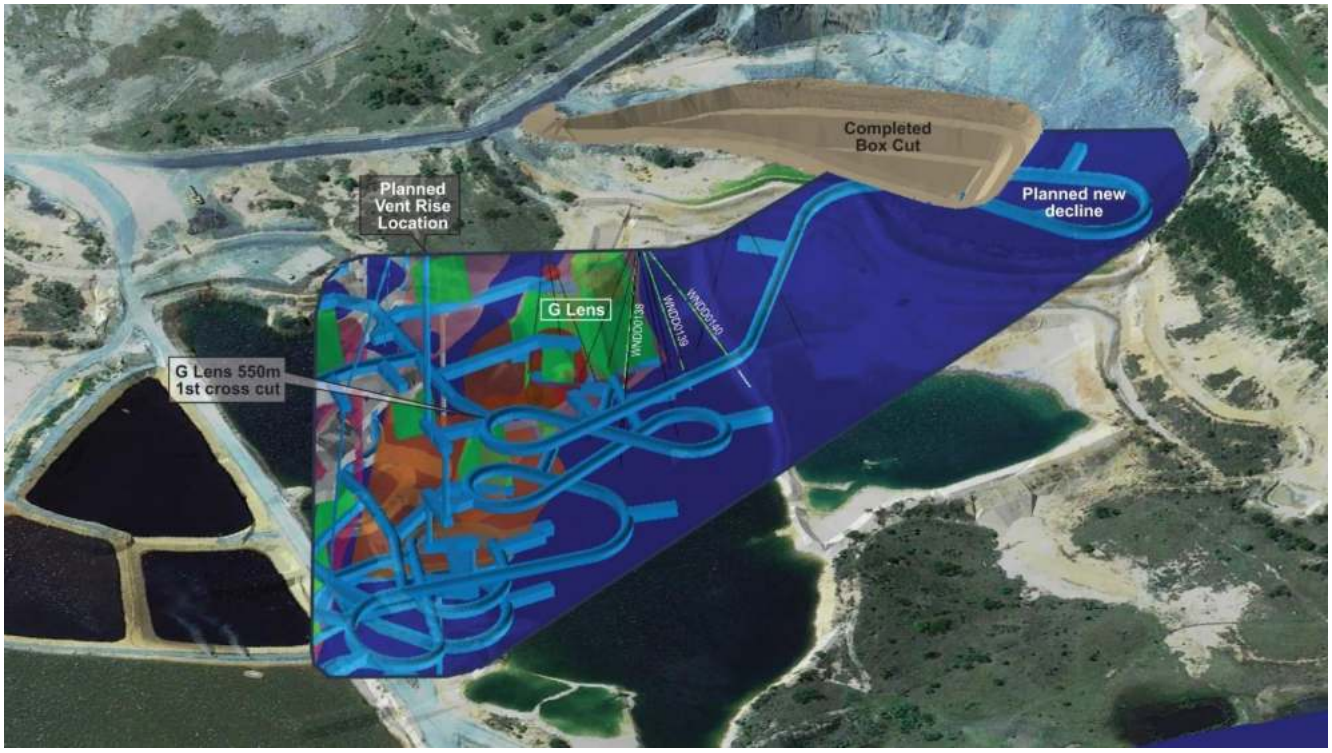
Heron Resources Limited

Woodlawn Zinc – Copper Project

Water Management Plan



Document Control Details

DOCUMENT DETAILS	Name:	Water Management Plan
	Author:	Rob Byrnes
	Reference:	TOP-SSE-MAN-0048
	Revision No.:	11
	Document Status	Operational

REVISION DETAILS	Revision No.	Date	Details of Revision	Reviewed By	Approved By
	1	10/1/15	Initial draft	HS	HS
	2	18/11/15	Issue to WaterNSW	HS	HS
	3	18/12/15	Issue to DPI Water	RB	AL
	4	23/03/15	Update with DPI comments	RB	AL/HS
	5	26/05/16	Issue to EPA, WaterNSW, DPI-Water, DRE, Infigen and Veolia	RB	AL
	6	12/9/16	Issue to Department of Planning and Environment	RB	AL
	7	20/2/17	Incorporation of agency comments	RB	AL
	8	11/4/17	Further DPE comments	RB	AL
	9	11/5/17	Operational	RB	AL
	10	2/8/17	Amendments for MOD2	RB	AL
	11	6/11/18	2018 Update	RB	AL

CIRCULATION DETAILS	Name	Department/Organisation
	Heath Sandercock	Heron Resources
	Andrew Lawry	Heron Resources
	Brian Hearne	Heron Resources
	Andrew Dawkins	GeoTerra Pty Limited
	Fran Kelly	WaterNSW
	David Stephens	DPI-Water
	Henry Gundry	Veolia Environmental Services
	Julian Thompson	Environment Protection Authority
	Chris Hammersley	Department of Industry Division of Resources and Energy
	Kelvin Lambkin	WaterNSW
	Stephen Shoesmith	Department of Planning and Environment
	Phillipa Duncan	Department of Planning and Environment

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1 INTRODUCTION

1.1 Purpose

This Water Management Plan (WMP) has been prepared for Heron Resources Limited's (Heron) Woodlawn Project (the Project) in accordance with Schedule 4, Condition 4, of the Project Approval 07_0143MOD2. Previous versions of this WMP covered specific issues relevant the construction phase, development of the box cut and portal, underground decline and refurbishment of the existing underground roadways to enable underground drilling of the target resource. As construction is nearing completion, this WMP also includes initial operations and provides further information on the current mine dewatering strategy as required under Heron's Environmental Protection Licence 20821 and the additional Water Access Licence issued by DPI-Water.

This WMP builds on the commitments made in the Environmental Assessment (EA) and provide further details on the measures to be implemented during the construction and operational phases of the project to ensure that the project's actual environmental impacts are consistent with those evaluated in the EA. The WMP also provides the mechanism to ensure that the commitments given at the planning and assessment phase are carried through to the construction and operational phases.

The WMP forms one component of the overall Environmental Management Strategy (EMS). The EMS includes a number of commitments and component management plans which together form the basis for the ongoing operation of the Woodlawn Mine.

As with any development project, changes will arise throughout the construction and operational phases. The EMS and component management plans will be updated as required to reflect any changes to the development project. Versions 2 to 8 incorporated comments made by government agencies during the initial review process. Government stakeholders included WaterNSW, DPI-Water, DPE, EPA and the Resources Regulator. Version 9 represented the approved operational WMP which was amended in August 2017 to include MOD2. This version represents an annual update.

1.2 Scope

This WMP covers the construction and initial operation of the project including:

- ❒ Mobilisation of construction equipment.
- ❒ Initial surface disturbance and construction area set up.
- ❒ Earthworks and required erosion and sedimentation controls.
- ❒ Erection of temporary buildings and contractors facilities.
- ❒ Erection of permanent buildings, hardstand and processing facilities.
- ❒ Construction of the new Tailings Storage Facility 4.
- ❒ Construction of the portal and underground entry area including paste fill plant.
- ❒ Mine dewatering and dewatering strategy.
- ❒ Development of the new underground decline.
- ❒ Establishment of a waste rock emplacement.
- ❒ Temporary and permanent revegetation work.
- ❒ Commencement of underground mining.
- ❒ Commencement of Tailings Retreatment.
- ❒ Processing of ore and production of concentrates.

Modifications to this plan will be required for the ongoing operation of the tailings retreatment and underground mining components. The Water Balance in particular will undergo regular reviews as the mine moves into production phases.

The overall objectives for the WMP are to:

- ❒ Implement the commitments made in the EA including specific conditions of approval and the Statement of Commitments.
- ❒ Ensure compliance with relevant environmental legislation, including the Project Approval, Environment Protection Licence, Mining Lease and water licensing.
- ❒ Manage environmental risks associated with the Woodlawn Project.
- ❒ Provide for continuous improvement in environmental performance.
- ❒ Provide a mechanism to identify and correct areas of non-compliance.

1.3 Consultation

This Plan has been formulated through a process of consultation with government and non-government organisations. A consultation log is provided in Appendix D which will be updated as required during the construction and ongoing operation of the Woodlawn Mine.

1.4 Key Personnel and Responsibilities

Management responsibility for the Woodlawn Mine will be as follows.

Table 1.1 - Key Mine Personnel

Position	Personnel	Company	Responsibility	Contact Details
Managing Director	Wayne Taylor	Heron	Overall responsibility for the construction and operation of the Woodlawn Project	02 9119 8111
Chief Operating Officer	Andrew Lawry	Heron	Responsible for project delivery and operations	02 9119 8111 02 4816 6341
General Manager	Brian Hearne	Heron	Conduct of mining operations	02 4816 6344
Mine Manager	Simon Fitzgerald	Heron	Mine Planning and Design	02 4816 6323
General Manager – Exploration and Geology	David von Perger	Heron	Resource evaluation	02 9119 8111 08 6500 9202
Environmental Officer	Dr Zoe Read	Heron	On site environmental management	02 48166335
Environmental Consultant	Robert Byrnes	IEC	Conduct of environmental management and compliance	02 4878 5502

Additional mining and processing operator positions are currently being filled as the mine transitions from construction to operation. These positions will include Manager of Mechanical Engineering, Manager of Electrical Engineering and Ventilation Manager.

1.4.1 Responsibility

The **Managing Director** has overall responsibility for the implementation of the EMS at Woodlawn Project as well as to review and approve expenditure and resources necessary to effectively implement the EMS and individual management plans.

The **Chief Operating Officer (COO)** reports to the Managing Director and is responsible for Project delivery and ultimate development and operation of the Project.

The **Project Manager** will ensure that the approved management provisions and requirements of the individual Environmental Management Plans (EMPs) and commitments are implemented. The Project Manager will review and evaluate the performance of the EMS program and environmental protection initiatives. This role may be merged with the Mine Manager during the construction period prior to commissioning.

The **Construction Manager** will be responsible for the day to day management of the construction workforce, implementation of the Construction EMP and report directly to the Project Manager.

The **Mine Manager** is responsible for the day to day management of the mine and overview role for environmental management systems on site, which will include:

- ❒ Ensuring compliance with environmental requirements for the site.
- ❒ Represent the on-site contact officer under the Environment Protection Licence and other statutes.
- ❒ Report to the COO on a monthly basis on the environmental performance of mine.
- ❒ Liaise with the Environmental Officer on environmental matters as required.

The **Environmental Manager** will provide the following assistance with the EMS:

- ❒ Provide technical assistance on environmental matters to the Mine Manager.
- ❒ Undertake the necessary environmental monitoring program.
- ❒ Organise external environmental experts as required.
- ❒ Organise external environmental audits of the site on an annual basis.
- ❒ Develop Corrective Action Programs in consultation with the Mine Manager and monitor their implementation.
- ❒ Develop and implement an Environmental Training Package for the Mine.

1.4.2 Company Structure

The Woodlawn Project will be developed by Tarago Operations Pty Limited, a wholly owned subsidiary of Heron Resources Limited (Heron) which merged with TriAusMin Limited which was the original proponent for the Project.

The Woodlawn Project is being developed as a “greenfield project” despite its long history and existing infrastructure. The construction program is managed by Heron using construction contractors. Once commissioned, the new facility will be operated by Heron through its subsidiary Tarago Operations.

1.5 Legislative Requirements

Of relevance to the Woodlawn Mine Project is the following legislation.

Mining Act 1992 – This Act covers the exploration and extraction of the State's resources having regard to the need to encourage ecologically sustainable development. It provides a framework for compensation to landholders for loss or damage resulting from such operations and requires the payment of security to provide for the rehabilitation of mine sites, effective rehabilitation of disturbed land and water, and ensures mineral resources are identified and developed in ways that minimise impacts on the environment.

Environmental Planning and Assessment Act 1979 – Provides the primary approval path for mining projects and sets environmental management and reporting conditions as part of the approval. For new mining approvals, it also provides an integrated approach to other mining related approvals. Woodlawn Mine holds Project Approval 07_0143 covering its development and operations. The Project Approval requires that a Construction Management Plan be prepared prior the commencement of construction.

Protection of the Environment Operations Act 1997 (POEO Act) - The POEO Act is administered by the Environment Protection Authority (EPA) and requires licensing for environmental protection, including waste generation and disposal, water, air and noise pollution. Under the POEO Act, an EPL is required for the Woodlawn Mine as it is defined as a scheduled activity. EPL 20821 has been issued by the EPA and is provided as Appendix C. The site has now been divided between EPL 11436 held by Veolia Environmental Services (Australia) Pty Limited (Veolia) and a separate part of the site by Infigen as shown on Plan 5.

Protection of the Environment Legislation Amendment Act 2011 – The POELA Act requires the preparation and implementation of a pollution incident response management plan. Pollution Incident response procedures are included in this Plan.

Water Management Act 2000 and Water Act 1912 - The Water Management Act 2000 (WMA) and the Water Act 1912 are administered by the Department of Primary Industries-Water and contain approval requirements for some developments to protect watercourses from any adverse effects resulting from works within or in proximity of these watercourses and to administer the taking of groundwater. Woodlawn is subject to the WMA and Veolia holds a Water Access Licence under the WMA under agreement with Heron.

Contaminated Land Management Amendment Act 2008 – This Act provides regulatory controls to ensure that land is not allowed to be put to an inappropriate use given its land use history and that processes are put in place to identify and investigate any contamination at an early stage in the environmental planning and assessment process. Any necessary remediation can therefore be made an integral part of any redevelopment and rehabilitation activities at the cessation of mining.

Waste Avoidance and Resource Recovery Act 2001 - This Act replaces the Waste Minimisation and Management Act, 1995. The purpose of the Act is to encourage the most efficient use of resources and to reduce environmental harm in accordance with the principles of ecological sustainable development. The Act provides for the making of policies and strategies to achieve these ends. It is an offence under the POEO Act to wilfully or negligently dispose of waste in a manner that harms or is likely to harm the environment.

Environmentally Hazardous Chemicals Act 1985 and Regulation 2008 - This Act prohibits the manufacturing, processing, keeping, distributing, conveying, using, selling or disposing of an environmental hazardous chemical or waste (prescribed activity) except under the provisions of a chemical control or a licence. The EPA is required to prepare inventories of environmentally hazardous chemicals and declared chemical wastes. The construction program will involve the use of explosives and diesel but otherwise it is unlikely that hazardous chemicals will be stored on site. An inventory of chemicals used during the construction program will be kept on site at all times.

Roads Act 1993 – All product concentrate produced at Woodlawn will be transported by road to either Port Kembla or Port Botany. Local roads leading to the Hume Highway are covered by the Roads Act and works and will be subject to a Road Transport Protocol in accordance with Condition 26 of the Project Approval. The

Protocol requires monitoring of the trucking and be prepared in consultation with Council and Roads and Maritime Services.

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011 – this policy replaces the Drinking Water Catchments Regional Environmental Plan No 1 and specifically requires all proposed development in the Sydney drinking water catchment to demonstrate a neutral or beneficial effect on water quality.

1.6 Project Approval Requirements

The Woodlawn Project received Project Approval on 4th July 2013 with subsequent modifications received on 22nd April 2016 and 6th July 2017. The approval was obtained under the provisions of Part 3A of the Environmental Assessment Act 1979 and following the public exhibition of an Environmental Assessment document.

