstone
Count	195	102
Mean	11.5	113.5
Minimum	1.0	64.0
Maximum	33.0	156.0
Standard Deviation	6.89	18.98
Coefficient of Variance	0.60	0.17

These data confirm the generally uniform nature of the deposit underlying the South Ottawa site and support the interpretation of the sandstone's thickness illustrated in Figure 6.2 (page 6-5).


Q:\CAD_GROUP\3076.019\FIGURE 7_1.DWG
E 818,000
E 822,000
E 826,000
E 830,000
E 834,000
N 1,696,000
N 1,692,000
N 1,688,000
N 1,684,000
N
ILLINOIS RIVER
Delbridge Island
EAST 1251ST
BROWNS CREEK
Mississippi Sand Mine
West Ottawa Pit
South Ottawa Pit
Ernat Salt Marsh
Catlin Salt Marsh
71
OTTAWA
Legend
Ottawa Operation Boundary
Drill Hole Location
Silica Sand Resource Areas
Active Mining Area
Mined Out Area
SCALE (ft)
1000 0 1000 2000
Note: Base Mapping Provided by U. S. Silica Company, with Additions by John T. Boyd Company.
FIGURE 7.1
MAP SHOWING
DRILL HOLE LOCATIONS
OTTAWA OPERATION
LaSalle County, Illinois
Prepared For
U. S. SILICA COMPANY
John T. Boyd Company
February 2023
Scale 1" = 2,000'

7.3.2 Silica Sand Quality

The Ottawa Operation produces a wide variety of proppant sand and specialty silica sands products for numerous customers. While not all of the finished products must adhere to a published set of specifications, U.S. Silica utilizes samples obtained during exploration to ascertain the suitability of the mineable sandstone for producing the various materials it supplies to customers.

Particle size distribution and iron content are noted as the primary drivers of mine planning at the Ottawa Operation. Particle size distribution within the sandstone, necessitates the concurrent mining of multiple areas of the mine to ensure supply of appropriately sized material to the processing plant. Similarly, as iron content increases near the top and bottom of the sandstone, this material must be discarded or blended with higher quality sand before processing.

U.S. Silica performs testing at their laboratories for API/ISO specifications; however, no data were made available for our review. Historically, API RP 19C/ISO 13503-2 proppant sand characteristics were strictly used to determine the suitability of a sand product for use during fracking stages of oil and gas well development. Over time, these specifications have become merely guidelines and the suitability of a proppant sand product is now determined by the end user. Indeed, many end users test the products that they purchase to determine if they meet their own internal specifications. BOYD notes that U.S. Silica has demonstrated commercial success in producing and marketing their finished silica sand products; as such, it is BOYD's opinion that sand quality data provided are representative and suitable for the estimation of silica sand resources and reserves.

7.3.3 Grain Size Distribution

Grain size distribution was analyzed according to API RP 19C/ISO 13503-2, Section 6.
A table of weighted average grain size distribution of the in-situ sand deposit, based on laboratory testing results, is shown in Table 7.2, below.

Table 7.2: Weighted Average Particle Size Distribution

Approximate In-Place Product Distribution					
% Retained By Mesh Size				% Product	
>40	40/70	70/140	<140	40/70	70/140
22.0	54.0	21.0	3.0	72.0	28.0

The preceding table highlights the relative fineness of the sand found within the Ottawa South Property, indicating a majority of the sand particles are concentrated between the “passing 40-mesh” and “retained 140-mesh” size fraction. Accordingly, the predominant marketable proppant sand product consists of the 40/140-mesh sand.

7.3.4 Grain Shape (Sphericity and Roundness)

Grain shape is defined under ISO 13503-2/API RP19C, Section 7. Under this standard, recommended sphericity and roundness values for proppants are 0.6 or greater. As part of the grain shape analysis, the presence of grain clusters (weakly cemented grain aggregates) and their approximate proportion in the sample are reported.

While individual sample testing results for the Ottawa Operation’s deposit were not available for review at the time of this report, it is important to note that the St. Peter Sandstone is well studied and widely known to consistently exhibit the general characteristics of being a fine-to-medium grained, well-rounded, and well-sorted sandstone comprised primarily of weakly cemented and extraordinarily pure quartz grains that contain little-to-no deleterious materials within the sandstone matrix.

U.S. Silica has also produced and sold sand into various oil and gas basins, where ultimately the sand has been shown to meet customer specifications.

7.3.5 Crush Resistance

Crush resistance is a key test that determines the amount of pressure a sand grain can withstand under laboratory conditions for a two-minute duration. It is analyzed according to ISO 13503-2/API RP19C, Section 11. Under this standard, the highest stress level (psi) in which the proppant produces no more than 10% crushed fine material is rounded down to the nearest 1,000 psi and reported as the “K-value” of the material.

The Ottawa Operation’s silica sand products are noted for exhibiting high crush strengths.

7.3.6 Mineralogical Analyses

Mineralogical analyses were performed via x-ray fluorescence to determine the concentrations of various minerals present within the sandstone matrix. Testing determined that the minerals present in the sandstone matrix will generally be removed during processing of the mined silica sand. Mineralogical testing was conducted on a composited interval of the entire mineable interval from a given drill hole.

7.4 Data Verification

For purposes of this report, BOYD did not verify historic drill hole data by conducting independent drilling. It is customary in preparing similar mining resource and reserve estimates to accept basic drilling and sample quality data as provided by the client subject to the reported results being judged representative and reasonable.

BOYD's efforts to judge the appropriateness and reasonability of the source exploration data included reviewing representative samples of provided drilling logs, sampling procedures, sand quality testing results, and discussing aspects of developing the operation with U.S. Silica personnel during our site visit. Reviewed drilling records were compared with their corresponding database records for transcription errors; of which none were found. Lithologic and sand quality data points were compared via visual and statistical inspection with geologic mapping and cross-sections.

7.5 Adequacy of Exploration and Sampling

BOYD's review indicates that in general, U.S. Silica has performed an acceptable level of drilling and sampling work at the Ottawa Operation. The work completed has been done by competent personnel in a manner consistent with industry practices. The amount of data available, combined with extensive knowledge of the St. Peter Sandstone, are sufficient to confirm deposit uniformity and continuity throughout the South Ottawa area. Similarly, BOYD's review of testing data provided by U.S. Silica suggests that the analyses completed are generally appropriate to determine silica sand characteristics and determine the subsequent quality of finished silica sand products. As such, it is BOYD's opinion that the exploration and sampling data are suitable for use in the estimation of silica sand resources and reserves for the Ottawa Operation.

8.0 SAMPLE PREPARATION, ANALYSIS, AND SECURITY

The reader is referred to Sections 7.2 and 7.3 of this report for details regarding sample preparation, analysis, and security.

9.0 DATA VERIFICATION

BOYD, by way of the data verification processes described in various sections of this report, has used only that data, which were deemed by the QPs to have been generated with proper industry standard procedures, were accurately transcribed from the original source and were suitable to be used for the purpose of preparing estimates of silica sand resources and reserves.

BOYD's subject-specific data verification efforts and our conclusions arising therefrom are discussed in the following sections of this report:

Topic	Report Section(s)
Exploration Data	Section 7.4
Sample Preparation, Analysis, and Security	Section 7.4
Silica Sand Resource Estimates	Section 11.2
Operating Plans	Chapters 13 and 1
Capital and Operating Costs	Chapter 18
Economic Analysis Inputs	Chapter 19

Based on our review, it is BOYD's overall conclusion that the information made available to us at the time of this report is representative and reliable for use in estimating the silica sand resources and reserves of the Ottawa Operation.

BOYD is not aware of any other limitations on nor failure to conduct appropriate data verification.

10.0 MINERAL PROCESSING AND METALLURGICAL TESTING

Please refer to Chapter 7 for information regarding mineralogical and grain size distribution testing.

11.0 SILICA SAND RESOURCE ESTIMATE

11.1 Applicable Standards and Definitions

Unless noted, silica sand resource estimates disclosed herein are done so in accordance with the standards and definitions provided by S-K 1300. It should be noted that BOYD considers the terms “mineral” and “silica sand” to be generally interchangeable within the relevant sections of S-K 1300.

Estimates of mineral resources are always subject to a degree of uncertainty. The level of confidence that can be applied to a particular estimate is a function of, among other things: the amount, quality, and completeness of exploration data; the geological complexity of the deposit; and economic, legal, social, and environmental factors associated with mining the resource. By assignment, BOYD used the definitions provided in S-K 1300 to describe the varying degree of certainty associated with the estimates reported herein.

The definition of mineral resource provided by S-K 1300 is:

> *Mineral resource is 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. A mineral resource is a reasonable estimate of mineralization, taking into account relevant factors such as cut-off grade, likely mining dimensions, location or continuity, that, with the assumed and justifiable technical and economic conditions, is likely to, in whole or in part, become economically extractable. It is not merely an inventory of all mineralization drilled or sampled.*

Estimates of mineral resources are subdivided to reflect different levels of geological confidence into measured (highest geologic assurance), indicated, and inferred (lowest geologic assurance). Please refer to the Glossary of Abbreviations and Definitions for the meanings ascribed to these terms.

11.2 Silica Sand Resources

11.2.1 Methodology

Based on provided information, U.S. Silica's geologic modeling and silica sand resource estimation techniques generally consist of following:

1. The top and bottom elevations of the quartzose (high-quality) St. Peter Sandstone interval is interpreted from drill hole records and sand particle size analyses. Strata above the interpreted sandstone interval are considered overburden (waste). Strata below the sandstone unit—generally, the Kress cherty shale or Shakopee Dolomite—are also considered waste.
2. Interpreted drill hole records are compiled and validated. Strata thicknesses are aggregated, and sand particle size analyses of the sandstone unit are composited for each data point. The compiled drill hole data are imported into GEOVIA Surpac™ geologic modeling and mine planning software.
3. A geologic block model of the deposit is developed using industry standard stratigraphic modeling methods. The geologic model delineates overburden, and the top and bottom of the mineable sandstone horizon.
4. Contiguous regions of mineable sandstone are outlined (applying criteria discussed below in Section 11.2.2), and LOM pit shells are created
5. Estimates of in-place overburden waste and mineable sandstone volumes are derived from the LOM pit shells and recent topographic (surface elevation) surveys.
6. An in-place sandstone dry density of 135 pounds per cubic foot is used to convert the in-place sand volumes to in-place sand tons.

11.2.2 Estimation Criteria

Development of the silica sand resource estimate for the Ottawa Operation assumes mining and processing methods and equipment which have been utilized successfully at the site for decades.

The target mining horizon, the St. Peter Sandstone, underlies the entirety of U.S. Silica's property at the Ottawa Operation, and is manifested as a continuous, flat-lying sedimentary rock unit with consistent depth and thickness. While the sandstone exhibits vertical variations in quality, all of the unit is mined and sold under various product specifications. The high-quality sandstone is easily distinguished from the surrounding lower-quality or non-sandstone rock units, aiding in the interpretation of the mineable horizon. Additionally, the Ottawa Operation has a lengthy commercial history of producing numerous products with various size and quality specifications, allowing nearly all of the identified mineable sandstone interval to be utilized. Based on the uniformity of the sand deposit being mined, cut-off grades, strip ratio, and other typical mining factors do not define economic mineabilty. Production of silica sand is driven by

market demand. Silica sand production can be modified in response to that demand. As such, the application of minimum mining thicknesses, maximum stripping ratios (the ratio of waste to sandstone excavated), or cut-off grades is not generally considered in the estimation of silica sand resources for the Ottawa Operation.

The limits of the silica sand resources are constrained to those portions of the interpreted sandstone deposit that:

- Are reasonably defined by available drilling and sampling data.
- Contain products that meet generally accepted specifications.
- Honor any legal mining constraints (e.g., property boundaries, environmental setbacks, utility and infrastructure setbacks, etc.).
- Adhere to physical mining constraints.
- Contain products that can be sold at a profit (i.e., be economic).

U.S. Silica applied the following offsets to define the silica sand resource boundaries for the Ottawa Operation:

- 25-ft buffer around wetlands and streams.
- 200-ft offsets from neighboring property boundaries.
- 160-ft right-of-ways around roadways.

The following mine design criteria are used to develop the pits shells which constrain the estimated silica sand resources:

- Slopes of 33% in topsoil, clay, gravel, or unconsolidated overburden materials.
- Slopes of 70° in sandstone.
- A minimum of a 10-ft wide safety bench is left at the alluvium/rock and rock/sand contacts.
- A minimum of a 25-ft wide safety bench is left at approximately 425 feet AMSL.
- The bottom of mineable resources is by pit design at a variable elevation to allow proper drainage, and is limited to 5 ft above the underlying shale/dolomite or a minimum elevation of 378 ft AMSL, whichever is higher.

Silica sand resources for the Ottawa Operation are assessed for reasonable prospects for eventual economic extraction by reporting only that material which has been subsequently converted to silica sand reserves after the application of all material modifying factors.

BOYD has reviewed the criteria employed by U.S. Silica in developing their estimates of silica sand resources. The parameters are supported by historical results and align with those employed at similar operations. As such, it is BOYD's opinion that the stated criteria are reasonable and appropriate for the estimation of silica sand resources at the Ottawa Operation.

11.2.3 Classification

Geologic assuredness is established by the availability of both structural (thickness and elevation) and particle size distribution for the St. Peter Sandstone. Classification is generally based on the concentration or spacing of exploration data, geological understanding, continuity of mineralization relative to the style of mineralization, and uncertainty with the exploration data. Table 11.1 provides the general criteria employed in the classification of the silica sand resources.

Table 11.1: Silcia Sand Resource Classification Criteria

Classification (Geologic Confidence)	Data Point Spacing (feet)		
Measured	0	–	1,500
Indicated	1,500	–	3,000
Inferred	3,000	–	6,000

Extrapolation or projection of resources in any category beyond any data point does not exceed half the point spacing distance.

BOYD reviewed the classification criteria employed by U.S. Silica with regards to data density, data quality, geological continuity and/or complexity, and estimation quality. The St. Peter Sandstone is well-known and of low geologic complexity. We believe these criteria appropriately reflect their implied levels of geologic assurance with respect to the estimation of silica sand resources.

Mineable sand resources on the property are well-defined throughout all areas of the mine plan. Observed drill hole spacing averages approximately 500 ft through a majority of the active mining area, with future mining areas exhibiting a general drill hole spacing averaging approximately 750 ft to 1,250 ft.

11.2.4 Silica Sand Resource Estimate

Resource estimates of in-place silica sand at the Ottawa Operation as of December 31, 2022, as reported by U.S. Silica are shown in Table 11.2 below.

Table 11.2: Ottawa Operation Silica Sand Resources
(as of December 31, 2022)

	In-Place Tons (000)		
Classification	Planned[1]	Additional[2]	Total
Measured	94,466	-	94,466
Indicated	1,564	-	1,564
Total Measured + Indicated	96,030	-	96,030
Inferred	-	88	88

Notes:
1. "Planned" resources are those included in the approved LOM plan.
2. "Additional" resources are those reported in addition to silica sand reserves.

As shown, U.S. Silica controls approximately 93 million in-place tons of measured and indicated silica sand resources, *inclusive* of silica sand reserves. In addition, they control approximately 88,000 in-place tons of inferred silica sand resources. Silica sand resources are not silica sand reserves and do not have demonstrated economic viability.

The silica sand resources shown under the “Planned” column of Table 11.2 include only those in-place tons which are included in U.S. Silica’s LOM plan for the Ottawa Operation and therefore considered for conversion to silica sand reserves. The silica sand resources shown under the “Additional” column of Table 11.2 have not been included in the LOM plan and are considered *exclusive* of (i.e., “in addition to”) the reported silica sand reserves. These “Additional” silica sand resources are considered to have prospects for eventual economic extraction by virtue of their similarity, in terms of demonstrated extraction methods and expected finished product qualities, to those converted to silica sand reserves. However, further studies are required to convert the “Additional” silica sand resources to silica sand reserves.

11.2.5 Validation

BOYD was provided with U.S. Silica’s exploration data, geologic models, and volumetric estimates. We have reviewed this information, on a representative basis, by:

- Verifying the accuracy of geologic model inputs by comparison with drilling logs and laboratory reports.
- Comparing the geologic model with compiled drilling data.

- Preparing a stratigraphic grid model of the sandstone unit and independently estimating pit shell volumes.

It is BOYD's opinion that the geologic model is representative of the informing data and that the data are of sufficient quality to support the silica sand resource estimate provided herein. Furthermore, it is our opinion that the estimation methods and criteria employed are both appropriate and reasonable for the deposit type and proposed extraction methods.

BOYD is not aware of any technical, legal, economic, or other relevant factors that could materially affect the silica sand resource estimate. The accuracy of silica sand resource estimate is, in part, a function of the quality and quantity of available data and of engineering and geological interpretation and judgment. Given the data available at the time this report was prepared, the estimates presented herein are considered reasonable. However, they should be accepted with the understanding that additional data and analysis available after the date of the estimate may result in a change to the current estimate. These revisions may be material. There is no guarantee that all or any part of the estimated resources will be recoverable.

12.0 SILICA SAND RESERVE ESTIMATE

12.1 Applicable Standards and Definitions

Unless noted, silica sand reserve estimates disclosed herein are done so in accordance with the standards and definitions provided by S-K 1300. It should be noted that BOYD considers the terms “mineral” and “silica sand” to be generally interchangeable within the relevant sections of S-K 1300.

Estimates of mineral reserves are always subject to a degree of uncertainty. The level of confidence that can be applied to a particular estimate is a function of, among other things: the amount, quality, and completeness of exploration data; the geological complexity of the deposit; and economic, legal, social, and environmental factors associated with mining the reserve. By assignment, BOYD used the definitions provided in S-K 1300 to describe the varying degree of certainty associated with the estimates reported herein.

The definition of mineral reserve provided by S-K 1300 is:

> *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.*

Estimates of mineral reserves are subdivided to reflect geologic confidence, and potential uncertainties in the modifying factors, into proven (highest assurance) and probable. Please refer to the Glossary of Abbreviations and Definitions for the meanings ascribed to these terms.

Figure 12.1, below, illustrates the relationship between mineral resources and mineral reserves.

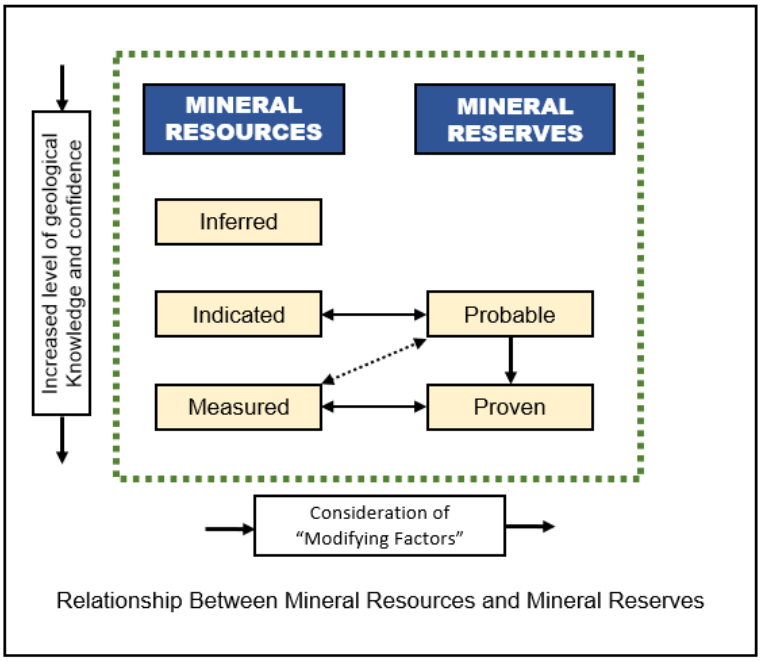


Figure 12.1: Relationship Between Mineral Resources and Mineral Reserves

By industry convention, silica sand reserves are presented on two bases: mineable and saleable. Mineable reserves represent the ROM tonnage available for excavation and processing. Saleable reserves represent the tonnage of finished silica sand available for sale after processing the mineable reserves.

12.2 Silica Sand Reserves

12.2.1 Methodology

Estimates of silica sand reserves for the Ottawa Operation are derived contemporaneously with estimates of silica sand resources. The Ottawa Operation utilizes commercially proven mining and processing methods to extract and process silica sand from the subject property. The operation's production plans are revised periodically to assure that the conversion of in-place sand to saleable product are: (1) in reasonable conformity with present and recent historical operational performance, and (2) reflective of expected mining and processing operations.