The EA contained a number of environmental commitments while the Project Approval was also subject to conditions. Specifically, the conditions and Proponent commitments relating to the preparation of a Water Management Plan is as follows:

Table 1.2 - Consent Conditions Relating to the Water Management Plan

Condition	Interaction with Construction	Where Addressed
Sch 4 Condition 4	The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Director-General.	This Plan
	This plan must be prepared in consultation with EPA, Department of Primary Industries Water, Water NSW, Infigen Energy and Veolia, by suitably qualified and experienced persons whose appointment has been approved by the Director-General, and submitted to the Director-General for approval prior to the commencement of mining operations under this approval.	Document Control details. Advice provided to DPE in relation to selected consultants
Condition 4(a)	Include a Site Water Balance that includes details of: sources of water supply; ❒ water use on site, including any potable water use; ❒ water transfers to/from the site; and ❒ any off-site water discharges.	Chapter 2 Section 2.2 Section 2.3 Section 2.4
Condition 4(b)	Includes a Surface Water Management Plan which includes: ❒ baseline data on surface water flow and quality in natural waterbodies that could be affected by the project; ❒ a detailed description of the surface water management system on the site, including the: - clean water diversions; - erosion and sediment controls; - water storage structures; and - tailings and evaporation dams.	Chapter 3 Section 3.1 Section 3.2 Section 3.2.1 Section 3.4 Section 3.2.2, 3.5 Sections 3.2.4, 3.2.5, 3.2.6
Condition 4(c)	Provides design objectives and performance criteria for the following:	Section 3.3

	- the surface water management system; - tailings and evaporation dams; and - waterbodies that could be affected by the project; ❒ a program to monitor: - the effectiveness of the water management system; - surface water flows, quality, and impacts on other water users; - potential acid rock drainage from the waste rock dumps; - potential seepage from tailings and evaporation dams; and - post-closure water quality;	Section 3.4 Section 3.5 Section 3.1 Section 5.1 Section 5.1 Section 3.6.2 Section 5.1 Section 5.1
Condition 4(d)	Groundwater Management Plan, which includes: ❒ baseline data of all groundwater levels, yield and quality of any privately-owned groundwater bores that could be affected by the project; ❒ groundwater assessment criteria; ❒ definition of areas of existing groundwater contamination; ❒ a program to monitor: - existing groundwater contamination indentified on the site; - impacts on the groundwater supply of potentially affected landowners; - the volume of groundwater inflow into the underground workings; - regional groundwater levels and quality in potentially affected aquifers; - potential groundwater quality impacts from paste fill operations; - potential acid rock drainage; - potential seepage from tailings and evaporation dams; and - the effectiveness of the seepage collection, treatment and storage system associated with the tailings dams, waste rock dumps, evaporation dams and all other water storages that receive contaminated or salt-laden water;	Chapter 4 Section 5.1 Sections 4.1, 4.2 Section 4.6 Section 4.5 Section 4.5.1 Section 4.5.1 Section 4.5 Section 3.2.3 Section 4.3.1 Section 4.3.2
Condition 4(e)	a Surface and Ground Water Response Plan that includes: ❒ trigger levels for investigating any potential adverse surface water and groundwater impacts of the project, including but not limited to seepage of contaminated water from the tailings dams, waste rock dumps, evaporation dams and the Woodlawn Landfill (VES Bioreactor); ❒ a protocol for the investigation, notification and mitigation of existing groundwater contamination on the site and any exceedances of the surface water and groundwater assessment criteria; ❒ measures to mitigate and/or compensate potentially affected landowners (including compensatory water supply if required);	Section 3.9 Section 4.5 Section 4.6 Section 4.5.1 Section 4.5.1

	❒ the procedures that would be followed to determine any appropriate action to be taken to mitigate or offset any surface or groundwater impacts caused by the project that constitute material harm to the environment.	Section 4.6
Condition 4A Table 3	The Proponent shall comply with the performance measures in Table 3 to the satisfaction of the Secretary Water Management - General: ❒ Minimise the use of clean water on site Erosion and Sediment - General: ❒ Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries Chemical and hydrocarbon storage: ❒ Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards Paste Fill Plant ❒ Design, install and maintain the paste fill plant to minimise potential for uncontrolled flows of tailings, materials, chemicals or waters (including but not limited to bunding of the tailings storage tanks).	Section 2.1 Section 2.2 Section 3.4 Section 3.2 Section 3.2
Sch 6 Condition 3	The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
3a	a description of: ❒ the relevant statutory requirements (including any relevant approval, licence or lease conditions); ❒ any relevant limits or performance measures/criteria; ❒ the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 1.5 Section 3.3 Section 3.9 Section 5.1 Section 5.2
3b	a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria	Entire Plan
3c	a program to monitor and report on the ❒ impacts and environmental performance of the project; ❒ effectiveness of any management measures (see b above);	Section 5.1 Section 5.9
3d	a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible	Section 5.5 Section 5.6 Table 5.1
3e	a protocol for managing and reporting any: ❒ incidents and complaints; ❒ non-compliances with statutory requirements and exceedances of the impact assessment criteria and/or performance criteria;	Section 5.12 Section 5.8 Section 5.5

3f	a protocol for periodic review of the plan.	Section 5.9
Statement of Commitments Item 3B	Development of a Water Management Plan which includes the following measures: ❒ minimise surface disturbance ❒ reuse sediment laden water where possible ❒ collect and contain all potentially contaminated water for re-use on-site (including collecting and containing water in ED1, ED2, ED3S,and water from underground workings for re-use) ❒ provide settling ponds allowing suspended particles in sediment laden water to settle. The WMP would fully integrate with Veolia's Woodlawn Site Water Management Plan, with the following features: ❒ Drainage from the proposed processing facility and associated areas would be directed to the process water dam to ensure potentially contaminated water is contained. ❒ Diversion embankments and drains would be constructed around the proposed processing facility to divert clean, uncontaminated surface water run-off back to the Hickorys Paddock drainage. ❒ Any saline water dewatered from the WUP would be contained within evaporation dams (ED1 and ED2). ❒ The surface water run-off from the local catchments of the TDS, TDN and TDW would be contained within these dams.	 Section 3.2.1 Section 2.1 Section 2.1 Section 3.4.5 Section 3.4.7 Section 3.2 Section 2.2 Section 3.5.1 Section 3.2.1 Section 3.7 Section 3.2.4
Statement of Commitments Item 3C	Surface water monitoring would be conducted at the existing Crisps Creek stations. Parameters of the monitoring would be in accordance with Veolia's existing monitoring program.	Sections 3.1 and 5.1
Statement of Commitments Item 3D	Additional surface water monitoring locations would be installed at the new tailings dam (TSF4) and the lowest drainage point north of the Project Site (north of the proposed processing facility). Parameters of the monitoring would be in accordance with Veolia's existing monitoring program.	Section 3.1 and attached as Appendix C
Statement of Commitments Item 3E	A seepage collection dam would be constructed for the proposed new tailings dam (TSF4). This would enable the capture of potential seepage from the TDN, which would then be pumped back into the tailings area.	Section 3.2.5
Statement of Commitments Item 3F	Sufficient free board allowance (the height of the dams above the water level) would be maintained throughout the operational life of the Project to prevent overflows during a 1:100 annual recurrence interval (ARI) event of 72 hours duration.	Section 3.2.5 Section 3.5
Statement of Commitments Item 3G	All hydrocarbon and chemical handling facilities would have impermeable surfaces and bunding capable of containing 110% of the largest tank's capacity.	Section 4.3.1
Statement of Commitments Item 3H	All processing related reagents and hydrocarbon products would be securely stored.	Section 3.2

Statement of Commitments Item 3I	In the case of a major hydrocarbon spill on an unsealed area, the contaminated soil at the site of the spill would be collected and transported to an approved waste depot or remediated safely on-site. Pits would be constructed downstream of any spill with sufficient hydraulic gradient to capture seepage water and contaminated material, enabling the pits to be pumped out.	Section 3.8
Statement of Commitments Item 3J	Existing groundwater bores would continue to be monitored for signs of contamination. New groundwater monitoring bores would be installed south and downstream of the TDS, north of TSF4 and south-west of the waste rock dump, as identified in Chapter 6 of this EA. This monitoring would be undertaken in conjunction with Veolia.	Section 4.2
Statement of Commitments Item 3K	Monitoring and investigations would be undertaken progressively to confirm (and if needed) manage the contaminated plume that is potentially emanating from existing ED1 and ED2. Investigations would identify and/or clarify leakages within these evaporation dams. Any leakages from these dams with potential to cause remobilisation of contaminated plumes in shallow subsurface aquifers or Crisps Creek would be repaired as soon as practicable.	These investigations are currently underway and the results will be provided in the Annual Review when available. Should additional work be required these will be included in a revision to this WMP
Statement of Commitments Item 3L	Monitoring of waste rock geochemistry and groundwater would be undertaken at regular intervals during the Project operation, as part of a comprehensive test program to monitor acid mine drainage (AMD) at strategically selected locations across the Project Site.	Section 3.6
Statement of Commitments Item 3M	Water sources for the Project would be limited to the use of water from: ❒ priority source: reuse of stored water within storage dams on-site ❒ secondary source: the existing water licence held by Veolia (under the *Water Act 1912*) for use of water from the Willeroo Borefield.	Section 3.7
Statement of Commitments Item 3N	A tailings thickener would be added to the processing plant to further reduce the water required to process the ore and tailings. The processed tailings would be thickened to a slurry density of at least 54 % solids before being placed in TSF4.	Section 3.2.5
Statement of Commitments Item 3O	Water usage from the borefield would be monitored to ensure licence limits are not exceeded.	Section 2.1
Statement of Commitments Item 3P	If extraction from the borefield results in reduced aquifer yields for surrounding users, Heron would investigate the options of: ❒ supplying affected groundwater users in the surrounding borefield with the Proponent's groundwater extraction, and / or ❒ deepening existing bores to intercept groundwater lower in the aquifer to re-instate the previous yield.	Section 4.5.1 Section 4.5

1.7 Project Summary

From a surface water management perspective, the new infrastructure being constructed in Hickory's Paddock is relevant for the construction program. However the new box cut and portal, paste fill plant, haul road to the new processing plant and dewatering activities have also been included along with the tailings retreatment component. These components lie within the existing water management system of the site which effectively captures dirty water in a series of channels which discharge into various on site water storages. The construction activities cover areas located within the existing site water management system and new areas that require additional water pollution controls. This will include appropriate bunding around the paste fill plant area which will be separate to the processing plant facilities.

The new area in Hickory's Paddock includes the processing plant, ore stockpiles, crushing and handling infrastructure, Tailings Storage Facility 4 (TSF4), offices, car park and access roads. This area requires additional water management controls.

The Project will require the ongoing use of water for tailings recovery, ore processing, surface and underground dust suppression and paste manufacture. The underground mine will also require the initial dewatering of the existing underground workings followed by ongoing dewatering to access new extraction areas.

Although the site has an established water management system which catered for the original mine operation, the system has been modified to cater for Veolia's Bioreactor facility. A greater use of recycled water is therefore proposed and will be facilitated by the inclusion of a water treatment plant to minimise the use of clean uncontaminated water on site.

1.8 Report Structure

This Water Management Plan has been divided into four components, namely the:

- ❒ Site Water Balance found in Chapter 2;
- ❒ Surface Water Management Plan found in Chapter 3;
- ❒ Groundwater Management Plan found in Chapter 4;
- ❒ Verification and Corrective Action found in Chapter 5.

Diagrams covering the overall site, specific water management structures and monitoring sites are provided in Appendix A - Plans.

This Water Management Plan (WMP) covers both construction and operational phases of the Project but will require further revision during the operational phase while the water balance modelling is being refined and verified with ongoing data. This version of the WMP also covers specific activities relevant to the construction phase which will not be relevant once the Project is operational. The water supply and recycling system however, will be progressively augmented as the mine transitions into the operational phase.

2 SITE WATER BALANCE

2.1 Sources of Water Supply

The primary sources of water for the construction and operation of the Woodlawn Mine Project are:

- ❒ Willeroo Borefield which is connected to the site via the Woodlawn Dam.
- ❒ Recycled water from the evaporation dams.
- ❒ Recycled water from existing and new onsite pollution control dams.
- ❒ Return water from the tailings dams.
- ❒ Groundwater ingress into the underground workings including initial dewatering activities.
- ❒ Recycled water from Veolia's operations including treated leachate.
- ❒ Rain water tanks.
- ❒ Treated sewage and grey waters.
- ❒ Trucked potable supplies.

The Woodlawn Mine will not have a connection to the town water supply and therefore needs to remain fully self-sufficient. Each water source will have specific uses and appropriate treatment options suitable for the intended use. Water will be categorised according to its intended use and initial water quality. A key feature of the water management system is to minimise the use of clean water onsite. Records will be kept of water usage on site and the volume of water from each supply source. This data will be used to refine the Water Balance.

Treatment methods will include:

- ❒ Nothing in the case of the return water from the tailings dams and use by the water monitor (water cannon used to mine the tailings).
- ❒ Simple settlement of solids within pollution control dams prior to use in dust suppression.
- ❒ pH adjustment for process water sourced from dams containing acidic water.
- ❒ Filtration for water sourced from rainwater tanks.
- ❒ Packaged water treatment (reverse osmosis) for process water blending, potable or domestic purposes from a variety of onsite sources.
- ❒ Removal of organics in the case of treated leachate from Veolia prior to reuse in the processing plant or other purposes.
- ❒ Blending of water from different sources to achieve the required quality for an intended end use.

Potable water is available at the new Heron office and is trucked in by licensed contractor and stored in above ground tanks. The main construction workforce are located in demountable buildings which are also supplied by potable water delivered to site.

Water for dust suppression is generally sourced from the existing enlarged pollution control dam at the base of the construction site. This dam contains stormwater runoff from the construction site and will be preferentially used as the main raw water source for construction. Once operations commence, water contained in this dam will be used for ongoing dust suppression and washdown.

Additional raw water is available from the Fresh Water Dam (FWD) on the western side of the Rehabilitated Waste Rock Dump (RWRD). Other water sources are available but usage will be restricted if water quality is not suitable for land application.

Construction on the main processing site is now nearing completion and the construction workforce has reduced from a maximum of 200 to less than 50. Towards the end of the construction phase, the water treatment plant will be commissioned which will be used to provide general ablution water. This will reduce the volume of potable water to drinking and showing water quantities only.

Construction of the processing plant includes the connection of a pipeline from the FWD to the Hickory's Paddock site for use as makeup water for the processing equipment. The Fresh Water Dam is connected to the licensed Willeroo borefield and the pipeline and pumping system will remain as is. Other raw water pipelines will be re-established from the evaporation dams as well as new feed lines from the tailings dams as part of the tailings retreatment project. The process plant will incorporate a water treatment facility to treat legacy water currently on the site as well as mine water. Water treatment will be to a level for processing purposes. The Project will maximise the amount of water recycling around the site and will preferentially use on site storages.

2.2 Water Usage on Site

During the initial construction phase, no more than 50 people were on site at any one time. This increased during the earthmoving phase and the construction of the overland haul road, box cut and new mine entry, when potable water usage was approximately 3,500 litres per day (L/d) and dust suppression and non-potable uses accounted for around 20,000 litres per week.

Peak demand for dust suppression occurred during late summer 2018 with over 800,000 L/d used by three water trucks with additional water used for clay compaction. Peak potable usage was 25,000 L/d but with an average of 12,000 L/d which was trucked to the site and stored in above ground tanks. Raw water for dust suppression is sourced from the existing water cart truck filling station which is supplied by the FWD and a new filling station adjacent to the main pollution control dam for the processing site.

The processing site is now directly connection to the Willeroo Borefield supply via the Woodlawn Dam tank. This supply is considered clean and will be minimised as far as practicable by maximising the use of recycled or reprocessed water for all uses other than potable purposes.

Process water demand will arise for the following purposes:

- ❒ Process water make up.
- ❒ Reagent mixing and services.
- ❒ Flocculant dilution.
- ❒ Cloth washing in filtration.
- ❒ IsaMill flush and gland seal.
- ❒ OSA flushing water.
- ❒ Paste plant services.
- ❒ Gland water.
- ❒ Potable water treatment plant feed.

A combined fire water/process/washdown system supplies the processing plant. The raw water header tank will be dedicated to raw water. Fire reserve will be provided as the lower portion of the process water dam. The fire water system will include two pumps, an electric pump and a diesel driven pump to ensure a continuous supply of water to the fire system in the event of a power failure. There is also a fire water jockey pump to maintain system pressure for small duty requirements.

2.2.1 Initial Mine Dewatering

Since the underground mine closed, the workings have slowly flooded. There is an estimated 1,411 ML of water contained within the underground workings which will need to be progressively removed to enable access. This

water will be pumped into ED1 and ED2 under an existing Works Approvals under Water Access Licence 40WA411642 (Lachlan Fold belt Groundwater Source) and WAL42034 (Goulburn Fractured Rock Groundwater Source).

Following the detection of analytes that may indicate the presence of leachate in the upper water level within the underground workings, a strategy involving the progressive dewatering of the mine was approved by the EPA. The approved strategy involves a staged approach with ongoing monitoring, environmental assessment and reporting. Stages 1 and 2 have been completed and Stage 3 is underway. The overall strategy is outlined below however given the need for flexibility and ongoing reporting to the EPA, minor variations are expected.

Stage 1 - Completed in May 2017 this stage involved an initial 3 ML of underground water being pumped to ED3. The water was fully tested and characterised for physical, chemical and odour characteristics. There were 10 times samples taken over the course of the initial pumping phase. The results of this analysis were provided to the EPA for review. The results were encouraging and demonstrated that the concentration of organics and resultant odour levels was at or below the initial sampling undertaken in late 2016.

Stage 2 involved the pumping of up to 100 ML in 25 ML increments at a rate of between 1.0 to 1.5 ML per day. These sub-stages are referred to as 2A to 2D. The EPA required additional odour assessments and modelling to be performed during Stage 2A along with progressing of the treatment testwork. Stage 2 water was contained in two separate coffer dams to allow testing. As the coffer dams are fully contained within ED2, there is no chance of any offsite discharges occurring.

Water samples were collected weekly and analysed for odour, ammonia, BOD, COD, metals, cations, anions and parameters such as pH, solids and conductivity. The primary purpose of Stage 2 was to pump sufficient volume to determine any trends in water quality and to fine tune the treatment process and to confirm the treatment plant design criteria and operating parameters.

In addition, The Odour Unit (TOU) prepared an Odour Impact Assessment specifically for the dewatering program. The odour dispersal model was based on the model prepared by TOU for Veolia and used additional data gathered during the Stage 2A dewatering program.

All data collected during Stage 2 was provided to the EPA. The data showed that no further treatment of the mine water was required and that odour levels were minor. The EPA approved the progression to Stage 3 dewatering as described below.

Stage 3 represents the ongoing dewatering of the mine. Monitoring is to continue on a monthly basis and reported to the EPA on a six monthly basis. A delay occurred between Stage 2 and Stage 3 to allow for the construction and HDPE lining of the remaining coffer dams within ED2. Mine water will continue to be pumped into ED1 and ED2 during Stage 3 as required by Heron under the provisions of EPL 20821.

Groundwater monitoring will be undertaken in accordance with the EPL and Water Access Licence as outlined in Chapter 5. A progress report will be provided to the EPA on a six monthly basis for the first 12 months following which the results will be summarised and reported by Heron in the Annual Review each year.

The removal and storage of this water will provide an initial storage source for the commencement of the ore processing. The combined storage capacity of ED1 and ED2 is approximately 2,100 ML while the amount stored in these dams currently is significantly less at approximately 500 ML. These dams will be maintained at a low level in order to receive the water from the underground workings. The main dewatering effort will occur over a 3 year period but can be varied to meet initial start-up volumes for the processing operations.

2.2.2 Operations

A typical annual summary of the total water demand during the operational phase is provided in Table 2.1.

Table 2.1 - Water Balance Summary - Full Production (year 2)

Usage	ML per month	Supply Source
Ore processing	31.5.	Treated water from onsite storages Recycling Willeroo Borefield
Non-Process Demand	15.3	Uncontaminated surface dams
Potable	0.7	Treated water Rainwater tanks
Underground equipment, dust suppression	2.4	Treated water from onsite storages Recycling Willeroo Borefield
Total Maximum Demand	**49.9**	
Groundwater Supply	29.9	Underground water
Recycled Underground	3.9	Underground workings
Treated wastewater	0.5	Processing plant
Runoff recycling	15.6	Surface dams, treated leachate Processing plant
Average Monthly Supply	**49.9**	
Site Storage Buffer	600 ML	ED1, ED2, other minor dams

The above water balance includes both the underground and the tailings retreatment operations at full production. Although subject to detailed annual analysis completed in 2016, the balance is under further review and a more accurate model will be provide following a full year of production.

2.3 Water Transfers to and from the Site

The primary water supply to the operation will come from the underground workings initially and supplemented by the Willeroo Borefield. Only minimal make up water from the borefield was required for the construction phase as the majority was provided by on site storages. The mine has access to a licensed supply of 600 ML/a (550 ML/a available to the Project) from the Willeroo Borefield (Lachlan Foldbelt Groundwater Source) which places the site in a potential water deficit during low rainfall periods at full production and requires the operation to maximise water recycling and reuse of stormwater runoff.

Although the mine is seeking a licensed supply from the Goulburn Fractured Rock Groundwater Source through a separate Water Access Licence, this is simply to account for a portion of the water from the underground workings which lie in a different groundwater source. It does not represent a new source of groundwater to supply the mine.

In response, Heron will continue to investigate water saving initiatives during the detailed design and construction phases. The potential water shortfall, should it occur, requires specific circumstances to arise simultaneously. These circumstances include peak production involving both tailings retreatment and underground extraction during very low rainfall summer months or drought conditions. Maintaining adequate water storage within ED1 and ED2 as a buffer for these periods will be important as there are limitations to the amount that can be supplied from the borefield.

The current water balance requires a storage buffer to be maintained on site, primarily within ED1 and ED2, of 600 ML. This buffer is adequate to cater for deficit months with no rainfall or prolonged drought periods with below average rainfall. Even under a prolonged drought lasting several years, the site has the ability to remain at full production. The recirculating volume used to mine the tailings will be in the order of 800 ML with make-up supply to cover losses. This volume of water will be progressively available for ore processing and other uses as the retreatment process winds down.

During the construction phase, there will be adequate water supplied from existing sources with only potable water being trucked to the site for a short period. Once the water treatment plant is established there should be minimal importation of water required.

2.3.1 Water Transfers Within the Site

The Environment Protection Licence allows for transfers of water between Veolia and the mine operations. These are nominated as:

- Between ED1 and ED2
- From ED1 to Tarago Operations Processing Site
- From Old Plant Runoff Dam to Tarago Operations Processing Site
- From Woodlawn Dam to Tarago Operations Processing Site
- Between tailings dams and ED1
- From Waste Rock Dam to ED1
- From Veolia treated leachate / storm water to ED2 / process plant
- Underground water to evaporation dams

These transfers are necessary to ensure water recycling is maximised, minimise the amount of freshwater used by the operation and to maintain safe operating levels in dams. The volumes transferred will be recorded and reported in the Annual Review. This data will also be used to update the water balance during operations and will include varying prevailing weather conditions.

2.4 Water Discharges

The Project will operate as a zero discharge site from the commencement of the construction phase through to operations. This means that contaminated surface water generated from the operation will be collected and stored for reuse rather than discharge off site. Only clean surface water from undisturbed or rehabilitated areas will be allowed to drain into Crisps Creek and Lake George catchment.

3 SURFACE WATER MANAGEMENT PLAN

Key environmental issues relating to surface water management are:

- ❒ Erosion and sedimentation control during the construction phase.
- ❒ Integration of temporary pollution controls with permanent controls.
- ❒ Maximising recovery of stored water for use on site.
- ❒ Management of Potential Acid Forming (PAF) materials generated during both construction and operation.
- ❒ Revegetation and landscaping.

3.1 Baseline Surface Water Data

The current surface water monitoring program commenced in 1996 as part of the original mining operation. This program was taken over by Veolia when the site was purchased from the Administrator of the failed mining company Denehurst and is now being shared with Heron. Given the length of the program, there is a large database currently available.

There are essentially two components to the monitoring program. The first is the monitoring requirements detailed on the current Veolia Environment Protection Licence and Herons EPL20821. These are:

Table 3.1 - EPL Monitoring Points

EPL Site Identification Number	Location Description
6	Site 115 - Allianoyonyiga Creek
7	Site 105 - Crisps Creek
8	Site 100 – Woodlawn / Willeroo boundary
9	Site 109 – Pylara boundary
10	Site 300 – process plant pollution control dam (yet to be constructed)
Veolia 14	Spring 2 - Crisps Creek
Veolia 16	Site WM200 - Raw Water Dam
Veolia17	Site WM201 - Existing mine buildings
Veolia 18	Site WM202 - ED3 South
Veolia 19	Site WM203 - ED3 North
Veolia 22	Pond 3, located within the landfill void
Veolia 23	Leachate Pond, north-western side of void - near top
Veolia 24	Leachate Recirculation System (In the open pit void)

Veolia Monitoring Points relate specifically to the Bioreactor waste disposal operation and will remain as part of Veolia's surface facilities area. The remaining points are relevant to the ongoing mining operation and are part of Heron's EPL covering the mine.

The second form of monitoring undertaken covers operational sites for the purposes of gaining information about the general water quality on site. These surface monitoring sites include ED1 and ED2, the three existing tailings dams and some additional background sites in adjacent waterways. An additional point will be added for TSF4 when constructed. Monitoring of these sites will also continue as part of the ongoing operation.

Special Mining Lease 20 (SML20) requirements for surface water monitoring include pH and conductivity monitoring of surface water. Heron also includes voluntarily annual analyses of zinc and sulphate to the schedule for assessment of creek surface water quality.

A summary of surface water results for SML20 over the period 2000 to 2016 period is presented in Tables 3.2 and 3.3.

Table 3.2 - SML20 Surface Water Quality – Creeks

Site	Number of Samples	pH			Conductivity (µS/cm)		
		Minimum	Average	Maximum	Minimum	Average	Maximum
100	49	5.8	7.1	8.3	210	906	2,190
105	87	5.4	7.4	8.6	188	1,992	4,800
109	149	6.3	7.3	8.4	150	1,174	4,720
115	87	6.1	7.7	8.6	174	1,803	4,360
FRC	65	4.6	7.3	8.1	55	5,868	12,100

Table 3.3 - 2015 SML20 Surface Water Quality – Dams

Site	Number of Samples	pH			Conductivity (µS/cm)		
		Minimum	Average	Maximum	Minimum	Average	Maximum
ED1	115	2.2	5.3	8.9	5,340	10,695	34,000
ED2	73	2.6	4.2	7.7	2,760	18,042	51,000
TDS	37	1.4	6.4	6.4	600	12,154	19000
TDN	41	1.7	2.9	4.0	1,160	13,213	38,000
PCD	11	3.25	5.63	7.75	1,650	3,970	6,670
TDSRW	49	2.5	3.9	7.8	1,510	7,594	33,260
WRD	115	1.6	3.1	3.8	1,707	17,693	31,300
WM200	64	4.9	7.4	8.7	360	1,632	2,930

Although the site is nil discharge, surface water can be heavily influenced by local geology and soils which reflect the chemistry of the underlying sulphide ore body. An important issue in determining if the mine has had any influence over natural background levels is to ascertain if there are any long term trends in water quality. Since 2007 there are no emerging trends although there have been isolated spikes in water quality. The data is reported each year in the Annual Review which includes an analysis of historic trends.

An extensive groundwater monitoring program is also undertaken which is described in Chapter 4. More details of the monitoring program are provided in the separate Environmental Monitoring Plan.

3.2 Description of Surface Water Management System

Although the Woodlawn site is now divided into three separate operations, the existing water management system operates essentially as it did when first constructed. The mining project integrates into this system but will require some additional pollution control structures to be installed. These additional pollution control structures are included in the plant design. The water supply system will remain unchanged as will the general principles of controlling runoff to avoid discharges from the site.

The overall water management system is shown on Plan 2 while the proposed additional structures required for the construction phase is shown on Plan 3.

The main features of the existing site water management:

- ❒ Surface water runoff from the Rehabilitated Waste Rock Dump (RWRD) flows via local drainage pathways to either the Woodlawn Dam or to Lake George.
- ❒ Subsurface drainage and any contaminated surface flows from the RWRD are captured within the Waste Rock Dam (WRD). Water contained in the WRD is pumped to ED1.
- ❒ Runoff from the Paste Fill Plant will be contained in a separate bund while the new box cut and surrounding area will be contained in surface drains which discharge into ED1 or Woodlawn Dam. The Paste Fill Plant bunding will be designed to contain uncontrolled flows of tailings materials, chemicals or waters (including but not limited to bunding of the tailings storage tanks).
- ❒ The run-off within the boundaries of the existing tailings and evaporation dams are fully contained within these dams.
- ❒ Seepage and excess runoff from the Tailings Dam West (TDW) and Tailings Dam North (TDN) are conveyed to the Tailings Dam South (TDS).
- ❒ Surface run-off from the old plant area is contained in the Plant Collection Dam (PCD) and pumped to ED1 via a pump and pipe system. This will be changed at a later date to pump directly to the new process plant.
- ❒ ED2 receives minor stormwater runoff but is used to store mine water along with ED1.
- ❒ ED3 complex is used by Veolia's Bioreactor and also receives stormwater runoff.
- ❒ Woodlawn Dam (FWD) receives clean water from local and rehabilitated catchments and raw water from the borefield.

The water management plan for the Project is integrated with Veolia's operations but involves additional drainage provisions within the Hickory Paddock area and minor changes within the main site as described below:

- ❒ Drainage from the proposed processing plant areas is directed to internal drainage sumps and silt traps.
- ❒ Dirty water from hardstand, car parking areas and internal roadways has been directed to the new Pollution Control Dam (NPCD) near the main carpark.
- ❒ Additional temporary sediment ponds and drains have been constructed along the access road and below the Run-Of-Mine (ROM) ore stockpile pad during the construction phase.
- ❒ Diversion embankments and drains have been constructed around the proposed processing plant to divert clean, uncontaminated surface water run-off back to the Hickorys Paddock drainage.
- ❒ All chemical and hydrocarbon products will be stored in bunded areas in accordance with the relevant Australian Standards.
- ❒ Any water dewatered from the underground operation will be contained within ED1 and ED2. This water will be held until required for the processing operation and tailings extraction.
- ❒ Veolia have constructed a leachate treatment facility and treated leachate and storm water will be directed to ED1.
- ❒ Veolia plan to expand leachate storage capacity by 150 ML and will use a separate coffer dam located in the south-east corner of ED1.
- ❒ The surface water run-off from the local catchments of TDS, TDN and TDW would be contained within these dams.
- ❒ Additional water reticulation will be established based on the original system operated by Denehurst, that is, a series of interconnected pipes between the tailings dams for delivery of tailings and return water however these will be connected to the new processing plant rather than the original plant site. Other

pipelines will be established from the new mine entry and the evaporation dams, the old plant dam (PCD), the new processing plant and from the new processing plant to the Paste Fill Plant.

As with the original mine operation, variations to the water management system will occur over time to cater for changes in the water demand/source points and operating conditions. Mine dewatering will initially be from a dedicated bore on the western edge of the Bioreactor however this will change to both the main decline, ventilation shafts and another dedicated dewatering bore. As all surface dams are potential source points, any new dam structures will be equipped with pumping facilities and connecting pipes to the Processing Plant supply, dust suppression systems or the main water storages ED1 and ED2.

In order to manage waters of different quality, Heron will need to subdivide some dams including the tailings and evaporation dams into cells in order to facilitate reprocessing. The water recycling system will include a reverse osmosis treatment process, pre-treatment and blending to achieve the required water quality for various raw water uses.

Details of the proposed construction phase water management components are provided in the following sections. Although the construction phase is drawing to a close, this information is still relevant for this version of the Water Management Plan.

3.2.1 Clean Water Diversions

As shown on Plan 3, clean water diversion channels have been constructed around the construction site and future mine facilities area. The channels were staged to only convey clean water away from active disturbance. The initial diversion channels included:

- Initial hardstand area and temporary demountable buildings.
- Access road.
- ROM pad area.
- Process plant construction area.

Surface runoff from the remaining area still flowed into the existing farm dam which was subsequently enlarged to contain sediment runoff from the completed mine infrastructure. Drainage downstream of TDN continued to flow into the main sediment dam and used for dust suppression during the initial construction phase until the completion of TSF4. The area of disturbance was limited to only that necessary to complete the construction phase. The design of new facilities has been reduced slightly from the approved footprint in accordance with the project commitment to minimise surface disturbance.

A clean water diversion channel was then constructed along the toe of the eastern hillslope below the TSF4 construction area. Shown on Plan 3, this drain discharges below the new pollution control dam. The existing natural drainage line below TSF4 now enters the new pollution control dam. This enables separation of the clean water from any dirty water generated from the construction of the TSF4 embankment.

The box cut and entry portal area will naturally drain into ED1 through the existing drainage system though a component drains to ED3 and the Woodlawn Dam.

3.2.2 Water Storage Structures

The existing farm dam on Hickory's Paddock was cleaned out and enlarged as part of the initial site set up. This dam is used to contain any contaminated runoff from the construction site. As described in Section 3.3, the pond was enlarged to a total capacity of 31ML in order to contain runoff from the design storm event, however other small sediment ponds will be installed to contain runoff from the access road and the ROM pad. These small ponds are designed to capture sediment close to the source rather than solely within the new pollution control dam.

3.2.3 Process Water Dam

As shown on Plan 3, a Process Water Dam will be located on the north eastern end of the processing plant facility. The dam will be constructed with earth walls and a HDPE liner and have a capacity of approximately 5.3 ML. This dam will supply the processing plant with water. The water supply to this dam will consist of recycled water from the process, return water from various processes and surface stormwater flow from within the processing area. Any spillages from within the processing area or washdown water will report to the process water dam. This dam will also receive make up water from the Fresh Water Dam.

3.2.4 Existing Tailings Dams

The Heron site contains three existing tailings dams, denoted as TDN, TDS and TDW (being Tailings Dams North, South and West), with a combined volume of 11.26 Mt of tailings, covering an area of over 110 hectares (ha). All three tailings dams will be reprocessed. The reprocessing will involve extraction of the tailings by high pressure water monitor to slurry the tailings to enable pumping to the processing plant. Water will be recycled as part of this process with makeup water provided by harvested water on site, groundwater seepage in the underground workings and the Willeroo Borefield supply.

The extraction process will require an initial water feed for the water monitor and sufficient water within the slurried tailings to enable pumping via overland pipeline. The initial 300 ML available within the existing tailings dams will be used however at peak production, in the order of 800 ML will be recirculating within the water reticulation system. This includes water stored within the unmined tailings dams, water contained within the pumping, processing and return system and water contained within the final tailings post treatment.