To derive estimates of mineable tons and saleable product tons (i.e., proven and probable silica sand reserves), the following modifying factors were applied to the in-place measured and indicated silica sand resources underlying the respective mine plan areas:

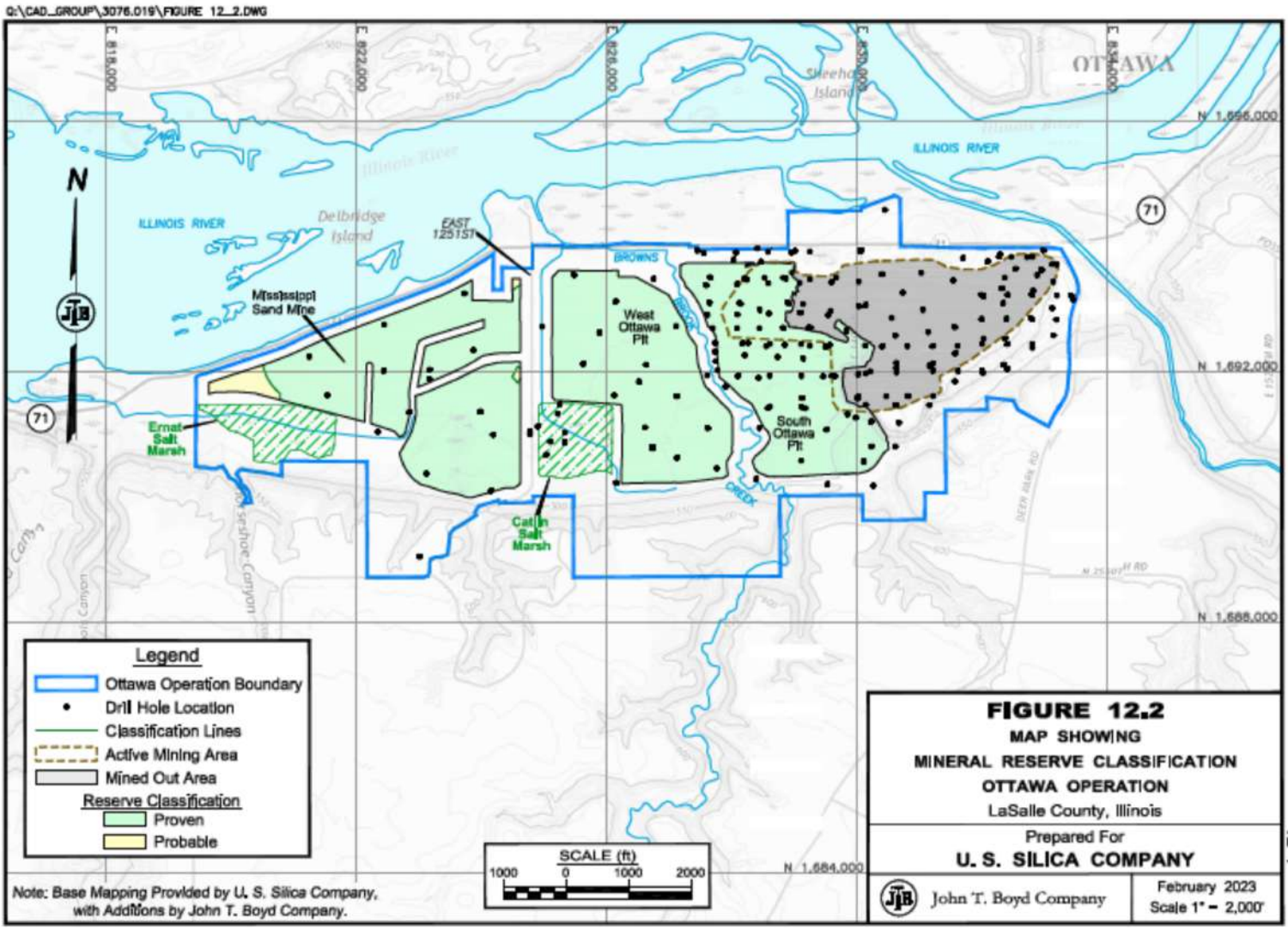
- A 95% mining recovery factor, which assumes that 5% of the mineable (in-place) silica sand resource will not be recovered for various reasons. Applying this recovery factor to the in-place resource results in the estimated ROM sand tonnage (i.e., the mineable silica sand reserves) that will be delivered to the wet process plant.
- An overall 86.5% processing yield. This factor accounts for removal of out-sized (i.e., larger than 20-mesh and smaller than 140-mesh) sand and losses in the wet and dry processing plants due to minor inefficiencies.

The overall product yield (after mining and processing losses) for the Ottawa Operation is estimated at approximately 82.2%. That is, for every 100 tons of in-place silica sand, approximately 82 tons will be recovered and sold as product. Mining recovery and processing yield factors are derived from historical operating results.

Economic availability of the silica sand reserves is established by the financial analysis presented in Chapter 19. A long-range average selling price of $42.37 per product ton has been used to estimate silica sand reserves for the Ottawa Operation.

12.2.2 Classification

Proven and probable silica sand reserves are derived from measured and indicated silica sand resources, respectively, in accordance with S-K 1300. BOYD is satisfied that the stated silica sand reserve classification reflects the outcome of technical and economic studies. Figure 12.2, following this page, illustrates the classification of the silica sand reserves at the Ottawa Operation.


Q:\CAD_GROUP\3076.019\FIGURE 12_2.DWG
E 818,000
E 822,000
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E 834,000
N 1,696,000
N 1,692,000
N 1,688,000
N 1,684,000
OTTAWA
ILLINOIS RIVER
Illinois River
Delbridge Island
Sheehan Island
EAST 1251ST
BROWNS
BEACH
CREEK
Mississippi Sand Mine
West Ottawa Pit
South Ottawa Pit
Ernat Salt Marsh
Catlin Salt Marsh
Sheehan Canyon
DEER RUN RD
N 2510TH RD
71
N
Legend
Ottawa Operation Boundary
Drill Hole Location
Classification Lines
Active Mining Area
Mined Out Area
Reserve Classification
Proven
Probable
SCALE (ft)
1000 0 1000 2000
Note: Base Mapping Provided by U. S. Silica Company, with Additions by John T. Boyd Company.
FIGURE 12.2
MAP SHOWING
MINERAL RESERVE CLASSIFICATION
OTTAWA OPERATION
LaSalle County, Illinois
Prepared For
U. S. SILICA COMPANY
John T. Boyd Company
February 2023
Scale 1" = 2,000'

12.2.3 Silica Sand Reserve Estimate

U.S. Silica's estimated surface mineable silica sand reserves for the Ottawa Operation total 78.9 million saleable product tons, as of December 31, 2022. The silica sand reserves reported in Table 12.1, below, are based on the approved LOM plan which, in BOYD's opinion, is technically achievable and economically viable after the consideration of all material modifying factors.

Table 12.1: Ottawa Operation Silica S
Reserves (as of December 31, 202

	Tons (000)	
Classification	Mineable	Saleable
Proven	89,742	77,627
Probable	1,486	1,286
Total	91,228	78,913

All of the reported silica sand reserves wholly owned by U.S. Silica.

The silica sand reserves of the Ottawa Operation are well-explored and defined. It is our conclusion that over 98% of the stated reserves can be classified in the proven reliability category (the highest level of assurance) with the remainder classified as probable. Given the geologic uniformity and history of mining the St. Peter Formation on the Ottawa Operation properties, it is reasonable to assume that the small portion of probable reserves will be converted to proven reserves upon completion of additional exploration and testing.

The Ottawa Operation has a well-established history of mining, processing, and selling silica sand products into various markets. BOYD has assessed that sufficient studies have been undertaken to enable the silica sand resources to be converted to silica sand reserves based on current and proposed operating methods and practices. Changes in the factors and assumptions employed in these studies may materially affect the silica sand reserve estimate.

The extent to which the silica sand reserves may be affected by any known geological, operational, environmental, permitting, legal, title, variation, socio-economic, marketing,

political, or other relevant issues has been reviewed as warranted. It is the opinion of BOYD that U.S. Silica has appropriately mitigated, or has the operational acumen to mitigate, the risks associated with these factors. BOYD is not aware of any additional risks that could materially affect the development of the silica sand reserves.

Based on our independent review, we have a high degree of confidence that the estimates shown in this report accurately represent the available silica sand reserves controlled by U.S. Silica, as of December 31, 2022.

12.2.4 Reconciliation with Previous Estimates

When comparing U.S. Silica's silica sand reserve estimates as of December 31, 2022, with the estimates presented[1] for December 31, 2021, we note a net decrease of approximately 8.7 million mineable tons resulting from: (1) depletion due to mining of approximately 3.2 million mineable tons, and (2) revisions to mine plans resulting in deductions of approximately 5.5 million mineable tons. BOYD does not consider these deductions, either individually or combined, to represent material changes to the silica sand reserves of the Ottawa Operation.

[1] U.S. Silica did not present reserves on a Saleable Tons basis for the 2021 financial year.

13.0 MINING METHODS

13.1 Mining Operations

Surface silica sand mining has been conducted at the Ottawa Operation for over 100 years. Recent and current mining operations are located in the South Ottawa Pit, on the south bank of the Illinois River.

In and around the Ottawa Operation, the St. Peter Sandstone generally exhibits a shallow depth, flat altitude, and consistent thickness. These characteristics favor conventional surface mining techniques. Since the target sandstone formation does not extend below the water table, the quarry is ‘dry-mined’ using truck and shovel mining methods. Mining occurs in a stair-like fashion to recover sand from the top of the formation (in elevation) down to the lowest practical elevation (generally 5 ft from the bottom of the St. Peter Sandstone).

The thin overburden, including topsoil, cap rock and vegetation, is cleared and transported to several mined-out areas in pit where it is stockpiled for future reclamation needs. The material is poorly consolidated and thus drilling and blasting is typically not needed for this stage of the mining operations. Overburden removal is performed, as required (usually one year in advance of sand mining), by third party contractors and does not appear to hinder sand mining to any appreciable degree.

Once the overburden has been stripped, the poorly cemented sandstone is drilled and blasted in a series of benches between 40 to 75 ft high. Drilling and blasting are performed by local third-party contractors several times a year depending on production requirements.

An excavator or front-end loader is used to load the shot sandstone into articulated haul trucks for transport to a “monitor station” where the material is further broken down

using high-pressure water to create a sand/water slurry. Figure 13.1, below, shows the loading operations in the South Ottawa Pit.

Figure 13.1: Loading Operations at the Ottawa Operation

The slurry is transported under the Illinois River to the processing plant via a series of pumps and high-density polyethylene (HDPE) pipes. A bulldozer is used to push any stockpiled rock in this area towards the monitor. Large stockpiling capacity at the monitor station can help alleviate ROM sand supply fluctuations caused by minor disruptions in mining activities.

After the slurry material is transported to the processing plant, the water is recycled and returned to the mine site for reuse. The pipes are positioned under the roadways to the north of the pit and under the Illinois River through lines which were drilled by directional boring methods. Booster pump stations along the slurry line allows the sand to stay in suspension. This method of mining and transportation has proven to be very effective since operations commenced in the South Ottawa Pit.

The mine generally operates year-round.

13.2 Mine Equipment and Staffing

13.2.1 Mine Equipment

The primary mobile equipment involved in sand excavation includes:

- One Volvo 480EC Excavator.
- Four John Deere 460E class articulated trucks.
- One John Deere 444 Loader
- One Caterpillar D8 Dozer.
- One John Deere 1050 Dozer.
- Two Volvo 350F Loaders.
- A water truck and other ancillary equipment.

The mobile equipment fleet is comprised of both leased and owned equipment. Regular maintenance of mobile equipment is performed by U.S. Silica personnel at the Ottawa facility. Major rebuilds or repairs are performed offsite at third-party repair facilities.

If maintained in good condition, the mobile equipment fleet should be capable of achieving production levels required by the LOM plan.

13.2.2 Staffing

The Ottawa Operation is staffed by 145 hourly and salaried personnel. A breakdown of employees by classification is provided in Table 13.1.

Table 13.1: Employees by Classification

Classification	Employees
Mine Operations	36
Plant Operations	59
Maintenance	24
Salaried	26
Total	145

Hourly employees are represented by the United Steelworkers of America.

Most employees live in and around the City of Ottawa. Except for a drop in employment in 2020 (attributed to poor market conditions during the COVID pandemic), staffing levels across the operational sites have largely remained consistent. The workforce can be expanded or reduced based on market and seasonal demands.

13.3 Engineering and Planning

The primary mine planning consideration is the safe, economical, and regular supply of raw high-quality sand feed to the processing plant. In commercial mining terms, the quantities of overburden removed, and sand mined each year at the Ottawa Operation are considered modest. The sandstone deposit affords easy access with its shallow depth and large areal extent. As such, mining plans for the Ottawa mine are relatively simple and very flexible, able to be modified based on demand in a relatively short time frame.

Geotechnically, the St. Peter Sandstone is relatively competent and the mining depths so shallow such that slumping, or collapsing, has not been a detriment to the mining process. The pit design parameters discussed in Section 11.2.2 have been used with success at the operation for decades.

Excessive inflow of groundwater into the pit is not expected. As such, dewatering before or during mining activities should be manageable with drainage ditches and sumps. Flood waters from the adjacent Illinois River are a manageable risk. Onsite water ponds can be used to hold any excessive ground or storm water.

13.4 Mining Sequence and Production

Mining of the St. Peter Sandstone at the Ottawa Operation commenced shortly after the founding of the Ottawa Silica Company in 1900 and has continued, without lengthy disruptions, to the present day. Over the past seven years, the operation has mined over 24 million tons of raw sand. During late 2019 and 2020, production was reduced from approximately 4 million tons per year to under 2.5 million tons in response to decreased

customer demand due to the COVID-19 pandemic. Production rebounded in 2021 and 2022, and is forecasted to rise in the LOM plan as illustrated in Figure 13.2, below.

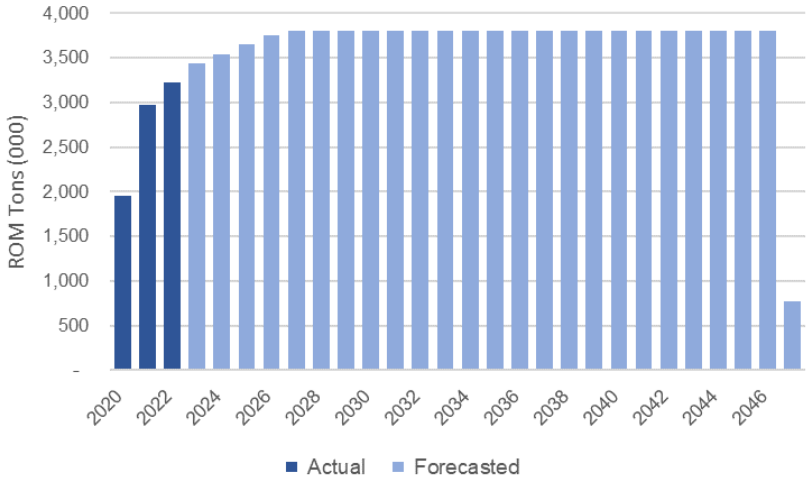
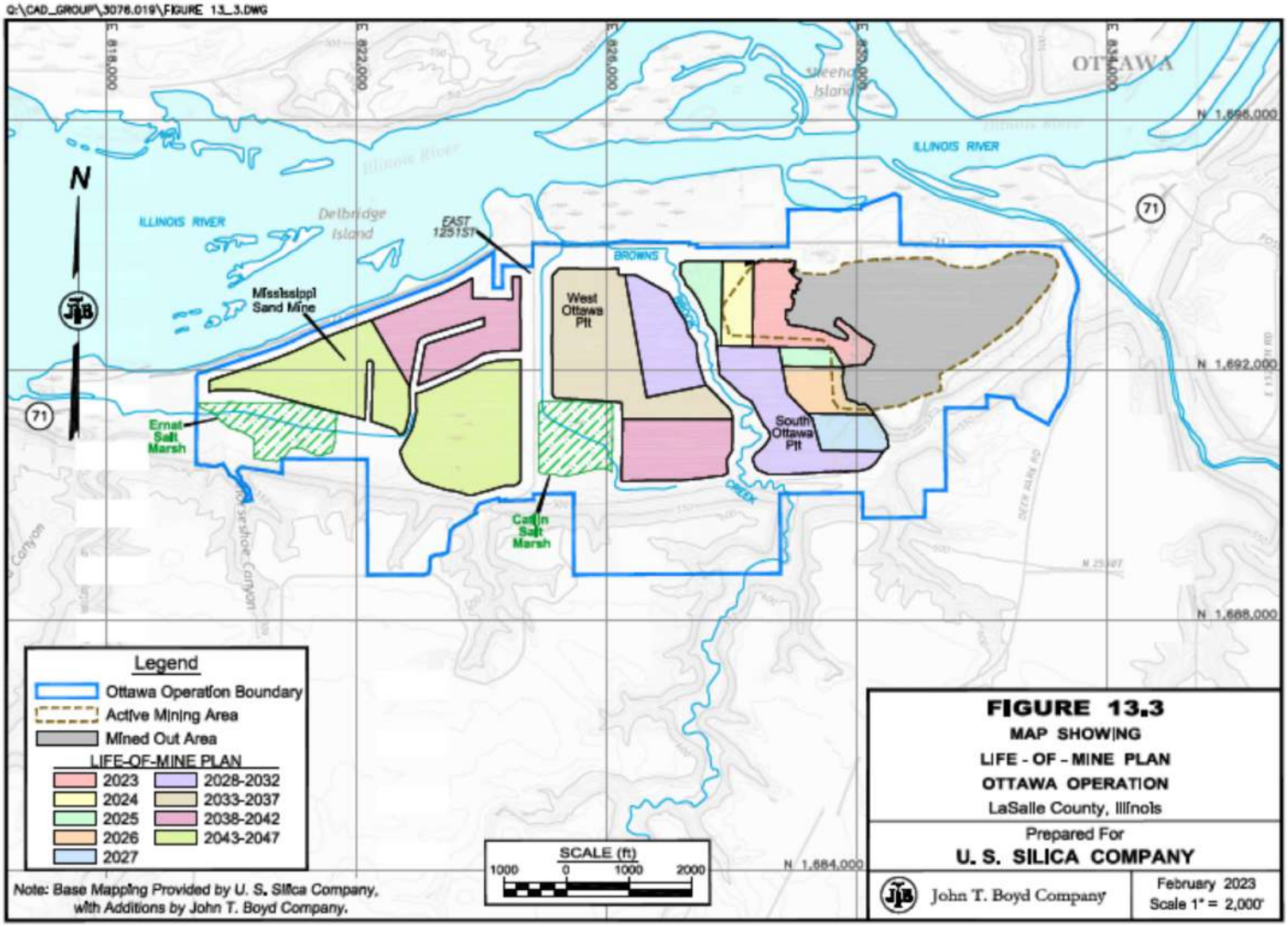


Figure 13.2: Recent Historical and LOM Forecasted Mining Production

The proposed mining sequence is illustrated in Figure 13.3, on the following page. As shown, the proposed mining sequence anticipates that the remaining northern half of the South Ottawa Pit will be mined out over the next three years (by 2025). Production will then shift to the southern half of the South Ottawa Pit and commence in a general north to south, then east to west direction until 2031. At which point, mining on the West Ottawa Pit located on the other side of Browns Brook will commence in an east to west, then north to south direction until sometime prior to 2042. Mining on the Mississippi Sand Mine, located west of the county road bisecting the property, will begin on or before 2042 in an east to west direction and mining will conclude on the south-east corner of the track sometime in 2047. Reclamation will occur concurrently with production as exhausted mining areas are returned to agreed-upon final design.

BOYD reviewed the LOM plans for U.S. Silica's Ottawa Operation to determine whether the plans: (1) utilize generally accepted engineering practices, and (2) align with historical and industry norms. Based on our assessment, it is BOYD's opinion that the forecasted production levels for the Ottawa Operation are reasonable, logical, and consistent with typical sandstone surface mining practices in the St. Peter Sandstone and historical results achieved by U.S. Silica.