As at December 2017 there was approximately 600 ML held within the existing tailings dams and a further 6 00 ML within the evaporation dams. These dams have little to no additional catchment other than their surface area. All rainfall and runoff from the dams and immediate surrounding area is contained within each dam structure. A component of the water held within the tailings dams will need to be removed prior to the mining commencing. This water will be pumped to ED1/2 which will also receive the water pumped from the underground workings during the construction period. This will enable sufficient water storage to commence the tailings retreatment once the processing plant is operational.

Woodlawn tailings are somewhat reactive and when allowed to dry, oxidises to produce an acid environment. The tailings remain fully contained within purpose built impoundments designed for the long term storage of tailings, however oxidation reactions will continue while ever the tailings surface is exposed to the atmosphere. The reprocessing operation will remove a large proportion of the sulphides which cause the acidic reactions however ultimately the project involves permanent rehabilitation on completion which will significantly reduce the potential for acid generation.

The original tailings impoundment, TDN, was constructed in 1979 which includes internal earthfill embankments. It has also been subject to some previous retreatment and will be the last dam to be reprocessed.

TDS was commissioned in August 1980 initially as a water storage pond, but had two additional lifts added in 1985 and 1988 to increase the storage capacity as it was subsequently used for tailings disposal. This dam is known to have a leak which is contained in a small dam below the main wall and seepage pumped back into the dam. This dam will be the first to be reprocessed and will involve repairing the wall/floor prior to refilling with fresh reprocessed tailings. The leakage collection and monitoring system will continue for at least a year following the reprocessing and repair of the dam to ensure the leak has been fixed. This dam is in the process of being emptied in readiness for use.

TDW was constructed in a single stage in 1990 after underground operations began. The dam contains an upstream impermeable plastic membrane on the face of the embankment and will be the second dam reprocessed. As no further work is required to this dam and once refilled with reprocessed tailings, it will be rehabilitated.

As the TDN dam will be the last to be reprocessed, it will be used to trial rehabilitation methods in the intervening period. This will allow time to refine the rehabilitation methodology before TDN is reprocessed and the rehabilitation trial area is lost. The process will use compost supplied by Veolia along with other materials for a capillary break and intervening layers. Drainage from TDN will pass into a channel running around the edge of the dam surface. This water will be collected and returned to the tailings reprocessing circuit.

3.2.5 New Tailings Dam

In order to contain the new tailings produced while extracting tailings from the existing dams, an additional tailings dam is required to be constructed. This new dam is denoted as Tailings Storage Facility 4 (TSF4). This facility will be progressively constructed with an ultimate capacity of 4 million tonnes (Mt). The floor of the facility will be excavated to rock/siltstone and then lined with clay to 0.9 m thick and compacted to achieve a hydraulic conductivity of at least $1x10^{-9}$m/s.

Although the dam is designed not to leak, any leakage should it occur would be collected in a designated collection pond located immediately below the dam wall. This pond will be equipped with a pump and dedicated pipeline which will enable the collected water to be recycled. As shown on Plan 3, all drainage from the construction of TSF4 and its completed dam wall will be directed to the new pollution control dam. Clean water from the hillslope to the east will be diverted to below the pollution control dam.

The construction of TSF4 was completed prior to commissioning the processing plant in order to receive fresh tailings. The downstream batter slopes are designed at 2.5H:1V; this design requires a reasonably strong ripped rockfill to provide an adequate level of stability. The upstream batter slopes are at 2H:1V. These slopes can be steeper as they will be supported by consolidated tailings. The crest width is approximately 8 m to allow light vehicles on the crest to assist in tailings management.

Slurry input will be approximately 60/40 solids and water and the ability to pump clarified water will be available via a drive-in access and sump which will move as the dam fills with tailings. The tailings will generally be delivered via spigots positioned along the inside wall of the dam to further assist with sealing the dam against leakage.

The dam will have a freeboard sufficient to contain the 1 in 100 year, 72 hour storm event without discharge, however as is common engineering practice, the dam will be equipped with a spillway. The design storm capacity has been based on a total surface area of 26.7 ha with an additional 6.3 ha of catchment which will have a runoff coefficient of 0.6.

Approximately 3 ML/month will be bound within the tailings plus losses due to evaporation. At peak production, approximately 90 ML/month will be returned from the tailings dams to the reprocessing circuit from an input of around 93 ML/month. The shortfall will be made up with supplies from recycled water from the site, ED1 and 2 and from the Willeroo Borefield.

3.2.6 Evaporation Dams

The evaporation dams were originally constructed at Woodlawn to manage contaminated water and ore processing demands. Three dams remain on site, covering an area of approximately 100 ha.

In recent years the volume of water stored in the evaporation dams has substantially reduced. ED3 forms part of the water management system for the Veolia Bioreactor and will not form part of the Woodlawn Project. However the remaining two evaporation dams (ED1 and ED2) will be used as part of the mining operation.

Although the main water feed source for the processing plant will be the Fresh Water Dam which in turn is supplied from the Willeroo Borefield, water contained in ED1 and ED2 will also be used when available. ED1 and ED2 will be used to store excess water from the underground workings, including the initial dewatering as well as contaminated runoff from the new mine infrastructure site. Depending on the use of this water, some treatment will be required. The water will be treated in a separate water treatment plant located in the main processing plant. Water treatment will be appropriate for the intended end use and may include filtration, pH adjustment and/or blending to satisfy the required end use.

ED1 was constructed in 1987 while ED2 was constructed in 1989 in order to increase the Woodlawn Mine's capacity to evaporate contaminated water. They were used for that purpose until the mine ceased operations. ED1 has a capacity of approximately 1,347 ML, while ED2 has a capacity of approximately 846 ML.

The initial start-up volume of around 800 ML for the tailings extraction process and processing plant supply will be sourced from the evaporation dams. Over the long term, the evaporation dams will need to hold around 600 ML as a buffer against drought conditions however as the site has historically run with an excess of water, holding an adequate buffer is not considered a constraint to the operation.

ED1 and ED2 are Prescribed Dams under the Dams Safety Act. Both dams have been the subject of formal surveillance reporting since 1997. Heron will continue the dam safety inspection program and dam surveillance reporting.

3.3 Design Objectives

All pollution control structures will be designed in accordance with the requirements of the publication series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries. General sediment controls will also adhere to the publication "Managing Urban Stormwater: Soils and Construction – 4th Edition", Landcom 2004 (Blue Book). The new tailings storage facility will be designed and constructed in accordance with advice from a registered geotechnical engineer.

The New Pollution Control Dam (NPCD) located below the processing plant in the Hickory's Paddock has been cleaned out and enlarged so as to contain all runoff from a 1 in 10 year, 72 hour storm event. Rainfall intensity for this event is approximately 2.33 mm/hr with a total rainfall during the storm equating to approximately 168 mm. The total catchment area of this pond is approximately 65 ha however clean water above the plant area and ROM pad will be diverted and the processing plant itself will have its own internal bunding system to contain rainwater. It is estimated that around 27 ha will require to be drained to the pond. Using a runoff coefficient of 0.35, the total storm water storage requirement for the pond will be around 31 ML. The actual built dam has a total storage capacity of 38 ML. This volume includes an allowance for silt containment and standing water.

The pond will also be equipped with a pump connected to a pipe to both the processing plant and PCD (which in turn is connected to ED1). This will enable evacuating water from the pond following rainfall but also delivery of additional water from ED1 during rainfall deficit periods.

The overriding objective is to manage water on site so that no offsite discharge of contaminated water occurs.

3.4 Erosion and Sedimentation Control

Erosion control structures were installed prior to soil disturbance and with the principle aim of containing sediment at its source. Once in place, the sediment control ponds as shown on Plan 3 was constructed. All runoff from the construction site passes through at least one sedimentation control structure prior to discharge into the main sediment control pond. The erosion control measures are designed to safely convey water from disturbed areas, reduce runoff velocity, increase batter and bench stability and reduce solids loading prior to entering the pollution control structures. Surface stability will be improved where possible by the use of temporary and permanent revegetation measures. Erosion control structures will be inspected regularly, particularly after heavy rainfall, and upgraded or repaired where necessary.

All erosion control measures will be maintained in accordance with the principles specified in the publication series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries. General sediment controls will also adhere to the publication "Managing Urban Stormwater: Soils and Construction – 4th Edition", Landcom 2004 (Blue Book). The principles of erosion and sedimentation control during the Woodlawn Mine construction phase are:

- ❒ Sediment basins, perimeter banks and other sediment and erosion control structures were installed as a first step in land disturbance.
- ❒ Stripping and stockpiling of topsoil was the second step in the construction process.
- ❒ Drainage works were installed early in the program to protect disturbed areas from runoff and to convey stormwater safely within the construction site.
- ❒ Batter grades were determined with geotechnical advice and included a range from 1(v):1(h) for stable batters associated with the mine entry, inner batter grade of 1(v):2(h) and an outer batter grade of 1(v):2.5(h) for dams and 1(v):3(h) for other external construction batters requiring rehabilitation. Shallower grades are required to facilitate the placement of composted organic material to minimise erosion and allow vegetation to establish.
- ❒ As construction works achieve a more permanent landform they will be progressively sown to a suitable grass seed mixture and fertilised. These areas will include the outer faces of the hardstand, road batters and external areas to the future processing plant site. The recent drought however may delay establishment of a permanent vegetation cover.
- ❒ On areas which will remain disturbed for some time, such as the Waste Rock Emplacement (WRE), permanent pollution controls and drainage provisions will be established.
- ❒ Staff and construction contractors will be trained in environmental awareness and good practice and the value of the erosion and sediment controls installed.
- ❒ All sediment and erosion control structures will be inspected and maintained to ensure their effectiveness throughout the construction program. Inspections will occur once per month and/or following rainfall events.
- ❒ A maintenance program will be implemented for all soil and erosion controls, revegetated areas and sediment ponds to maintain their effectiveness during the construction program.

3.4.1 Soil Types and Suitability

Understanding the soils on site is an important aspect in the design and management of soil and erosion controls. Yellow duplex soils dominate the vicinity of the Woodlawn site, most evident on the slopes and drainage lines. These soils are a texture contrast between coarse and sandy A-horizon soils (topsoil) and the finer, clay-like, B-horizon soils (subsoil). Duplex soils are often divided into red, yellow, brown and dark brown soils on the basis of subsurface soil colour. These categories of duplex soils can then be differentiated again by a number of other physical and chemical qualities. These qualities include surface crusting, hard setting, the presence of a bleached horizon between the A and B horizons, and the soil reaction trend which is the gradual change in pH (acid, neutral or alkaline) down the soil profile.

The soils on the project site are generally highly erodible. The soils also exhibit surface sealing, where the surface soil has become compacted and resistant to water filtration. Sheet erosion of the topsoil is common, with stripping of the A-horizon resulting from clearing and over grazing. The combination of past poor land management practices and the dispersive nature of the soil have resulted in extensive sheet and gully erosion, particularly in the project site and the western part of the Woodlawn site.

The chemistry of the soils is also relevant with the average heavy metal concentrations measured in soils approximately 500 m from the ore zone were 200 parts per million (ppm) copper, 800 ppm lead and 300 ppm zinc. In comparison, chip samples taken from over the ore zone indicated average heavy metal concentrations of 2,000 ppm copper, 8,000 ppm lead and 2,000 ppm zinc. The naturally high metal content in the soils was the original mechanism used to determine the location of the ore body.

These issues have been addressed in this Water Management Plan by designing adequate safeguards to avoid soil and subsoil loss from the construction site. The range of measures proposed are described in the following sections and identified on Plan 3.

3.4.2 Sediment Fences

Sediment fencing consists of filter fabric erected down slope of all areas to be disturbed. There are several proprietary products available which generally have the same function and involve a buried toe with at least one metre of above ground filtration fabric supported between timber or metal pickets.

The purpose of the sediment fencing is to filter surface runoff from disturbed areas, including the construction of the initial pollution control ponds and clean water diversion channels prior to them being stabilised by temporary revegetation. The fencing is to remain in place until surface runoff is either clean or adequately controlled by other erosion and sedimentation controls.

Sediment fences have also been installed in some drainage lines to assist with sediment collection as well as around temporary disturbed areas which will be subject to revegetation work.

3.4.3 Contour and Graded Banks

Contour banks are constructed in situ with no greater than a 1% fall to allow safe passage of water. Depending on the overall length and profile of the slope, a contour bank is to be constructed every 10 m of vertical height.

Contour banks will be constructed in areas where there are steep unbenched slopes. These channels are designed to convey water back to pollution control ponds and include roadside and hardstand drains.

There will be two types of drains used, one with an associated channel and one without. Constructing the banks with an associated channel allows for greater stability during high flows and therefore used on steeper slopes while a constructed embankment alone can be used on gentler slopes.

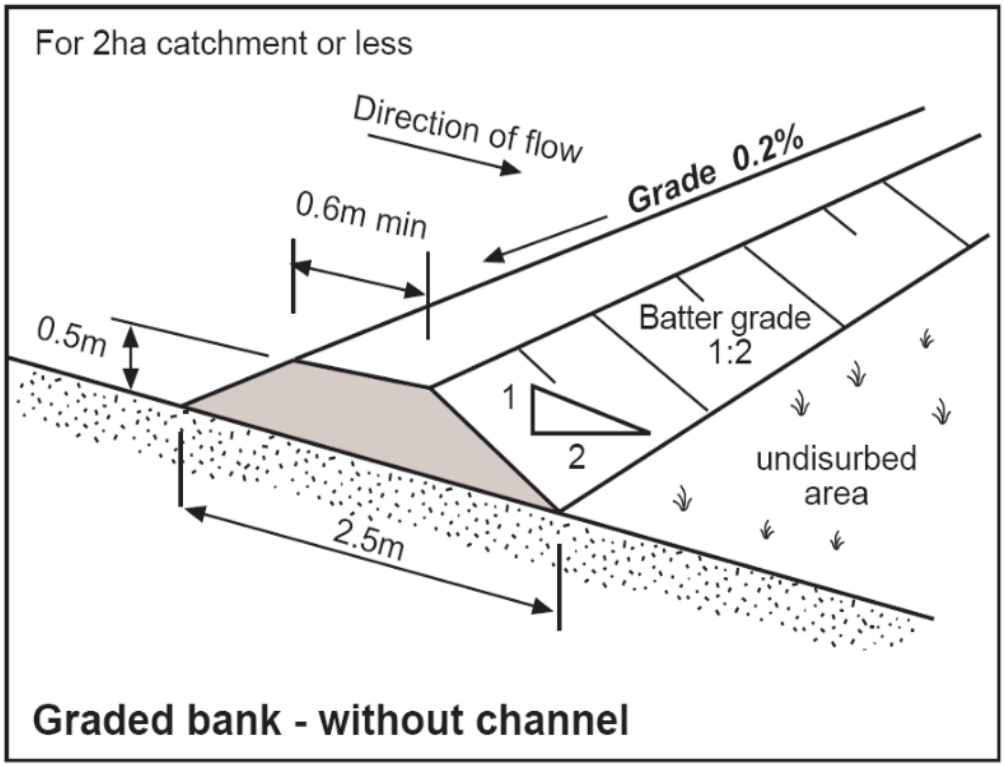


Figure 1 - Graded Banks

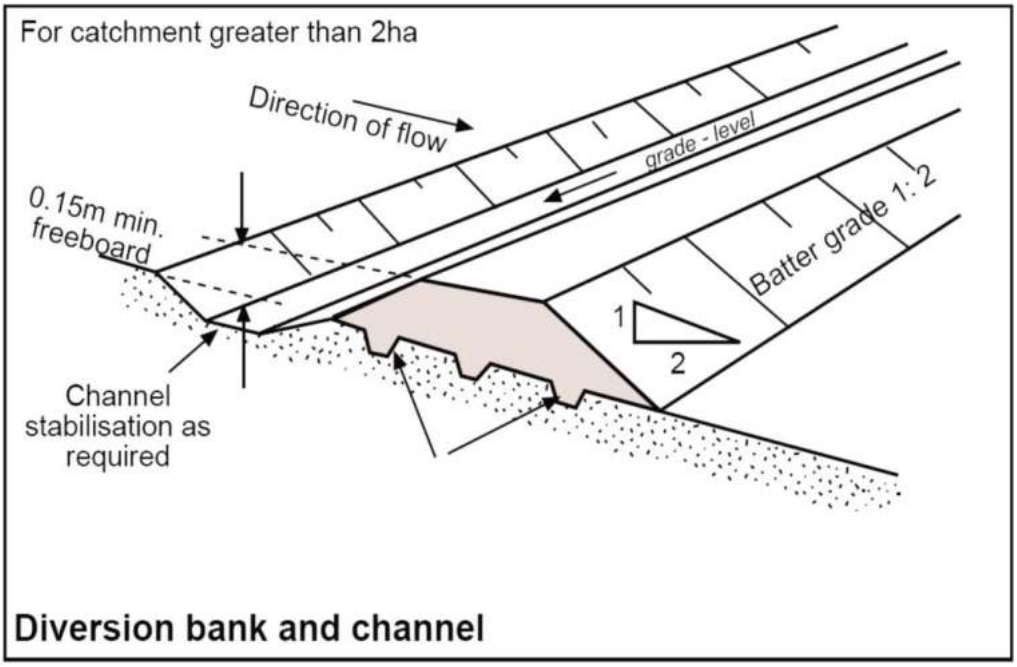


Figure 2 - Diversion Bank and Channel

Where the calculated runoff velocity of the design storm is greater than 2.5 m/s^2 using runoff modelling, rock lining will be provided for energy dissipation and stability.

3.4.4 Absorption Banks and Level Spreaders

An absorption bank is the same as a contour bank but is constructed along the contour and then tapered up at each end. Runoff from the slope is therefore contained within the bank with no discharge at either end.

These were used in selected areas to retain as much water as possible within areas to be rehabilitated. They may also be useful along the surface of the completed tailings dams.

In some cases level spreaders were added at one or both ends of the diversion banks described in Section 3.4.3. These prevent build-up of water and subsequent blow out of the bank. They essentially act as a spillway for each absorption bank.

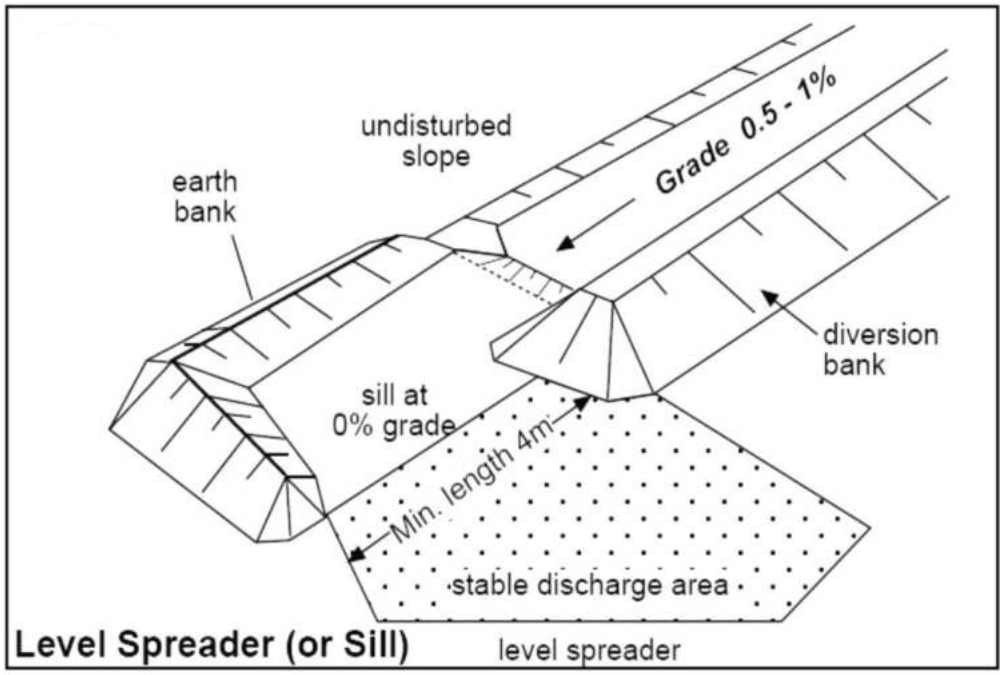


Figure 3 - Level Spreader

3.4.5 Sediment Basins

Several small sediment basins were required during construction for the control and settlement of solids. These are located below disturbed areas and exist within the dirty water system. They will remain on completion of construction and form part of the ongoing water management system, supplemented as required by the main pollution control structures. The primary purpose of these basins is to contain sediment from normal rainfall events as well as reduce flow velocity during high rainfall events.

All sediment ponds will be designed in accordance with “Blue Book” criteria and methods.

3.4.6 Energy Dissipater

Energy dissipaters, in the form of rock rubble have been placed where necessary within the current facilities and drainage system. These provide additional erosion protection during high flow conditions. The rock rubble will be sourced from the dolerite stockpile area or otherwise verified as non-acid producing prior to installing in the drains.

3.4.7 Check Dams

Check dams were constructed along drains longer than 100 m and where slope exceeds 2%. The dams were constructed using rock rubble and silt fencing. The purpose of the check dams is to reduce flow velocity as well as channel grade. Sediment is collected behind the check dams which will be regularly cleaned and inspected for scour, particularly immediately down stream.

3.5 Permanent Water Management Structures

The permanent water management structures covering the surface facilities area were installed as part of the initial construction program. Permanent structures essentially follow from temporary erosion controls but are expanded as necessary to cover the ongoing operation. Permanent water management structures are shown on Plan 3.

The mine currently operates as a zero discharge site for contaminated water. This requires the on-site management of all waters that come into contact with the orebody or other material extracted from the mine. Acid mine drainage potential exists in some areas disturbed by mining.

Plan 2 shows the existing water management system at Woodlawn and highlights the extensive network of clean water contours diverting water away from disturbed areas. The system is designed with flexibility allowing drainage from disturbed areas to be pumped to either ED1 or the tailings dams. This system remains as is during the construction phase but will include additional clean and dirty water structures to maintain the site as "nil discharge".

The site contaminated water inventory is a measure of the volume of contaminated water held in major storage dams and is a key environmental indicator showing the effectiveness of water management strategies over the life of mine.

Since the early 1990s the site has a negative water balance which is supplemented by importation of raw water from the nearby Willeroo Borefield. This is largely the result of the closing of the underground mine which has since flooded. Monitoring has shown that there has been a reduction in the contaminated water inventory since 1994, highlighting the effectiveness of water management and rehabilitation strategies since that time. This philosophy will continue with the new operation as it is important that sufficient stormwater capacity exists to maintain the site as nil discharge, however the new water source from the Bioreactor will add to the water balance for the mine and assist in reducing the risk of water deficits in dry years.

In terms of water management, the tailings dams are self-sustaining. They currently do not contribute any water to the water balance during an average year. During the tailings retreatment process, water contained in the tailings dams will be recirculated into the plant. This will include any rainfall collected within the dams.

The design storm criterion for the tailings and evaporation dams is 1 in 100 year recurrence interval (ARI) of 72 hours duration. The design criteria for the main pollution control pond for the new surface facilities area will be in 10 year, 72 hour storm event. This pond will be equipped with a pump to recirculate contained water within the water management system. This design criteria combined with the ability to pump water for reuse in the operation is necessary to maintain the site as nil discharge for contaminated water.

Both temporary and permanent water management structures will be monitored weekly during construction and then monthly following commissioning. Additional inspections will be conducted following rain events to ensure safe operation. Repairs will be undertaken as required.

3.5.1 New Stormwater Control Dam

Drainage from the main surface facilities, hardstand areas and buildings will be directed through gravity drains and drive-in sumps to a new dam shown on Plan 3. The dam will have an earthen wall and rock armoured spillway but equipped with a pump to recirculate water back into the main water management system for the site. The dam will largely contain soil sediments but as with all surface runoff on site may also contain contaminants which would be unsuitable for offsite discharge.

The processing plant area will be surrounded by a bund to contain runoff. Within this area, a separate process water dam will be constructed to store water from the raw water tank and process facility run-off. Water from this dam would be pumped to the process water tank as needed and then reticulated to the various process areas.

Given the risk of a water deficit during drought conditions, runoff will be harvested from all storage facilities on site including relatively clean runoff from administration buildings and hardstand areas, the NPCD and leachate from the Bioreactor. The design criteria for the new dam is provided in Section 3.3.

3.6 Managing Acid Forming Materials

3.6.1 During Construction

Given the high sulphur content, some of the waste rock and tailings are prone to acid generation. The majority of these materials originated at depth and it is not anticipated that acid forming materials will be encountered during the excavation of the box cut for the underground mine entry. The decline however may encounter acid forming materials at depth.

Mineralisation in the tailings material is linked to the source ore from the mine, predominantly zinc, copper, and lead–rich sulphides. Pyrite is the most abundant sulphide. To confirm the presence of Potentially Acid Forming (PAF) materials, it is necessary to undertake chemical testing which artificially accelerates oxidation in order to determine the potential for low pH to be produced over time. These tests will be performed in accordance with the Waste Rock Management Plan (TOP-SSE-MAN-0044).

Access roads, haul roads and hardstands will be constructed from non-acid forming (NAF) waste rock. This includes the main haul road between the underground entry site and the Processing Plant site.

Tailings Storage Facility 4 (TSF4) will be constructed from rock from underground and surface stockpiles and clay material borrowed from within the footprint of the dam in a series of lifts. NAF waste rock may be used in construction of additional downstream lifts and to supplement the clay material borrowed from within the dam. The use of NAF rock will provide erosion protection on the TSF4 walls.

3.6.2 During Operations

The raw unprocessed tailings material is known to be PAF and will therefore be handled in a manner which does not allow for any drainage to leave the site that has come into contact with, or otherwise impacted by the tailings. Once processed, the material will be permanently stored within either TSF4 or another empty existing tailings dam and rehabilitated. The rehabilitation process is covered in the separate Rehabilitation and Vegetation Management Plan which includes multiple layers of compost and clean NAF material in order to produce a long term viable surface growing media while keeping the underlying tailings in an anaerobic condition.

New material from the underground mine therefore represents the potential for increasing PAF on the surface. The Woodlawn geological model identifies the target sulphide ore body and can initially be used to determine materials that require testing to determine PAF/NAF status. A testing program will include initial screening tests for primary geological units followed by geochemical static tests, solubility tests and kinetic tests. Details of the testing program are provided in the Waste Rock Management Plan (document number: TOP-SSE-MAN-0044) but in general involve:

- Initial screening of different rock types encountered during the development of the new mine access. These tests will include Acid Production Potential (APP) which is calculated by assuming that all sulfur in the sample is converted to sulfuric acid. APP is reported as kg H_2SO_4 equivalent per tonne.

- Determining Acid Neutralising Capacity (ANC) which measures the capacity of a sample to neutralise any acid that is produced. In the ANC analysis a finely ground sample is reacted with a known amount of hydrochloric acid. The resultant solution is back titrated to pH 7.0 with sodium hydroxide to determine the amount of acid neutralised by the carbonates and other acid consuming minerals present in the original sample. ANC may be reported as either kg $CaCO_3$ or kg H_2SO_4 equivalent per tonne.

- Determining Net Acid Production Potential (NAPP) which is a theoretical prediction of whether the APP of a material is greater than its ANC. The NAPP test will be used as the first screening test for sulphide material not destined for the processing plant. Material with a positive NAPP will be separated and dumped in the designated Waste Rock Emplacement.

- Determining Net Acid Generation (NAG) will also be used as an alternative or cross check on NAPP testing. This is a static test method using hydrogen peroxide to oxidise any sulphides present in the sample. The acid produced from the oxidation reaction may subsequently be partially or totally consumed by acid neutralising components of the sample. Any remaining acidity is determined by back titration to both pH 4.5 and 7.0 and reported as NAG (expressed as kg H_2SO_4).

The initial characterisation testing will involve more detailed kinetic testing which involves free draining leach columns in the laboratory to simulate natural weathering conditions to provide information on a range of potential environmental issues such as sulphide reactivity, oxidation kinetics, metal solubility and leaching behaviour. The testing process involves repeated wetting and drying followed by testing of its leachate. Additional data will be obtained using Sequential NAG testing which provides a snapshot of the balance between the acid generation and the acid neutralisation reactions occurring in solid material to produce the net acidity after each of five additions of hydrogen peroxide. The Kinetic NAG test will also be performed as a variation which includes temperature and pH of the material at set intervals during the reaction period.

The end result of the testing process will be the development of an indicator test which can determine if the material can be classified as PAF or NAF. Identified PAF material will be used to partially backfill sections of the old mine workings or in the progressive backfilling of the newly mined stopes prior to complete backfilling with paste fill. Waste rock monitoring will be undertaken throughout the operation of the Project to ensure acid generating wastes are controlled and to determine if practical separation of the NAF and PAF material can occur. If so, the material will be managed such that suitable acid consuming and/or NAF material surrounds any PAF rock, or the waste rock will be co-deposited with the tailings.

All PAF material that needs to be brought to the surface will be separately emplaced in the Waste Rock Emplacement while NAF materials will be progressively used for construction purposes around the site including the TSF4 wall, road base, rehabilitation and foundation materials.

PAF materials will be stored within the new Waste Rock Emplacement shown on Plan 2, which ensures that drainage from this area enters the TDN. The material will be progressively used for selected purposes that do not allow long term oxidation on the surface. These will include internal walls within the tailings dams, underground re-emplacement or co-disposal with new tailings.

3.7 Water Recycling

A key consideration of this Water Management Plan is the maximisation of water recycling opportunities. This will involve categorising water according to its quality and end use. The following water recycling initiatives will

be undertaken on site. This list will be expanded in subsequent plans as more opportunities are identified and implemented.

- ❒ During the construction program, water required for dust suppression and compaction purposes will be first sourced from the Pollution Control Dam in Hickory's Paddock.
- ❒ Rain water collection tanks will be installed on all buildings and structures.
- ❒ A water treatment plant will be installed which will be capable of producing a range of water quality from potable standard to raw water feed quality for the processing plant. The treatment process will include simple pH correction and blending as well as chemical treatment, disinfection and filtration processes.
- ❒ Outflow from the sewage treatment plant will be treated and returned to the raw water circuit.
- ❒ The evaporation dams ED1 and ED2 will remain the principle water storage dams for the site.
- ❒ Water stored in the Rehabilitated Waste Rock Dam will be pumped to the evaporation dams.
- ❒ Excess water contained in the tailings dams will be transferred to the evaporation dams.
- ❒ Excess water contained in the new PCD will be transferred to the evaporation dams.
- ❒ Excess water from the underground mine will be transferred to the evaporation dams.
- ❒ The first source of water for the processing plant will be recycled water from the evaporation dams either directly or via the water treatment plant.
- ❒ The first source of water for the tailings retreatment operation will be water sourced from the evaporation dams or water recycled from the existing tailings dams.
- ❒ The first source of water for all surface dust suppression will be water contained in the NPCD.
- ❒ The first source of water for underground dust suppression and equipment cooling will be treated raw water from the water treatment plant.
- ❒ All water used in the paste fill plant will be treated water from the water treatment plant.
- ❒ Suitable water from Veolia's operation including storm water and treated leachate will be transferred to ED1 and available for Heron's use.

At all times, water contained within the sediment control ponds will be preferentially used as this represents stormwater runoff and it is necessary to maintain these ponds at a near empty condition. However, defined minimum levels will be maintained in the evaporation dams to cater for rainfall deficits. Although supply from the Willeroo Borefield will be required throughout the operation, it will be viewed as a secondary source not the primary source.

3.8 Contamination Management

Virtually all areas disturbed by past mining have some level of contamination. The contamination exists as metals, often naturally occurring in the soils as well as within the tailings dams. The tailings retreatment operation involves removal of metals contained in the existing tailings dams which will significantly reduce this source of contamination. The rehabilitation program will further isolate any residual sources of contamination thereby reducing the risk of contamination leaving the site.

For the construction component, waste rock will be tested for potential acid generation which may liberate contained metals. Only non-acid forming materials will be used in surface exposed hardstand and batters.

Although there is no known hydrocarbon contamination within area of Heron's responsibility, all fuel and oil stores used during the construction phase will be fully bunded. For construction these facilities will be

temporary however the final constructed storage facilities will meet the requirements of AS1692 and AS1940. The facilities will include current best practice hydrocarbon management and containment facilities. Any material collected within these containment facilities will be disposed in an approved licensed facility or bioremediated on site as considered appropriate. Similarly, any major hydrocarbon spill on an unsealed area, the contaminated soil at the site of the spill would be collected and transported to an approved waste depot or remediated safely onsite.

3.9 Surface Water Trigger Action Response Plan

The primary goal of the surface water management system is to not discharge contaminated surface water from the site. The mechanism to determine that the site is not impacting on receiving waters is the current background monitoring program. The main background monitoring sites are:

- Farm Road Crossing (FRC) which is located downstream of ED1 in Crisps Creek.
- Site 105 which is located further downstream in Crisps Creek just below the new Processing Plant Site.
- Site 100 which is located on the western perimeter of SML20 and measures water quality downstream of the Rehabilitated Waste Rock Dam in Allianoyonyiga Creek.
- Site 109 which is located on the edge of SML20 downstream of the TDS.

In determining appropriate triggers for background receiving water it needs to be understood that surface water can be heavily influenced by local geology and soils which reflect the chemistry of the underlying sulphide ore body. An important issue in determining if the mine has had any influence over natural background levels is to ascertain if there are any long term trends in water quality. Since 2007 there are no emerging trends although there have been isolated spikes in water quality.

The full TARPs covering surface and groundwater are provided in Section 5.2.