Q:\CAD_GROUP\3076.019\FIGURE 13_3.DWG
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OTTAWA
ILLINOIS RIVER
Illinois River
Sheehan Island
Delbridge Island
EAST 1251ST
BROWNS
CREEK
Mississippi Sand Mine
West Ottawa Pit
South Ottawa Pit
Ernat Salt Marsh
Caslin Salt Marsh
71
N
Legend
Ottawa Operation Boundary
Active Mining Area
Mined Out Area
LIFE-OF-MINE PLAN
2023
2024
2025
2026
2027
2028-2032
2033-2037
2038-2042
2043-2047
SCALE (ft)
1000 0 1000 2000
Note: Base Mapping Provided by U. S. Silica Company, with Additions by John T. Boyd Company.
FIGURE 13.3
MAP SHOWING
LIFE - OF - MINE PLAN
OTTAWA OPERATION
LaSalle County, Illinois
Prepared For
U. S. SILICA COMPANY
John T. Boyd Company
February 2023
Scale 1" = 2,000'

14.0 PROCESSING OPERATIONS

14.1 Overview

The Ottawa Operation's processing plant is located on the north shore of the Illinois River. U.S. Silica purchased the plant in 1987, when it acquired the Ottawa Operation. The plant has been upgraded and expanded several times since its initial construction.

The production of finished silica sand begins when the plant receives a slurry of raw sand and water from the mine. From this slurry, multiple products are generated through various wet and dry processing methods. Figure 14.1, on the next page, presents a simplified process flow from the mine to the product distribution.

Currently the plant runs 24 hours a day, 365 days a year and has a nominal capacity of 3.29 million tons of finished sand per year. Plant capacity is limited by the ability to separate fine silica sand and by permit restrictions tied to drying capacity.

BOYD is unaware of any reported interruptions, outages, shortages, or failures related to processing operations which have materially affected the Ottawa Operation. Given the operation is well-established, we believe the risk of such events materially affecting the estimates of silica sand reserves presented herein is low.

14.1.1 Wet Processing Plant

The Wet Processing Plant was originally built in 1975 and underwent expansions in 2009 and 2011. The Wet Processing Plant does not produce any finished goods, but instead supplies feed-materials to other processing operations.

The plant receives its raw sand feed through the slurry pumping system from the mine. The slurry from the mine is passed through a material washer to remove the very fine size fractions (mostly clays) which are too small to include in salable products. These very fine particles, or tailings, are separated from the plant feed and are sent to settling ponds where the water is recovered for future use. From here the plant feed passes through a bank of hydrosizers, hydro-cyclones, and vacuum filters to remove excess water. This water is also reclaimed for future use.

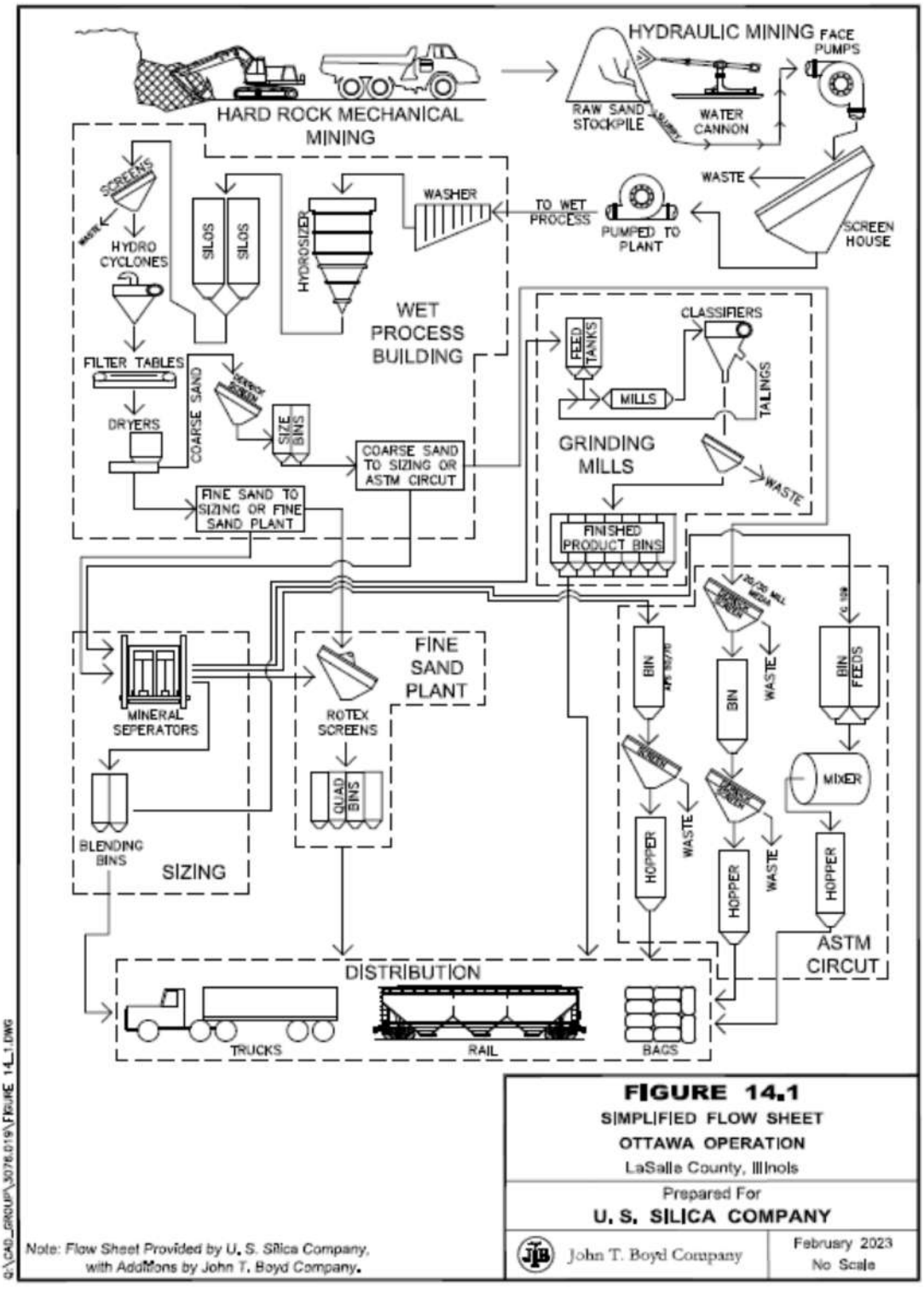

FIGURE 14.1

SIMPLIFIED FLOW SHEET

OTTAWA OPERATION

LaSalle County, Illinois

Prepared For

U. S. SILICA COMPANY

Note: Flow Sheet Provided by U. S. Silica Company, with Additions by John T. Boyd Company.

John T. Boyd Company

February 2023

No Scale

Q:\CAD_GROUP\3076.019\FIGURE 14_1.DWG

By this point, the sand has been separated into coarse and fine particle size fractions which are processed in dedicated, parallel coarse and fine circuits based on the sizes of their intended final use. The wet silica sand streams are then dried in four fluidized bed dryers where the dried silica sand is processed as whole grain silica in the Sizing and Fine Sand Plant or sent to the Grinding Mill for production of ground silica products. One dryer is dedicated to the coarse-sand stream and three to the fine-sand stream.

14.1.2 Sizing and Fine Sand Plant

The Fine Sand Plant was built in the 1950's and is used to produce whole grain silica sand products. Whole grain products are shipped primarily to the foundry, glass, and hydraulic fracturing industries.

Drying of whole grain silica begins by processing portions of the coarse-sand stream and the fine-sand streams from the Wet Processing Plant. This material is then sorted into various size fractions, then prepped for shipment by either a bulk carrier (rail or truck) or is loaded into bags in the bagging plant and warehoused for specific end-use markets.

14.1.3 Grinding Mills

The Grinding Plant was built in the 1940's and utilizes dry ball mills to reduce whole-grain silica sand into ground-silica products for sale to the specialty and composite glass, fused silica, adhesives, and countertop markets. It is also used as a filler and extender for a range of applications including paints and coatings, sealants, ceramics, and epoxy. The products produced as ground silica carry the trademark Sil-Co-Sil™.

The grinding mills process material produced from the coarse-sand stream of Wet Processing Plant or from the Fine Sand Plant. Dried whole grain sand is pulverized in ball mills using ceramic grinding media. The mill discharge is classified into size fractions using air classifiers. The finished products are then moved into storage bins for bulk loading or packaging. The oversize grains are rejected by the classifiers and return to the mill feed for re-grinding in a closed circuit.

14.1.4 ASTM Circuit

The ASTM Circuit produces U.S. Silica's ASTM products. The Ottawa Operation has the distinct advantage of supplying the well-known, highly respected original "Ottawa Silica" that is used for cement and abrasion testing under ASTM 20/30 and ASTM C109. The Ottawa Operation remains the only supplier of fully ASTM-compliant sands in the world.

The ASTM Circuit takes material from the Sizing and Fine Sand Plant and passes it through several screening and blending operations to produce silica sand meeting the rigid specifications required of ASTM products.

14.2 Production

The Ottawa Operation's LOM plan forecasts increased production from the processing plant until the nominal production capacity is reached. Recent annual production results and forecasted production over the expected life of the operation is provided in Figure 14.2, below.

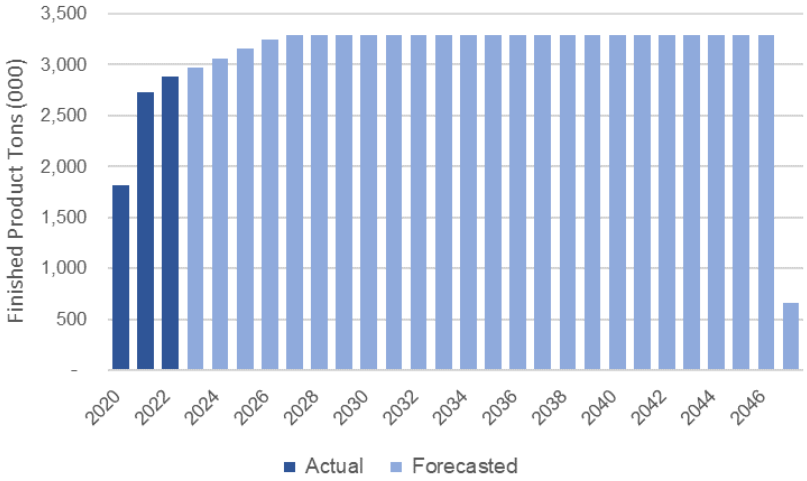

Figure 14.2: Recent Historical and LOM Forecasted Processing Plant Production

14.3 Conclusion

Based on our review, it is BOYD's opinion that the processing methods and existing equipment at the plant will be sufficient for the forecasted production of finished silica sand products.

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15.0 MINE INFRASTRUCTURE

15.1 Overview

The infrastructure required for the ongoing operations is generally in place at the Ottawa Operation. Figure 3.1 (page 3-2) illustrates the general layout of the infrastructure at the Ottawa Operation.