4 GROUNDWATER MANAGEMENT PLAN

4.1 Background

The Woodlawn Mine is located within the Captains Flat-Goulburn Synclinorial Zone of the Lachlan Fold Belt, which is a narrow belt of volcanic and sedimentary rocks extending over a 300km north–south range. The zone is a fault-bounded Silurian to Devonian aged basin that hosts a range of base metal and gold occurrences.

The Woodlawn Volcanogenic Hosted Massive Sulphide deposit is located in the keel of an asymmetric north-northwest plunging syncline and is hosted within the Woodlawn Volcanics that comprise felsic volcanics and volcaniclastics. Mineralisation at Woodlawn is contained within a series of northwest striking, moderately to steeply southwest dipping ore lenses (A to J). They vary from 2 to 40m in thickness and extend from 50 to 200m along strike with down dip/plunge extents of up to 700m (C Lens).

Extensive existing underground workings occur however the mine prematurely closed due to failure of the previous owners Denehurst Limited. Heron will reopen these workings and develop further underground extraction areas.

The project area bedrock has low to very low permeability, although fractures, joints and faults, where interconnected, create enhanced porosity storage and secondary permeability flow paths, with very small inflows to the pit of 1 – 2 L/sec being observed, predominantly in association with exposed faults in the pit walls. This rate is anticipated to occur as part of the ongoing underground mine development.

Since closure of the underground mine, the old workings have flooded and it has been estimated that in the order of 1.4 Gigalitres of water will need to be removed to enable the mine to be deepened and expanded. Not all the water needs to be removed prior to reopening the underground mine and dewatering can occur progressively.

A dewatering bore has been established on the western embankment of the Bioreactor which is connected to an overland pipeline to ED1/2. A second dewatering bore has also been established near the light vehicle access road to the mine entry. These bores are covered by Works Approvals under the Water Access Licence 40WA411642 (amended statement of approval 40WA411642 dated 12 April 2016, expires 15 April 2025) with the volume dewatered being accounted for within the existing 600ML/a allocation. A second dewatering bore has been established an additional Works Approval The dewatering of the mine will be staged in accordance with the methodology outlined in Section 2.2.1.

4.2 Baseline Groundwater Data

The overall Woodlawn mine and Veolia's Bioreactor landfill site has a network of over 50 monitoring bores and piezometers, which monitor the tailings dams, evaporation dams, waste rock dump and plant / processing / office areas. As with surface water monitoring, the groundwater monitoring program has been undertaken in various forms since 1996 and includes components specific to both the mining operation and Bioreactor site. Heron is responsible for the majority of the ongoing groundwater monitoring program however all data is shared with Veolia.

The groundwater monitoring program of most relevance to the Woodlawn Mine development and new infrastructure areas are:

- ED1/WM202 which will cover surface drainage from the new portal site.
- MB6 which is an existing groundwater monitoring bore located adjacent to the new portal site, or an equivalent replacement if this bore is damaged during the excavation of the box cut.

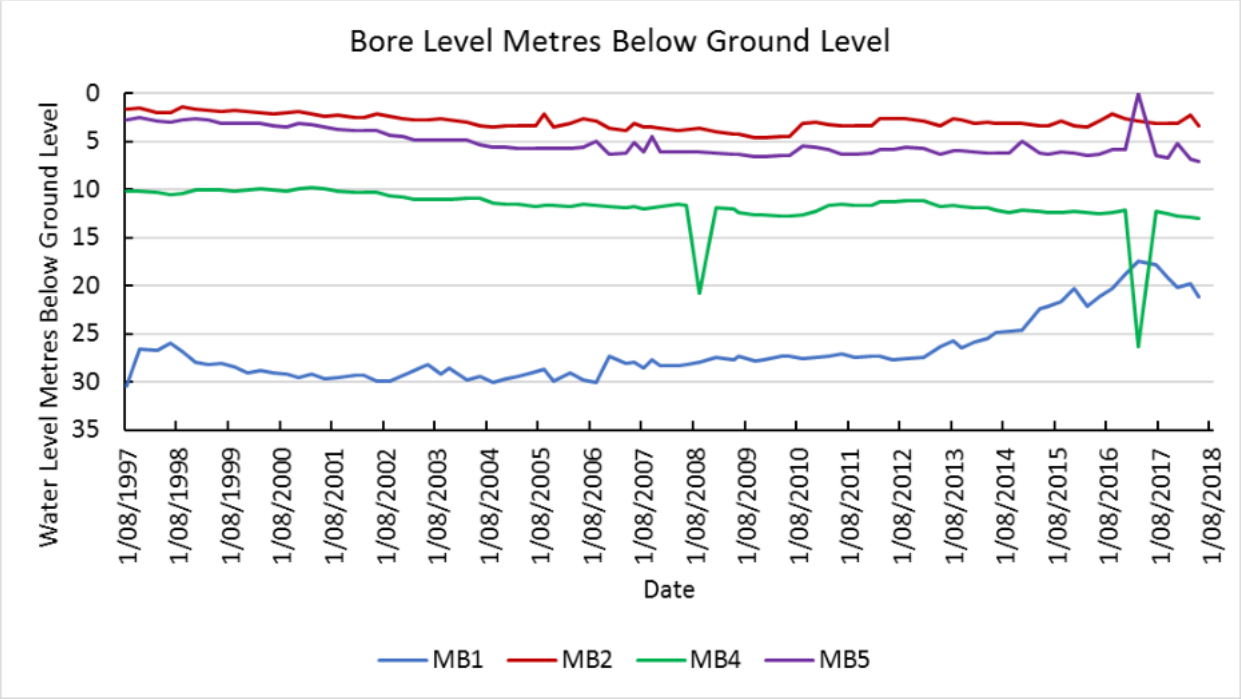
- ❒ MB4 which is an existing groundwater monitoring bore located in the upper portion of the Hickory's Paddock.
- ❒ MB8 which is an existing groundwater monitoring bore located below the new processing site.

The monitoring program has been designed largely around determining whether or not the site is influencing groundwater quality or quantity. The results of the program are reported each year to a range of government agencies in the Annual Review. Heron has undertaken a review of the groundwater monitoring program and determined that some rationalisation of the monitoring sites will be required. This will include installing additional monitoring bores specific to monitoring groundwater from water storages but may also include removal of replicate monitoring sites. As production has yet to commence Heron has taken over the existing monitoring network within its EPL boundary while Veolia remains responsible for monitoring bores within its EPL boundary. The respective EPL boundaries are shown on Plan 5.

The monitoring program will reviewed on an annual bases and modified as required based on the project phasing. Any expansion or rationalisation of the program will be conducted in consultation with EPA and DPE.

4.2.1 Groundwater Levels

Groundwater levels around the mine site have been relatively static over the past 10 years although some fluctuate in response to rainfall while others show a gradual increase or decrease. Monitoring of piezometers MB2, 4, and 5 indicate a gradual, although minor, water level decline of up to 2 m while MB1 shows a slight increase as shown in Graph 1 below.



Graph 1 - Standing Water Level

Standing piezometric level in each monitoring bore will be taken at the time of water quality testing. The purpose of this data is to ascertain trends in groundwater surrounding the mine site over time. This data will be reported in the Annual Review each year along with a comment on trends.

4.2.2 Groundwater Quality

Historical records indicate that, where groundwater is unaffected by contact with mineralised basement or waste material, it is near neutral with moderate to slightly elevated salinity. However, variable quality exists where seepage occurs through the waste rock, tailings and storage dams and through contact with basement sulphides occurs. Recent data available for groundwater within the old underground indicates moderate salinity and mineral concentration and a neutral pH, however some historic data suggests that pH can become acidic with elevated metals.

Groundwater in the underground is likely to undergo changes in quality as the void is dewatered due to:

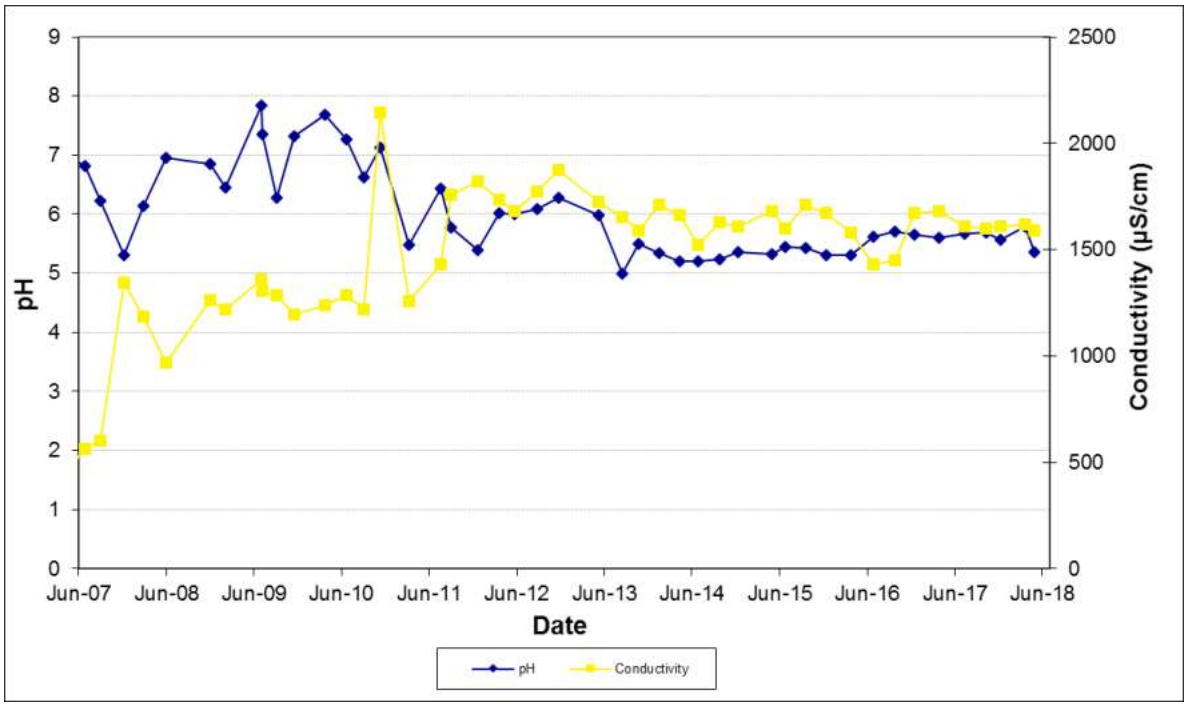
- ❒ changes in stratification;
- ❒ oxidation of sulphide minerals;
- ❒ inflow of storage with connected secondary permeability features in contact with mineralised strata; and
- ❒ inflow rates of in mineralised mine water groundwater

The upper portion of the water body within the flooded workings may contain organic compounds derived from the overlying Bioreactor. Because of this, the dewatering program was staged as described in Section 2.2.1. This allowed time to install any necessary treatment to enable the water to be reused, which was ultimately not required.

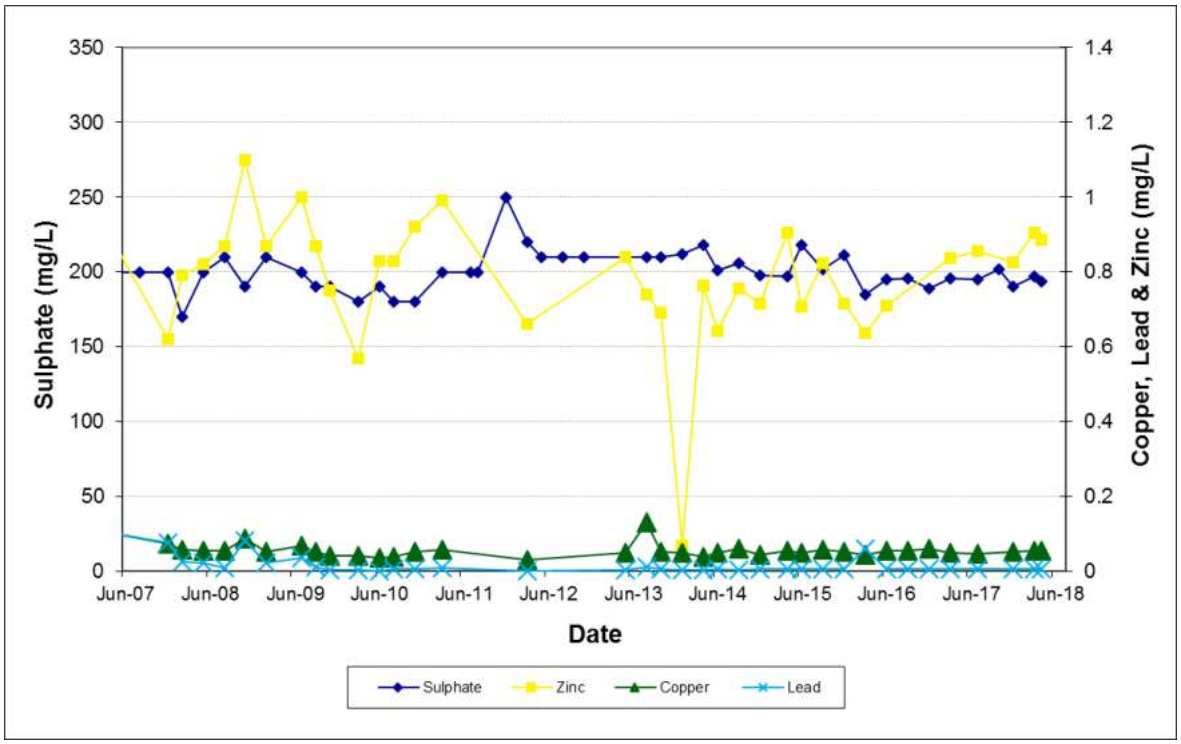
The sulphide ore body to be extracted by the underground mine is naturally mineralised, and as a result, the groundwater contains elevated metals, low pH and elevated salinity. For this reason, the initial mine dewatering and ongoing removal of groundwater entering the underground workings will be pumped to ED2.

There are three monitoring bores which are specifically relevant to the future mining operation. MB 4 is located to the east of the mine void in the upper portion of the Hickory's Paddock while MB 8 is located on Collector Road downstream of the proposed processing plant site. Both these sites will represent monitoring bores for the ongoing processing and materials handling site. MB6 is located adjacent to the new mine portal on the western side of the void near the dolerite stockpile area.

As shown in Graphs 2 and 3, since December 1996, MB4 has not shown any obvious signs of contamination from the mining activities or particular trend in pH, salinity, sulphate or metals, whilst the nearest surface water monitoring sites (WM201 and PCD) currently show no observable influence from discharging polluted groundwater, however they are heavily affected by acidic, metalliferous surface runoff from the disused plant area.

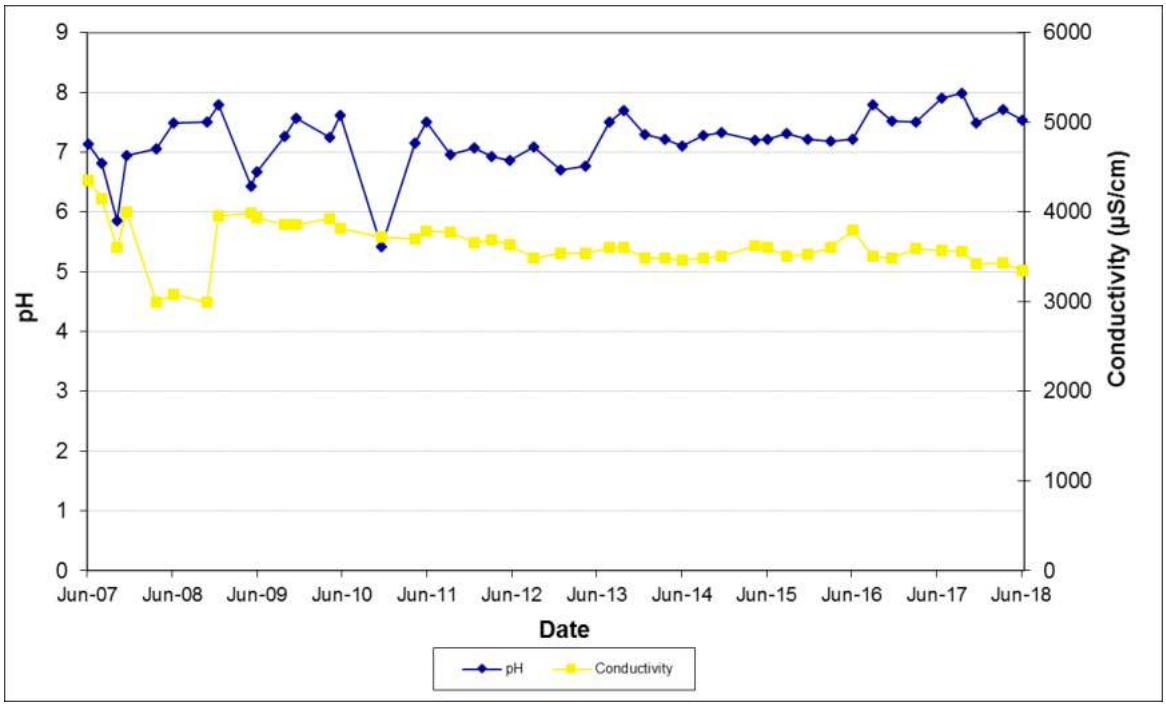


Graph 2 - MB4 pH and Conductivity

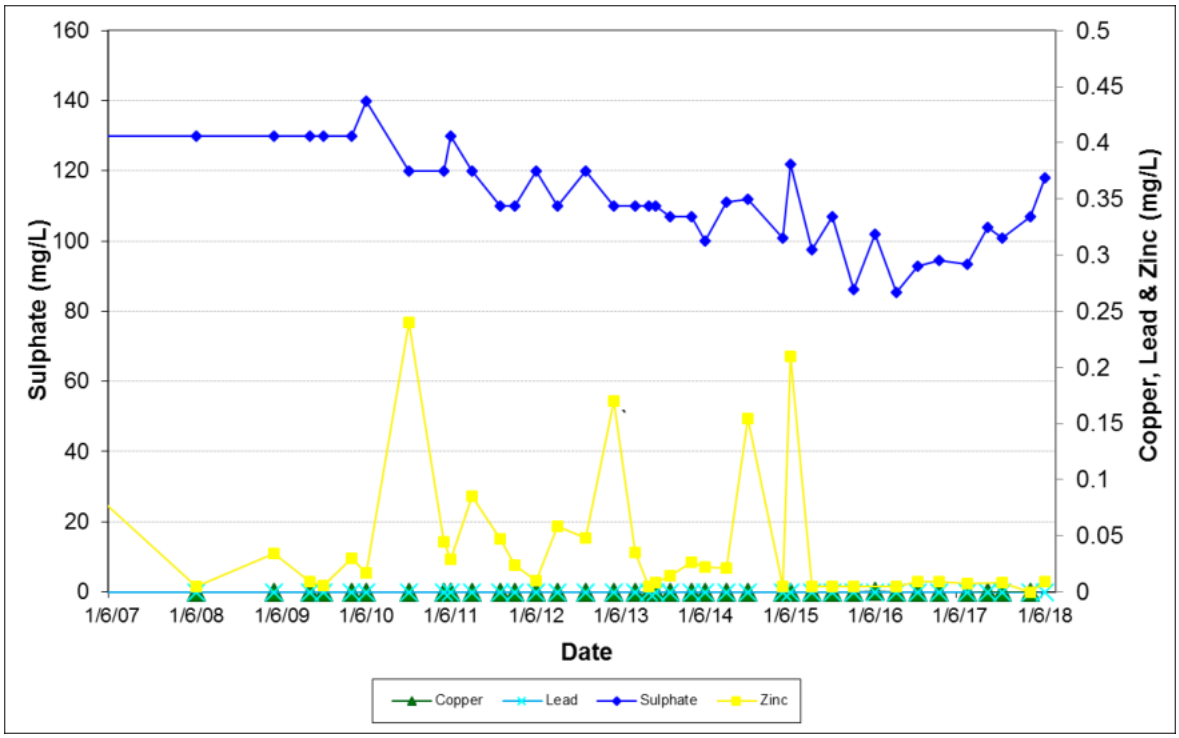


Graph 3 - MB4 Sulphate and Metals

Similar results have been obtained for MB8 (Graphs 4 and 5) which is located adjacent to Collector Road to the northeast of the site and downstream of the proposed processing plant site. The data shows pH is stable with a long term average of 7.04 (results since 2004). Conductivity trends were relatively stable around 3,460 – 3,620 µS/cm and less than the long term average of 3,842 µS/cm (results since 2004). Sulphate levels have decreased slightly while metals have been consistently at trace levels. MB8 will be used as an ongoing verification of the performance of the new TSF4.



Graph 4 - MB8 pH and Conductivity



Graph 5 - MB8 Sulphate and Metals

The above data shows that groundwater contamination off site is currently not occurring. The purpose of groundwater management is to ensure that this remains the case moving forward with reopening the Woodlawn Mine. There are several methods that were previously employed do reduce groundwater contamination while Heron have developed further groundwater management and monitoring initiatives to build on this over time. These aspects are discussed further in the following sections.

4.2.3 Monitoring of Seepage

During the preparation of the Woodlawn Mine Project EA, the Sydney Catchment Authority raised the issue of potential leakage from the Evaporation Dams. Denehurst, the previous mine owners, provided some initial advice in relation to potential leakage from the Evaporation Dams in 1998 but there was minimal monitoring data to confirm whether or not the dams integrity, or whether there were any downstream surface or groundwater quality impacts.

There has now been close to 20 years of monitoring data which can be analysed and a more conclusive investigation conducted.

The water quality contained in ED1 has been monitored since March 1989. As the function of the dam is to evaporate surface and groundwater collected from the original mining operation, the data indicates water within ED1 is acidic with high salts and metals although some variability occurs. The variability occurs during periods of high rainfall when water inflow is near neutral and with relatively low salt and metal content. The concentration of salts and metals then progressively increases and the pH falls as a result of evaporation and regular input of runoff from the Rehabilitated Waste Rock Dump. A similar pattern occurs in ED2 which has been monitored since 1992.

Crisps Creek downstream of ED1, as monitored at Site 105, is slightly alkaline with a long term average pH of 7.7, low salt levels of generally less than 1,000 µS/cm and only trace levels of Zinc. Conductivity rises in low flow conditions but remains at least 1 order of magnitude lower than that contained in ED1.

Veolia in consultation with Heron undertook a detailed investigation which included the installation of 6 additional piezometers around ED1. Although the investigation did not confirm the presence of any leakage, a decision was made to improve the dam lining in ED1 by the installation of HDPE liner. The liner covers all individual cells within the dam.

4.3 Groundwater Management

The primary method of avoiding groundwater contamination is to ensure that surface dams and storages have minimal seepage. Although the natural groundwater regime is influenced by the sulphide volcanic rock in the area and in many instances shows naturally elevated metals, it is important that the mining activities do not increase these levels. The proposed management provisions are described in the following sections.

4.3.1 Construction Phase Groundwater Management

Excavation of the proposed 30m deep box cut and the associated decline is anticipated to generate low volumes of groundwater inflow (<1L/sec) that can be managed via pumping to the dirty water storage and evaporation facilities on site.

As such, groundwater is not anticipated to pose a significant threat for the construction phase of development due to the inherent low hydraulic conductivity of the rock mass. Groundwater inflow to the underground is sourced from the basement rock strata and shallow alluvium within the site. Inflows to the decline are anticipated to be similar to existing monitored water quality, with elevated salinity, elevated metals and lower pH where it is in contact with sulphide mineralisation.

Groundwater within the underground will be contained within the mine, with minor risk of the regional basement aquifers being impacted by the mine water. This water will be removed along with the dewatering activities prior to recommencement of underground extraction. This water will be pumped into ED2.

Activities relating to the construction of the processing facilities in Hickory's Paddock will disturb the current site conditions, creating dust and sediment with the potential for contamination of surrounding areas with additional sediment loads. Contamination of groundwater will be avoided by siting, design and construction and dirty water impoundment to contain sediment and allow appropriate removal and disposal.

Contaminated water spill prevention measures, such as double-walled fuel tanks and lined or bunded containment cells will be provided to prevent the accidental release of processing products or other chemical solutions. All bunding will be capable of containing 110% of the largest tank's capacity.

A separate storage area (the WRE) has been provided to temporarily stockpile Potentially Acid Forming materials which will drain into the northern tailings dam. The WRE will be used only if required during the construction and operational phases of the operation. The stored material will be progressively used in a manner which does not allow for any drainage to leave the site. Other groundwater management provisions during the construction phase include:

- ❒ bunding of the stockpile areas to minimise off-site migration of the waste and ore material;
- ❒ installation of seepage collection sumps and pumps to send seepage to the tailings dams;
- ❒ installation of erosion and sediment control structures, which will be inspected regularly, particularly during periods of high rainfall;
- ❒ establishment of silt fences around disturbed areas prior to stabilisation; and
- ❒ only NAF materials will be used for construction purposes where they are, or likely to be, exposed to the surface.

Effective groundwater management follows normal surface water management principles as contaminants need to be contained at their source and not allowed to either escape to surface or to groundwater systems. To achieve this, normal bunding will be installed as part of the construction program but will also include sealing to ensure that contained spillages do not seep through or below the bunded areas.

Contaminants associated with maintenance activities include degreasers, lubricants, oil, fuel etc which have the potential to adversely impact the shallow groundwater if spilled. Similarly, chemical agents associated with the processing plant can also impact shallow groundwater system if spilled or leaked. Mitigation and management measures recommended to limit groundwater contamination will include:

- ❒ provision of Oil/water separators;
- ❒ bunding around the maintenance areas;
- ❒ bunding of washdown areas;
- ❒ waste collection facilities; and
- ❒ spill response strategies.

All bunding systems will be designed in accordance with Australian Standard AS 1940:2004 *Storage and Handling of Flammable and Combustible Liquids* (and subsequent amendments) and AS 3780:2008 *Storage and Handling or Corrosive Substances* (and subsequent amendment). Specifically, the design of the processing plant will satisfy the following requirements:

- ❒ The bund wall and floor must be constructed from materials impervious to the liquid or toxic substances stored.
- ❒ The bund walls and floors must be strong enough to withhold any spillage from the storage facilities.
- ❒ Wall bunds at tank storages should be 0.5m to 1.5m high depending on the required containment capacity and the distance from the tank (the closer the tank to the wall, the higher the wall because of

the decreased surface area available. The distance between the tank and the bund wall must be at least 1m.

- ❒ Doubled skinned or self bunded fuel tanks can be used in compliance with Australian Standards during construction periods or temporary storage requirements.
- ❒ The bund floor must have a collection sump and a graded floor for the collection of liquids. There must be no access to the stormwater system within the bund.
- ❒ A permanent bunded area should contain pipes and pumps for the removal of liquids. The pipe and pump facilities must be arranged within the areas so that the bund can't leak and that the pumps will still operate when the bund is full.
- ❒ Bunded areas within the processing plant should be adequately ventilated ensuring so build of gases and that it does not restrict fire fighting access.
- ❒ Open air bunded areas may be installed with a roof preventing precipitation from entering the bund.

4.3.2 Operational Phase Groundwater Management

Management of groundwater during the operational phase will largely be a continuation of the management of structures and safeguards built during the construction phase. The operational phase will include consideration of additional monitoring data and verification procedures to ensure that the groundwater impacts are within predicted levels.

The pre-feasibility study of potential inflows to the underground workings will be updated when suitable access is provided once the decline is completed to assess the potential rate of inflow to, and storage within the deeper workings. The assessment will consider the inflow from seepage from within the open cut and from the adjacent groundwater system. For each component, water quality and potential rate of inflow will be assessed. This will include monitoring of groundwater inflows (volume and quality) into the mine and the volume of water removed. This data will be used to update the Water Balance. Previous data from the mine's operational period showed water ingress of approximately 1.5 litres per second (47.3 ML/year) entering the mine. This figure has been used in the Water Balance but may require revision once the underground mine is operational.

Depending on the outcome of this assessment, additional work may be required, including updating the water balance to include any variation in groundwater make, usage and storage provisions. Other ongoing groundwater management provisions include:

- ❒ Sealing of TDS as part of the tailings retreatment project. Success will be determined by ongoing monitoring of the seepage below the dam wall.
- ❒ Effective rehabilitation of the tailings dams as soon as practicable following retreatment to reduce the potential for seepage in the long term.
- ❒ Maintain sufficient freeboard on all pollution control dams, tailings dams and evaporation dams to avoid untreated releases off site.
- ❒ Ensure all PAF material is stored within the WRE and that all drainage continues to enter the TDN structure. No PAF material is to be stored on the surface following completion of the operation and final rehabilitation phase.
- ❒ Continue the current groundwater monitoring program as well as provide additional groundwater monitoring points as specified in the EA and Statement of Commitments.

Continuation of the groundwater monitoring program as described below is the main management tool which will be used throughout the ongoing operation in order to verify that the site is not adversely impacting groundwater systems.

4.4 Management of Paste Fill

The proposed underground extraction method will incorporate paste backfill of existing and new voids rather than the previous method of using extracted fill. An expected 180,000 m^3 of paste fill will be used underground per operating year. The paste will be a mixture of processed tailings and cement, and is engineered to achieve required strength and cohesion parameters. The engineered nature of paste fill makes the stoping operations more reliable and systematic, with the length of open voids controlled to ensure local stability. The paste fill will be delivered from the surface Paste Plant adjacent to the mine entry box cut via boreholes and reticulated in steel and polyethylene pipes.

The permeability of the paste will be in the order of 2.0 x 10^{-8} m/s which is significantly lower than the previous rock fill method and the material will have much lower metal and sulphide concentrations that the original ore that was mined from the paste filled stope. The impact on groundwater quality will be minimal however there would be a slight increase in water holding capacity of the mined area compared to the original strata.

The paste will generally be alkaline and may over time increase the pH of the mine water. This will be monitored during the course of mining but is considered a desirable outcome. As with the reprocessing of the tailings dams, the completed underground extraction areas will result in a general reduction in sulphide material. This in turn will reduce the occurrence of acidic groundwater generation compared to the pre-mining environment.

4.5 Groundwater Monitoring

Monitoring of piezometric installations provides an indication of the hydraulic pressures associated with onsite dams. These readings, in conjunction with groundwater quality data, contribute to assessing the integrity and stability of the large storage dams and the potential for offsite impacts to be occurring. It is important to note that the environment prevailing at Woodlawn is heavily influenced by the sulphide ore body which has already been the subject of mining for many years. The natural environment is therefore normally high in base metals

The groundwater quality monitoring program is designed to monitor groundwater in the vicinity of the mine for a wide range of analytical parameters indicative of mining operations. Comparison of background groundwater quality with surface water monitoring results (from tailings dams) and downstream groundwater quality can provide an indication of the management and containment of contaminated land and runoff. All groundwater monitoring locations are shown in Plan 5.

The existing monitoring program was established in the late 1990s however some sites date back to 1984. The network is designed to enable monitoring of any seepage from dam structures, tailings storage structures, rock emplacements and new installations including the processing plant, paste fill plant and the new tailings storage facility.

The monitoring program will be extended as required during the operational phase. The original EA suggested the installation of additional groundwater monitoring bores to ensure that all potential contamination flow paths are captured. The main area requiring additional monitoring is the new TSF4 installation where up to 4 additional piezometers will be required. These will be installed down gradient of the new infrastructure in Hickory's Paddock. The installation depths and screening provisions will be confirmed through consultation with DPI Water but are likely to be in the order of 12 m deep. This depth was determined based on the average depth of other monitoring bores. These enable assessment of the baseline and ongoing changes in groundwater levels or chemistry resulting from the proposed works.

Shallow groundwater monitoring will continue to be undertaken from MB4 as well as the existing groundwater monitoring network. The new bores however will be monitored as outlined below.

4.5.1 Water Levels

Groundwater levels will be monitored in the existing open standpipe piezometers manually every 6 months as is currently undertaken, however the new bores covering TSF4 will be installed with pressure transducers set to read at least 12 hourly, and will be downloaded as outlined in **Table 4.1**.

Standing groundwater levels will be taken manually on a quarterly basis from at least the following bores:

- ❒ MB2, MB3 and MB10 which lie in the Crisps Creek Catchment downstream from ED1.
- ❒ MB4 and MB8 which lie upslope and downslope respectively from the processing plant site in Hickory's Paddock.
- ❒ F1 which is located downstream of the main dam wall of TDS.
- ❒ X2 which lies downstream of TDS eastern dam wall of TDS.
- ❒ ETP8 which lies downstream of TDN on the eastern side.
- ❒ NTP1 which is located on the northern side of TDN. This site may however be buried in future as TSF4 develops. The monitoring bores for TDN will be replaced with the new bores for TSF4.
- ❒ MB6 which is located adjacent to the paste fill plant and new mine entry.
- ❒ MB15 which is located on the western side of the Rehabilitated Waste Rock Dump.
- ❒ MB13 which is located on the western side of SML20 in Allianoyonyiga Creek.
- ❒ MB17 which is located to the west of the Rehabilitated Waste Rock Dump.
- ❒ Water levels within the underground workings.

DPI-Water has specifically nominated MB3, MB8, MB17 and MB13 in Works Approval 40WA417428 to be used to assess any impact on licensed bores of the dewatering of the mine workings. By continuing to measure water levels in the above bores, the impact on regional groundwater levels can be determined. This will continue to provide information on the potential to impact on groundwater supplies to neighbouring properties.

Specific TARPs have been developed in consultation with DPI-Water and are included in the Approved Interim Bore Management Plan relating to condition DS6041-00001 of Works Approval 40WA417428. These TARPs are reproduced in Table 5.2.