The surface facilities currently located at the operation are well constructed and have the necessary capacity/capabilities to support the Ottawa Operation's near-term operating plans. Operational preference may lead to the upgrading of some existing facilities if the operation expands in the future.

BOYD is unaware of any reported interruptions, outages, shortages, or failures related to infrastructure requirements which have materially affected the Ottawa Operation. Given the operation is well-established, we believe the risk of such events materially affecting the estimates of silica sand reserves presented herein is low.

15.2 Transportation

The Ottawa Operation is serviced by a network of roads maintained by the local municipality, county, and state. These roads are either paved or well-maintained graded roadways. Road access is available year-round.

The Illinois Railway is a former BNSF short line that handles rail car transfer for the processing plant. Empty rail cars are delivered by the railway's owner, OmniTrax, and loaded ones are moved to the CSX interchange located in the City of Ottawa, where they can transfer to the mainline. Access to several other Class 1 railroads—BNSF, Union Pacific, and Norfolk Southern—is also available. The BNSF has a connection with the Illinois Railway at Oswego, IL and Streator, IL. The Union Pacific and Norfolk Southern can be accessed via truck transloading. U.S. Silica leases all its rail cars. Switching and other yard operations are performed by plant personnel with the company's Trackmobile Railcar Movers.

U.S. Silica also has access to several third-party owned barge terminals which are located on the north shore of the Illinois River. The land upon which these terminals are located is owned by U.S. Silica.

15.3 Utilities

Electric power for the processing plant is supplied by Ameren Illinois. It is delivered by an above-ground network of utility poles running parallel with the CSX rail corridor and terminates at a substation located on the west end of the processing facility, directly south of the Dry Product Plant. Power is then distributed to the facility by several underground powerlines and above ground poles. The South Ottawa Pit is supplied with electricity by the Cornbelt Energy Corp.

Natural gas used by the processing plant is currently supplied by NiCor. The gas is delivered by several underground pipes running parallel to the CSX rail line.

Water is used for both personnel consumption and for the mining/processing of the silica sand. Potable water is delivered to the processing plant by the City of Ottawa's public water system. A private well on site at the South Ottawa Pit is used for sanitary needs of the employees there. Water for mining and processing operations is provided by a series of wells drilled at the South Ottawa Pit site. In addition, U.S. Silica has a recycling system where water is recovered from processing and tailings disposal and pumped back to the mine site for reuse. The water for industrial uses is transported by a series of pumps and HDPE pipelines, either as a water/sand slurry mix, or recycled water.

15.4 Tailings Disposal

The mining and processing of silica sand at the Ottawa Operation creates a substantial amount of waste tailings. These tailings are typically a mixture of clay, very fine sand, and other non-silica minerals. Tailings is typically disposed of in ponds (former mining pits) where the solid materials settle to the bottom and water is recovered for reuse.

These tailings ponds are currently located directly to the east of the processing plant in the old mining pits. The existing tailing ponds are designed to accommodate rejects generated during the next 5 to 10 years of production. Once mining has progressed to the West Ottawa Pit, it is anticipated that the former South Ottawa Pit will be back filled with tailings.

15.5 Other Structures

Several other buildings are located on the property, including:

- Office buildings that host operations, safety, financial, and administrative staff.
- Several support buildings for housing machinery and maintenance activities.
- A warehouse for material storage and product bagging
- Several product loadouts.
- Various pump structures and outbuildings.

16.0 MARKET STUDIES

16.1 Product Specifications

The Ottawa Operation is U.S. Silica's largest "blended" operation, supplying various grades of silica sand to both the O&G and the ISP markets. Their finished silica sand products are used in variety of industrial applications by a large customer base. Products sold by the operation include:

- 40/70-mesh and 100-mesh silica sand for oil and gas proppants used in hydraulic fracturing ("fracking"). The availability of rail and barge transportation allows the Ottawa Operation to serve distant markets, including the Bakken, Permian, and Marcellus basins.
- Fine-grain silica sand, called "F-Grade", used in foundry casting.
- 200-mesh sized fine silica sand used as a cement additive for injecting into wells to bond steel casings to the rock.
- Bright, white very fine white silica powder called "Sil-Co-Sil" used for countertops, ceramics, fiberglass, and specialty glass.
- ASTM 20/30 and ASTM C109 compliant sand, called "Ottawa Silica", that is used for cement and abrasion testing. The Ottawa Operation remains the world's only supplier of "Ottawa Silica".

The Ottawa Operation's long history, high quality sand, and robust transportation network allows it to transport product to both industrial and oil and gas markets that would otherwise be uneconomical for similar deposits to enter.

16.2 Historical Sales

Recent historical sales data provided by U.S. Silica for the Ottawa Operation is summarized in Table 16.1, below.

Table 16.1: Historical Sales Data

	Units	2020	2021	2022
Product Sales	000 tons	1,820	2,726	2,888
Average Selling Price	$/ton sold	36.91	34.47	42.37

O&G demand, as well as whole silica demand generally, dropped in 2020 as compared to 2019 due to the COVID-19 pandemic. However, recovery began in the fourth quarter of 2020 and continued throughout 2021 and 2022. In 2020, the average selling price (ASP) was $36.91 per sold ton. In 2021, the ASP dropped to $34.47 per sold ton; however, the ASP rose to $42.37 per sold ton in 2022.

According to sales information provided by U.S. Silica for the Ottawa Operation:

- Sales of whole grain silica sand to the O&G segment account for approximately 60% of total sales. The ISP segment accounts for nearly all of the remaining sales.
- Contract sales account for roughly 45% of total product sales.
- The top-five customer by sales revenue account for approximately 15% of total sales.

BOYD is not aware of any material contracts for the sale of silica sand from the Ottawa Operation.

16.3 Market Outlook

Historically, the Ottawa Operation had been founded in 1900 as a supplier to the ISP markets—more specifically, the glass and foundry industry which was in a state of expansion. As the market grew, the Ottawa Operation has also worked on diversifying to other areas, such as ceramics, cement, and fiberglass.

In the last 20 years, the O&G industry in the United States has exploded in size in response to new technologies for horizontal drilling and the fracking of tight hydrocarbon deposits. The proppants used to help free the oil and gas require a very fine silica sand to prop open the cracks. The sand from the Ottawa Operation was found to be an excellent sand for this purpose due to its high compressive strength and individual grain shapes. As demand for proppant sand grew, the Ottawa Operation underwent several expansions to meet the needs of the O&G market.

Starting in the late 2010’s, to lower costs, oil and gas companies started to look for more locally sourced silica sand. Transportation costs were attractive enough to spur the opening of many new silica sand mines (for example, U.S. Silica’s Crane and Lamesa operations were opened in the Permian Basin in Texas for this reason). In 2020, due to COVID-19 and the collapse of oil and gas prices, sales into the silica sand segment from the Ottawa Operation was significantly reduced. The industrial sand market was affected

as well, but not as greatly. Since late 2020, the oil and gas industry has become a dominant customer once again for the Ottawa Operation. During this same period U.S. Silica has seen an increase in demand from its industrial customers

Having survived the challenging environment of 2019 and 2020, the Ottawa Operation should continue to prove viable into the future notwithstanding a sustained and significant energy price collapse. Their low-cost mining scheme, advantaged transport to select basins, and high-quality product help to create an advantage compared with other silica sand producers.

U.S. Silica expects sustained growth for the Ottawa Operation in both the O&G and ISP segments. Although local sources of proppant sand have been developed and taken some demand away, it is expected that the Ottawa Operation's higher quality products will see increased, although uneven, demand in the O&G industry. The Ottawa Operation's long history and excellent sand quality should continue to drive growth in the ISP segment, especially with growth in demand for consumer goods.

17.0 PERMITTING AND COMPLIANCE

17.1 Permitting

Numerous permits are required by federal, state, and municipal law for mining, processing, and related activities at the Ottawa Operation. U.S. Silica reports that necessary permits to support current and near-term operations are in place or pending approval. New permits or permit revisions may be necessary from time to time to facilitate future operations. Given sufficient time and planning, U.S. Silica should be able to secure new permits, as required, to maintain its planned operations within the context of current regulations.

A description of the salient permitting requirements for the Ottawa Operation follows.

The Illinois Department of Natural Resources (IDNR) requires a Surface Mining Permit for all operations that affect over 10 acres per year by mining or remove more than 10 ft of overburden (soil on top of the rock or mineral being extracted). A Surface Mining Permit application requires the operator to submit an operating plan that illustrates how the land will be affected by mining operations, as well as a reclamation plan that describes how the mined land will be restored for future use. The mine reclamation plan must be submitted for review to the LaSalle County Board. If the County Board requests, a public hearing will be scheduled by the IDNR to receive comments on the proposed reclamation plan. The Ottawa Operation has current IDNR permits (Nos. 1862-12, 1743-15, 1776-17, and 1825-19). In support of these permits, a surety bond was issued to IDNR in the amount of $344,000 for approximately 80 acres of surface mining reclamation.

U.S. Silica maintains a Spill Prevention, Controls and Countermeasure (SPCC) Plan at the Ottawa Operation to address requirements of the federal Oil Pollution Prevention Regulations (40 CFR Part 112). The SPCC Plan establishes oil spill preparedness, prevention, planning, response, and notification procedures per the federal regulations and addresses state-specific oil spill reporting notification and response requirements as administered by the Illinois Emergency Management Agency (IEMA).

Construction of the slurry pipeline, which transports raw sand from the mine to the processing plant under the Illinois River, was authorized by the US Army Corps of Engineers and IDNR as a Nationwide Permit 12 (CEMVR-OD-P-2006-53). In May of 2017, U.S. Silica received approval from IDNR to replace the existing sand slurry

pipeline within their easement under Statewide Permit No. 8 which authorizes the construction of underground pipeline and utility crossings.

IDNR authorized a Mine Refuse Disposal Permit 1947-SP for the slurry refuse disposal area within an approximately 43-acre inactive pit (“A Pit”) located at the North Ottawa site. The permit includes a description of proposed reclamation activities following disposal activities.

U.S. Silica is permitted to discharge stormwater from the Mississippi Sands Mine under National Pollutant Discharge Elimination System General Permit No. ILG840203. No mining has been conducted by U.S. Silica at the Mississippi Sands Mine as of the date of this report.

Individual Permit No. IL0001325, as approved by the Illinois Environmental Protection Agency (ILEPA), authorizes discharge of wastewater from the North and South Ottawa sites. Sampling and reporting requirements include three grab samples monthly reported using the Discharge Monitoring Report system, quarterly visual monitoring, semi-annual monitoring and reporting of metals, arsenic, cyanide and total phenols, and an annual inspection report.

Air emissions resulting from the processing plant at Ottawa are authorized under the ILEPA Clean Air Act Permit Program Permit #95060046. Provisions of the permit include maintenance and calibration of monitoring devices and monthly opacity visible emissions observations.

The Ottawa Operation is classified under RCRA Subtitle C as a Very Small Quantity Generator of Hazardous Waste (EPA ID #ILD155166952), generating less than or equal to 100 kilograms per month of non-acute hazardous waste. Waste classifications handled at the site include D001 Ignitable Waste, D002 Corrosive Waste, and D009 Mercury. U.S. Silica personnel maintain an Illinois Radioactive Material License (#IL-01709-01) through the IEMA.

U.S. Silica maintains a LaSalle County Floodplain Development Permit #2014-12 for construction of an earthen berm within a regulated Special Flood Hazard Area of the Illinois River watershed basin.

17.2 Compliance

U.S. Silica reports having an extensive environmental management and compliance process designed to follow or to exceed industry standards.

In their 2021 corporate sustainability report, U.S. Silica reports:

- Increasing the use of renewable energy sources.
- Improving the quality of local water by utilizing best-in-class tailings management techniques.
- Recycling or reusing tailings waste for land reclamation.
- Partnering with neighbors and local chapters of the North American Bluebird Society to provide safe nesting boxes, food, and other habitat management measures to support the bluebird populations in and around the Ottawa Operation.

Mine safety is regulated by MSHA. MSHA inspects the facilities a minimum of twice yearly. U.S. Silica's safety record compares favorably with its regional peers.

Based on our review of information provided by U.S. Silica and available public information, it is BOYD's opinion that the Ottawa Operation's record of compliance with applicable mining, water quality, and environmental regulations is generally typical for that of the industry. BOYD is not aware of any regulatory violation or compliance issue which would materially impact the silica sand reserve estimate.

17.3 Post-Mining Land Use and Reclamation

Disturbed areas at the Ottawa Operation must be reclaimed in accordance with approved reclamation and abandonment plans. These plans are a condition of U.S. Silica's operating permits and licenses and generally require:

- Landscaping of berms and areas affected by berms.
- Regrading and landscaping of unconsolidated overburden piles and pit highwalls.
- Regrading and landscaping of disused roads.
- Natural flooding of the excavated pits for the creation of lakes.
- Removal of all equipment and product stockpiles.
- All hazardous wastes must be disposed of.

Mine site reclamation costs are funded from U.S. Silica's Asset Retirement Obligations (ARO) account. Funding of the ARO account is included in the Ottawa Operation's operating costs discussed in Chapter 18 and included in the economic analysis

presented in Chapter 19. ARO costs estimates are reviewed annually and current estimated at approximately $5.5 million for the Ottawa Operation. As a matter of good mining practice, U.S. Silica seeks to conduct progressive reclamation throughout the operation’s mining life to minimize risk and costs at closure.

17.4 Community Engagement

The Ottawa Operation has been a fixture in the Ottawa, Illinois community for over a century. U.S. Silica is one of the major employers and economic contributors in the area. BOYD is unaware of any plans, negotiations, agreements with local individuals or groups or commitments to ensure local procurement and hiring.

U.S. Silica’s corporate sustainability report outlines the components of its core community engagement initiatives. It's stated priorities include increasing charitable contributions to organization that support the local community and actively seeking opportunities for volunteering and community engagement.

18.0 CAPITAL AND OPERATING COSTS

18.1 Historical Financial Performance

Table 18.1 summarizes the past three years of financial data for the Ottawa Operation. We remind the reader that the COVID-19 pandemic caused severe economic, market, and other disruptions which began to affect U.S. Silica's silica sand operations in the second quarter of 2020.

Table 18.1: Historical Financials

	Units	2020	2021	2022
Production:				
ROM Production	000 tons	1,953	2,967	3,230
Process Yield	%	93.2	91.9	89.4
Product Sales	000 tons	1,820	2,726	2,888
Gross Revenues	$ 000	67,191	93,961	122,377
Average Selling Price	$/ton sold	36.91	34.47	42.37
Total Cash Costs of Sales	$ 000	53,662	76,614	94,895
Average Cash Cost of Sales	$/ton sold	29.48	28.11	32.85
Capital Expenditures	$ 000	2,182	1,517	5,770

Gross revenues include income from product sales and shipping.

Total cash costs of sales include operating costs (i.e., mining, ongoing reclamation, processing, product loadout, and other related costs) in addition to selling, general, and administrative expenses.

Capital expenditures include maintenance (sustaining) expenses and discretionary spending on continuous improvement projects to drive and maintain cost efficiencies.

Based on the financial data presented above:

- Average realization increased from $36.91 per ton sold in 2020 to $42.37 per ton sold in 2022.
- Total cash cost of sales also increased from $29.48 per ton sold in 2020 to $32.85 per ton sold in 2022.
- EBITDA margin increased slightly from 20.1% in 2020 to 22.5% in 2022.
- Capital expenditures totaled almost $9.5 million over the three years, averaging $1.27 per ton sold.

18.2 Estimated Costs

The production and unit cost estimates provided by U.S. Silica are based on actual past performance and their customary internal budget review and approvals process. Operating volumes are well-defined and understood, as are mining and processing productivities. As such, it is BOYD's opinion that the production and financial projections are reasonable and are likely to be within ± 20% accuracy level.

This section contains forward-looking information related to capital and operating cost estimates for the Ottawa Operation.

There are inherent known and unknown risks and uncertainties associated with all mining operations. These risks, uncertainties, and other factors are not quantifiable, but include or are not limited to, adverse general economic conditions, operating hazards, inherent uncertainties in interpreting engineering and geologic data, fluctuations in commodity prices and prices for operational services, government regulation and political risks, as well as other risks commonly associated with the mining industry.

18.2.1 Projected Capital Expenditures

The Ottawa Operation and related facilities are fully developed and should not require any near-term major capital investment to maintain full commercial production. Historically, the timing and amount of capital expenditures has been largely discretionary and within U.S. Silica's control. Their budgetary allocations for sustaining and discretionary capital expenditures over the next three years is provided in Table 18.2, below.

Table 18.2: Projected Capital Costs

Year	CapEx ($ 000)
2023	4,000
2024	2,135
2025	2,213
Total	8,348

BOYD considers the near-term detailed capital expenditure schedule as presented by U.S. Silica to be reasonable and representative of the capital necessary to operate the Ottawa Operation.

After 2025, capital expenditures are projected to increase 3% per year from 2025's level until the end of operation's life. As the Ottawa Operation is in a steady state of production, the projected capital expenditures are considered reasonable and expected.

18.2.2 Projected Operating Costs

Operating cost estimates were developed based on recent actual costs and considering specific operational activity levels and cost drivers. The estimates consider current and expected labor headcount and salaries, major consumables and unit prices, power costs, and equipment and maintenance costs. The total operating cost estimate includes all site costs related to mining, processing, and general and administrative activities.

In the near-term, U.S. Silica expects their unit operating costs to stay relatively consistent (on an uninflated basis). As such, the projected total cash cost of sales over the life of the mine is $32.85 per ton sold. As the operation is in a steady state, BOYD considers the future operating cost estimates to be reasonable and appropriate.

19.0 ECONOMIC ANALYSIS

19.1 Approach

The economic analysis presented in this chapter was made for the purposes of confirming the commercial viability of the Ottawa Operation's reported silica sand reserves and not for the purposes of valuing U.S. Silica, the Ottawa Operation, or its assets. The economic analysis contains forward-looking information related to the projected operating and financial performance of the Ottawa Operation and therefore involves inherent known and unknown risks and uncertainties, some of which may be outside of U.S. Silica's control. U.S. Silica, as with all mining companies, actively evaluates, changes, and modifies business and operating plans in response to various factors that may affect operational and/or financial results. Actual results, production levels, operating expenses, sales realizations, and all other modifying factors could vary significantly from the assumptions and estimates provided in this analysis. Risk is subjective, as such, BOYD recommends that each reader should evaluate the project based on their own investment criteria.

The financial model used for the purposes of the economic analysis has been prepared in-house by U.S. Silica as part of their annual budgeting process. The model forecasts future free cash flow from silica sand production and sales over the life cycle of the Ottawa Operation using the annual forecasts of production, sales revenues, and operating and capital costs discussed earlier in this report. A DCF analysis, in which future free cash flows are discounted to present value, is used to derive a NPV for the silica sand reserves. Use of DCF-NPV analysis is a standard method within the mining industry to assess the economic value of a project after allowing for the cost of capital invested.

The financial evaluation of the Ottawa Operation has been undertaken on a simplified after-tax basis and does not reflect U.S. Silica's corporate tax structure. NPV is calculated using an after-tax discount rate of 12.5% ($NPV_{12.5}$). Cash flows were assumed to occur in the middle of each year and are discounted to mid-year 2022. Cost estimates and other inputs to the cash flow model for the project have been prepared using constant 2022 money terms, i.e., without provision for inflation. Internal rate of return and project payback were not calculated, as there was no initial investment (sunk costs) considered in the financial model provided herein.

A suite of sensitivities was calculated to evaluate the effect of the main drivers of economic performance, including variations in sales prices, operating costs, and capital costs.

BOYD has reviewed the financial model and its inputs in detail. It is our opinion that the financial model provides a reasonable and accurate reflection of the Ottawa Operation's expected economic performance based on the assumptions and information available at the time of our review.

19.2 Assumptions and Limitations

Cash flow projections for the Ottawa Operation have been generated from the annual forecasts of production, sales revenues, and operating and capital costs discussed earlier in this report. A summary of the key assumptions and limitations is provided below:

- Sales volumes of finished silica sand are expected to increase 3% per annum (limited by processing plant capacity of 3.29 million product tons per year) while maintaining a consistent product mix.
- ROM production requirements are based an expected processing yield of 86.5% (the historic average) and are also projected to increase 3% per annum until plant capacity is reached. Forecasted ROM production is at or below the capacity of the existing mining equipment and related infrastructure.
- Forecasted revenues are based on sales of various grades of finished silica sand with a weighted-average sales price of $42.37 per ton.
- Capital and operating costs are discussed in Chapter 18. Capital expenditures are derived from budgetary allocations for the first three years of the forecast and escalated thereafter at 3% per annum. Unit operating costs are expected to remain relatively constant over the life of the operation at $32.85 per sold ton.
- Taxes are based on:
  - Federal Business Income Tax rate of 21%.
  - Illinois Corporate Income and Replacement Tax rate of 9.5%.
- Buildup of net working capital is equal to 25% of positive cash (operating) margins.
- Depreciation and amortization expenses are estimated as the average of the proceeding three years.
- No asset recovery/salvage values were included in the valuation.

19.3 Financial Model Results

Estimated LOM pre-tax and after-tax cash flows for silica sand production from the Ottawa Operation are presented in Table 19.1, on the following page.

Table 19.1

ANNUAL PRODUCTION AND CASH FLOW FORECAST
OTTAWA OPERATION
Prepared For
U.S. SILICA COMPANY
By
John T. Boyd Company
Mining and Geological Consultants
February 2023

Description	Units	2023	2024	2025	2026	2027	2028 to 2032	2033 to 2042	2043 to 2047	Total
Production:										
ROM Production	000 tons	3,439	3,543	3,649	3,758	3,803	19,017	38,035	15,984	91,228
Product Sales	000 tons	2,975	3,064	3,156	3,251	3,290	16,450	32,900	13,826	78,913
Total Revenues	$ 000	126,052	129,834	133,729	137,741	139,397	696,987	1,393,973	585,797	3,343,511
Average Selling Price	$/ton sold	42.37	42.37	42.37	42.37	42.37	42.37	42.37	42.37	42.37
Total Cash Costs of Sales	$ 000	97,730	100,662	103,682	106,792	108,077	540,383	1,080,765	454,176	2,592,266
Average Cash Cost of Sales	$/ton sold	32.85	32.85	32.85	32.85	32.85	32.85	32.85	32.85	32.85
EBITDA	$ 000	28,322	29,172	30,047	30,949	31,321	156,604	313,208	131,621	751,244
Depreciation & Amortization	$ 000	8,096	7,406	7,001	7,501	7,303	36,573	73,182	36,592	183,653
EBIT	$ 000	20,227	21,766	23,046	23,448	24,018	120,031	240,026	95,029	567,591
Taxes	$ 000	6,169	6,639	7,029	7,152	7,326	36,610	73,208	28,984	173,115
Operating Income	$ 000	14,058	15,127	16,017	16,296	16,693	83,422	166,818	66,045	394,476
Capital Expenditures	$ 000	4,000	2,135	2,213	2,279	2,348	12,839	32,138	20,002	77,954
Net Working Capital Contribution	$ 000	210	212	219	225	93	-	-	-	960
Net Income	$ 000	9,847	12,780	13,585	13,791	14,252	70,583	134,680	46,043	315,562
Pre-tax Cash Flow	$ 000	24,112	26,825	27,615	28,444	28,880	143,765	281,070	111,619	672,330
Discounted at 12.5%	$ 000	22,733	22,481	20,572	18,835	16,998	60,295	50,989	8,400	221,303
After-tax Cash Flow	$ 000	17,943	20,186	20,586	21,292	21,554	107,156	207,862	82,635	499,215
Discounted at 12.5%	$ 000	16,917	16,917	15,335	14,099	12,687	44,950	37,751	6,203	164,859

Table 19.2, below, provides a summary of the estimated remaining life of mine financial results for the Ottawa Operation.

Table 19.2: Financial Results

	Units	Remaining Life of Mine Total
Remaining Life	years	25
Production:		
ROM Production	000 tons	91,228
Product Sales	000 tons	78,913
Total Revenues	$ millions	3,343.5
Total Cash Costs of Sales	$ millions	2,592.3
Capital Expenditures	$ millions	78.0
Pre-Tax:		
Cash Flow	$ millions	672.3
$NPV_{12.5}$	$ millions	221.3
After-tax:		
Cash Flow	$ millions	499.2
$NPV_{12.5}$	$ millions	164.9

DCF-NPV on a pre-tax and after-tax basis, using discount rates of 10%, 12.5% (the base case), and 15%, were calculated utilizing the projected cash flows. Table 19.3 summarizes the results of the pre-tax and after-tax DCF-NPV analyses:

Table 19.3: DCF-NPV Analysis

	NPV ($ millions)		
	10%	12.5%	15%
Pre-Tax	262.0	221.3	190.7
After-Tax	195.0	164.9	142.1

As shown, the pre-tax DCF-NPV ranges from approximately $190.7 million to $262 million. The after-tax DCF-NPV ranges from approximately $142.1 million to $195 million.

The economic analysis confirms that the Ottawa Operation generates positive pre- and after-tax financial results and a real $NPV_{12.5}$ of $164.9 million. As such, it is BOYD's

opinion that the Ottawa Operation's silica sand reserves have demonstrated economic viability.

19.4 Sensitivity Analysis

Table 19.4, below, shows the sensitivity of the project after-tax for a cash flow discounted at 12.5% ($NPV_{12.5}$) to a variation over a range of 20% above and below the base case in: (1) average selling prices and (2) operating costs.

Table 19.4: After-Tax $NPV_{12.5}$ Sensitivity Analysis ($ millions)

Cash Costs of Sales	Revenues									
		-20%	-15%	-10%	-5%	0%	5%	10%	15%	20%
	-20%	131.2	168.5	204.7	241.0	277.2	313.4	349.6	385.8	422.0
	-15%	101.9	139.6	176.7	212.9	249.1	285.3	321.5	357.7	394.0
	-10%	72.7	110.4	148.1	184.8	221.0	257.2	293.5	329.7	365.9
	-5%	43.5	81.2	118.9	156.6	192.9	229.2	265.4	301.6	337.8
	0%	14.3	52.0	89.7	127.4	**164.9**	201.1	237.3	273.5	309.7
	5%	-	22.8	60.4	98.1	135.8	173.0	209.2	245.4	281.6
	10%	-	-	31.2	68.9	106.6	144.3	181.1	217.4	253.6
	15%	-	-	3.3	39.7	77.4	115.1	152.8	189.3	225.5
	20%	-	-	-	10.5	48.2	85.8	123.5	161.2	197.4

As might be expected, the project is most sensitive to changes in product pricing and operating costs. The Ottawa Operation generates negative value only if costs are increased substantially *and* selling prices are reduced dramatically.

The project is less sensitive to capital costs. There is little to no impact varying the capital costs from 70% to 130% of the base case.

This analysis demonstrates the project value to be relatively robust, with positive NPVs reported across the range of values assessed.

20.0 ADJACENT PROPERTIES

There is no information used in this report that has been sourced from adjacent properties. There are no other active silica sand mines in the immediate vicinity of the Ottawa Operation.

21.0 OTHER RELEVANT DATA AND INFORMATION

BOYD is not aware of any additional information which would materially impact the silica sand reserve estimates reported herein.

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22.0 INTERPRETATION AND CONCLUSIONS

22.1 Audit Findings

BOYD's independent technical assessment was conducted in accordance with S-K 1300 and concludes:

- Sufficient data have been obtained through site exploration and sampling programs and mining operations to support the geological interpretations of the sandstone deposit underlying the controlled property of the Ottawa Operation. The data are of sufficient quantity and reliability to reasonably support the silica sand resource and reserve estimates presented in this report.
- BOYD is of the opinion that our data verification efforts: (1) adequately support confirm the reasonableness of geologic interpretations, resource estimation criteria, and economic assumptions, (2) and therefore support the use of the data in silica sand resource/reserve estimation.
- The 78.9 million saleable product tons of silica sand reserves (as of December 31, 2022) identified on the property are reasonably and appropriately supported by technical studies, which consider expected geologic conditions, planned mining and processing operations, forecasted product revenues, and operating and capital cost estimates. As such, BOYD is of the opinion that there are reasonable expectations that the stated silica sand reserves for the Ottawa Operations are technically, economically, and legally extractable as of December 31, 2022.
- In addition to the reported reserves, U.S. Silica controls approximately 88,000 in-place tons of inferred silica sand resources at the Ottawa Operation. It is BOYD's opinion that the stated silica sand resources have been reported using economic and mining assumptions to support the reasonable potential for eventual economic extraction.
- There is no other relevant information material to the Ottawa Operation that is necessary to make this technical report summary not misleading.

22.2 Significant Risks and Uncertainties

As a mining operation with a lengthy operating history, the purpose of U.S. Silica's periodic mine planning exercises is to: (1) collect and analyze sufficient data to reduce or to eliminate risk in the technical components of the project, and to, (2) refine economic projections based on current data. There is a high degree of certainty for this project under the current and foreseeable operating environment. A general assessment of risk is presented in the relevant sections of this report.

23.0 RECOMMENDATIONS

Based on the scope of our assignment, BOYD has no recommendations regarding the Ottawa Operation. It is our understanding that U.S. Silica continuously reviews and improves operating practices as a matter of course.

24.0 REFERENCES

A list of supporting information is provided in Section 2.4. Additional references are cited as footnotes in the report as required.

25.0 RELIANCE ON INFORMATION PROVIDED BY REGISTRANT

In the preparation of this report, BOYD has relied, exclusively and without independent verification, upon information furnished by U.S. Silica as presented in Table 25.1, below.

Table 25.1: Information Relied Upon from Registrant

Subject Matter	Information	Report Chapter(s)
Environmental	Permits, bond, and reclamation liability	3, 17
	Sustainability initiatives	17
	Surface tailings management	15
	Mine closure requirements and plans	17
	Monitoring/compliance requirements for protected areas/species	3, 17
Governmental	Income tax rates	19
Legal	Property title and status	3
	Encumbrances, easements, and right-of-ways	3
Macroeconomics	Inflation, interest, and discount rates	19
Markets	Market overview and strategy	16
	Long-term product price projections	11, 12, 16, 19
	Product specifications	16
	Marketing and sales contracts	16
Social	Community relations	17

BOYD exercised due care in reviewing the information provided by U.S. Silica within the scope of our expertise and experience (which is in technical and financial mining issues) and concluded the data are reasonable and appropriate considering the status of the subject properties and the purpose for which this report was prepared. We have no reason to believe that any material facts have been withheld or misstated, or that further analysis may reveal additional material information. However, the accuracy of the results and conclusions of this report are reliant on the accuracy of the information provided by U.S. Silica.