4.5.2 Mine Water Pumping

Heron will develop procedures as part of an underground water management plan to manage the potential risk of in-rush from:

- ❒ water stored in decommissioned workings, and;
- ❒ intersection with bores, structures or drainage holes.

Flow meters will be strategically located throughout the mine to enable reliable measurement of water pumped in and out of the workings to assist in the identification of groundwater make and water accumulation as the decline development and subsequent mining progresses. A description of the initial dewatering program is provided in Section 2.2.

4.5.3 Water Chemistry

During logger downloads, the field pH and EC will be measured from the open standpipe piezometers with calibrated hand held meters, whilst sampling for laboratory analysis of the waters will be conducted on a 6 monthly basis.

At least one appropriately purged and prepared groundwater sample will be collected from each piezometer at 3 monthly intervals for pH and EC, and six monthly for ongoing laboratory analysis assessment of any mining related changes in groundwater quality. Samples will be analysed for:

- ❒ field pH and electrical conductivity (3 Monthly), as well as 6 monthly for;
- ❒ total dissolved solids;
- ❒ Na, Ca, Na, K, HCO_3, SO_4, Mg, Cl, F;
- ❒ filterable Fe, Mn, Cu, Pb, Zn, Cr, Al, Cd, Co, As, Hg; and
- ❒ bicarbonate, carbonate, alkalinity and nitrogen (ammonia).

All monitoring will be conducted in accordance with the Murray Darling Basin Groundwater Quality sampling Guidelines, August 1997, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) or Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines or the latest equivalent.

Table 4.1 Proposed Groundwater Monitoring

Aspect	Frequency	Purpose
Open Standpipe Piezometer water levels	Logged at 12 hour frequency and downloaded every three months.	To measure the basement groundwater levels
Open Standpipe Piezometer field water quality	Three monthly monitoring of pH and EC	To measure field groundwater quality changes, if any, at various locations due to mining
Open Standpipe Piezometer groundwater laboratory analysis	Six monthly sampling and laboratory analysis for parameters outlined in Section 4.4.2	To measure detailed groundwater quality changes, if any, at various locations due to undermining

The purpose of the chemical analysis is to identify water which may have been altered by the mining operation or storage areas. Although background levels can vary considerably and be heavily influenced by the naturally occurring sulphide ore body, specific characteristics and identifiers have been developed as part of the Trigger Action Response Plan detailed in Section 4.5.

4.5.4 Rainfall

Rainfall will be monitored daily at the existing Woodlawn weather station for the duration of the mining operation. This data will be used to update the runoff values used in the water balance assessment as required.

4.5.5 Reporting

Progress against the requirements of this Plan will be reported regularly to the DPE and other relevant agencies as required by the Project Approval.

In accordance with the requirements of the Project Approval, the environmental performance of the Woodlawn Mine will be reported on the Heron website as well as contained in the Annual Review.

4.6 Groundwater Trigger Action Response Plan

The Trigger Action Response Plans covering surface and groundwater are provided in Section 5.2.

These triggers will be reviewed and adjusted as required in consultation with the relevant agencies following completion of 12 months of data acquisition and interpretation, and annually, or as specified by the relevant agency thereafter.

Since groundwater quality is influenced by natural geology, and specifically, the sulphide rich volcanic in the area, specific trigger values are difficult to set for any bores other than those that are set within sedimentary rock. However, in some instances, it may be possible to establish trends which may indicate the influence of mining operations. Establishing the equivalent of the 80th percentile groundwater quality generally in accordance with ANZECC 2000 methodologies will be goal of the ongoing monitoring program.

5 VERIFICATION AND CORRECTIVE ACTION

An essential component of the EMS is verification and implementation of corrective actions as required to achieve the requirements of the Project Approval and Environment Protection Licence (EPL). This Water Management Plan has adopted the principals of continuous improvement which is the key outcome of verification and corrective action initiatives.

5.1 Environmental Monitoring

Heron has developed an environmental monitoring program covering both the construction and operational phases. Since the approval of the redevelopment of the Woodlawn Mine and the subsequent transfer and renewal of SML20, Heron has taken over a component of the environmental management and monitoring responsibilities from Veolia for areas outside the Bioreactor facility.

Heron has obtained a separate Environment Protection Licence covering the future mining operation which is contained as Appendix C. This licence will exclude any specific monitoring required for the Bioreactor which will remain the responsibility of Veolia. There will be some common monitoring points between the licences and as otherwise required by the various planning approvals. These include the sharing of the onsite weather station and some background surface and groundwater monitoring sites. The current environmental monitoring sites are shown on Plan 5 and described in Sections 3.1 and 4.4.

Additional monitoring will be required for the construction program in relation to water management. This will include:

- ❒ Weekly inspections of all temporary pollution control facilities during the construction phase. Additional inspections will be undertaken following rainfall events. Any build up of sediment or repair work will be implemented as soon as practicable.
- ❒ Monthly water samples to be taken at the main pollution control pond in Hickory's Paddock on a monthly basis. This sample is to be tested for pH, conductivity and metals as indicators.
- ❒ Weekly inspections of the construction site by the Environmental Manager and a report prepared on the function and operability of all pollution controls, revegetation condition, temporary erosion and sedimentation controls. The inspections will be recorded and remedial action with responsibilities and timeframes noted.
- ❒ Installation of additional groundwater monitoring wells downstream of TSF4 prior to commissioning.

During the operational phase, the monitoring program will conform to the requirements of this plan and as specified in the EPL and Project Approval. The monitoring program will continue for the life of the Project and include the final rehabilitation phase for a period as specified by DRE. The post-closure water quality data will be used to compare with long term operational data to determine if any long term water quality implications will arise. The currently approved Mining Operations Plan requires post closure monitoring of rehabilitation activities. This usually extends over a 3 year period which would also include water quality monitoring at the key external sites.

The existing monitoring program includes a number of monitoring bores around surface water storages including ED1, ED2, TDS and TDN as well as other bores which are designed to monitor seepage from the Rehabilitated Waste Rock Dump and associated seepage collection dam. These are generally monitored biannually for pH, conductivity, sulphate, zinc, copper, lead, iron, calcium, magnesium, potassium and sodium.

As required by Condition 4(c) of the Project Approval, the effectiveness of the monitoring program will be reviewed annually to ensure it captures sufficient data to determine the potential for seepage from structures,

acid drainage from the existing and proposed rock dumps and the potential for off site impacts. The results of this review will be provided in the Annual Review.

Veolia operate additional monitoring bores near ED3 which are also monitored for ammonia. The monitoring sites which are listed on Heron's EPL 20821 are shown on Plan 5 and the monitoring descriptions are detailed in the EPL provided as Appendix C. Data collected are reported in the Annual Review which includes an analysis of the results. To date, these results do not show that the operation has historically caused impacts to surface or groundwater systems beyond the boundaries of SML20.

There has been some concerns raised by various government agencies in relation to the potential leakage from ED1 however the monitoring results surrounding the structure do not show an increase in metal concentration or conductivity or reduced pH. Heron will continue to liaise with government agencies on these issues and report on any future investigations in the Annual Review each year.

5.2 Trigger Action Response Plan

The purpose of the Trigger Action Response Plans (TARPs) is to allow early detection of events and actions that may result in material harm to the environment, the mining operation or people. The level of likely impact that may result from the trigger being activated is assessed on a progressive scale which will influence the type of response action proposed. The TARPs then set out guidelines and directions on what actions are to be taken to rectify the situation so that the risk or harm is not allowed to escalate.

Generally three event levels have been assessed. The first event level relates to the normally anticipated or predicted range of impacts which lie within assessment goals or standards. The second event relates to exceedences or measured impacts up to 20% of assessment goals. The third level would be generally regarded as well in excess of the anticipated impacts where environmental damage or harm may reasonably be expected. As the Woodlawn Mine has yet to commence production, these TARPs are to be considered preliminary and will be updated progressively as a result of ongoing mining operations and further data being obtained. Some TARPs relate to construction activities and the initial mine dewatering program. Once operational, these TARPs will no longer be applicable.

As required by the overall Environmental Management Strategy for the Woodlawn Mine, all environmental management plans and component TARPs will be reviewed on an annual basis and updated as necessary.

The primary goal of the surface water management system is to not discharge contaminated surface water from the site. The mechanism to determine that the site is not impacting on receiving waters is the current background monitoring program. The main background monitoring sites are:

- Farm Road Crossing (FRC) which is located downstream of ED1 in Crisps Creek.
- Site 105 which is located further downstream in Crisps Creek just below the new Processing Plant Site.
- Site 100 which is located on the western perimeter of SML20 and measures water quality downstream of the Rehabilitated Waste Rock Dam in Allianoyonyiga Creek.
- Site 109 which is located on the edge of SML20 downstream of the TDS.

In determining appropriate triggers for background receiving water it needs to be understood that surface water can be heavily influenced by local geology and soils which reflect the chemistry of the underlying sulphide ore body. An important issue in determining if the mine has had any influence over natural background levels is to ascertain if there are any long term trends in water quality. Since 2007 there are no emerging trends although there have been isolated spikes in water quality.

An appropriate trigger set-point, referred to as the assessment criteria, would therefore be the development of trends which would indicate that the changes are not related to natural variability. For each of the listed

background sites, the water quality trigger is therefore a change of greater than 20% in each water quality parameter measured over sequential quarterly periods during any 12 month period. Variability in water quality can be extreme as shown in Tables 3.2 and 3.3 however the data shows correlation to rainfall patterns.

The response to such an event would be an investigation into the causes of the change and reporting back to the Department of Planning and Environment (DPE) and Department of Industry, Resources and Energy (DRE) within the Annual Review. Should a change greater than 20% occur over a 6 month period, the DRE and DPE will be notified and advice sought from the EPA.

Should the trend continue over a two year period and be found to be independent of rainfall patterns then an external investigation would be commissioned. The results of the investigation, including any recommendations would be provided to DPE, DRE and EPA.

Similarly for groundwater, the TARPs have been set at nominated levels which may indicate that groundwater contamination may be occurring. As the natural groundwater quality is variable and often high in salts and metals, specific indicators have been identified. The triggers relate to the detection of and trends for these indicators over a 12 and 24 month period.

As there is an exceptionally large environmental monitoring data base available at Woodlawn, the best form of triggers would be the development of trends outside the normal natural variability. The database has extended over drought and flood periods and with this knowledge, unusual trends can be determined which may indicate that the mine may be having an influence on natural surface or groundwater quality. The following triggers will be reviewed on an annual basis once the mine is operational.

Table 5.1 - Trigger Action Response Plan – Water Quality

Component	Parameter	Trigger	Action
Surface Water			
Site 115 Allianoyonyiga Creek	pH	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Conductivity	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
Site 105 Crisps Creek	pH	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting

Component	Parameter	Trigger	Action
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Conductivity	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
Site 100 Woodlawn/Willeroo Boundary	pH	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Conductivity	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
Site 109 Pylara Boundary	pH	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Conductivity	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA

Component	Parameter	Trigger	Action
Farm Road Crossing (FRC)	pH	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Conductivity	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
Mine Dewatering Stage 2A-2D	Ammonia	<1000 mg/L	Continue pumping
		Varied readings but average over 3 samples less than 1000 mg/L	Continue pumping but increase monitoring frequency to daily
		Rising trend over 3 samples above 1500 mg/L	Dilute with ED3 stormwater to reach 1000 mg/L
		Single Sample above 2000 mg/L	Cease pumping until pilot treatment is available
	BOD	<120 mg/L	Continue pumping
		Fluctuating readings but average over 3 samples less than 200 mg/L	Continue pumping but increase monitoring frequency to daily
		Rising trend over 3 samples above 300 mg/L	Dilute with treated leachate to reach 120 mg/L
		Single Sample above 500 mg/L	Cease pumping until pilot treatment is available
	Odour	Within estimated levels for Stage 1	Continue pumping
		50% above estimated levels with rising trend	Assess odour impacts by remodelling site
		Odour levels estimated to increase at nearest receptor	Cease pumping until pilot treatment process operational
Mine Dewatering Stage 3	Ammonia	Within agreed levels with EPA	Continue pumping
		Exceedence of EPA agreed values	Cease pumping until treatment process is corrected
	BOD	Within agreed levels with EPA	Continue pumping
		Exceedence of EPA agreed values	Cease pumping until treatment process operation is corrected
Groundwater Monitoring Bores	pH	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting

Component	Parameter	Trigger	Action
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Conductivity	< 20% trend change over longterm average over 12 months	Continue monitoring and reporting
		> 20% trend change over longterm average over 12 months	Investigate rainfall patterns and dam levels Inspect for signs of leakage Continue monitoring and reporting
		> 20% trend change over longterm average over 24 months	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Ammonia	0-10mg/L	Continue monitoring and reporting
		>20 mg/L with rising trend over 3 samples	Investigate nearby storages for leachate content Advise DPE, DRE and EPA of results
		>50 mg/L and rising trend over 6 samples	Engage external consultant to investigate causes and to provide recommended remedial actions Report results to DRE, DPE and EPA
	Hydrocarbons (TPH)	0-100 µg/L, ie undetectable at laboratory	Continue monitoring and reporting
		> 100 µg/L	Investigate source of hydrocarbons and report to DPE, DRE and EPA

Table 5.2 below specifically deals with groundwater level TARPs. These TARPs are specified in the DPI-Water approved Interim Bore Management Plan (August 2018) which relate to Works Approval 40WA417428 condition DS6041-00001.

Table 5.2 – Trigger Action Response Plan - Groundwater

Monitoring Bore	Trigger Level	Response Action
MB3	Recorded water level in MB3 is between 5 – 6 mbgl during a quarterly period for 3 consecutive quarterly periods	Response Action 1
	Recorded water level in MB3 is greater than 6 mbgl during the normal monitoring period	Response Action 2
MB8	Recorded water level in MB8 is between 7.5 – 8.5 mbgl during a quarterly period for 3 consecutive quarterly periods	Response Action 1
	Recorded water level in MB8 is greater than 8.5 mbgl during the normal monitoring period	Response Action 2
MB17	Recorded water level in MB17 is between 7 – 8 mbgl during a quarterly period for 3 consecutive quarterly periods	Response Action 1
	Recorded water level in MB17 is greater than 8 mbgl during the normal monitoring period	Response Action 2
MB13	Recorded water level in MB13 is between 6 – 7 mbgl during a quarterly period for 3 consecutive period	Response Action 1
	Recorded water level in MB13 is greater than 7 mbgl during the normal monitoring period	Response Action 2

Abbreviations:

Term	Meaning
mbgl	metres below ground level
Response Action 1	Investigation and advise Department of Industry - Water and the Natural Resources Access Regulator within 5 business days of detection.
Response Action 2	Investigate and advise Department of Industry - Water and the Natural Resources Access Regulator within 5 business days of trigger exceedance and undertake remedial measures to address impacts from mining operations on groundwater supply for all affected landholders.
Remedial measures	Remedial measures should include but not restricted to the lowering of pumps, reconstruction of existing bores, construction of new bores, monetary compensation for increased pumping costs and/or for securing water from alternative sources.
Normal monitoring period	monthly
Quarterly period	A period of three consecutive months

The above groundwater triggers are tied to the Water Access Licence Works Approvals.

5.3 Response to Monitoring Triggers

Following receipt of surface and groundwater monitoring data, the Environmental Manager will review the results against the trigger values identified in this WMP. In the event that any trigger values are exceeded, Heron will arrange for further check measurement to be undertaken to confirm the initial monitoring result. There have been several anomalous results evident in the large data record for the site and it is important in future to verify that the results obtained are real and not laboratory error or simply extraneous results.

Should the check sampling indicate the water quality/volume/piezometric level remain outside the trigger values, the proponent will contact the DPE in the first instance. In the case that a breach of the EPL has, or may have, occurred, the EPA will also be notified.

Heron will implement the first trigger response which will include undertaking an investigation of the results and determine the cause. The investigation will include analysis of external factors such as rainfall patterns,

seasonal response and dam water levels and quality. Any additional requirements of the relevant government agency will also be implemented.

In the event that the trigger was in relation to groundwater level, the Department of Primary Industries - Water (DPI-Water) will also be notified and any advice received will be implemented (Response Action 1). In general, the investigation will include but not necessarily be limited to:

- ❒ an analysis of surrounding water levels and climatic conditions to determine whether the exceedance is restricted to a limited area or is more widespread and whether there is a clear link between climatic conditions and the water levels in the bore(s);

- ❒ Engagement of a suitably qualified and experienced expert in consultation with the DPE and DPI Water to further investigate the lowered groundwater level and provide advice in relation to the significance of the decrease in water level and recommended amelioration measures to be implemented, including a review of any groundwater model or groundwater drawdown predictions.

If the trigger was in relation to water quality trends in background sites, the investigation will include but not necessarily limited to:

- ❒ Request that the laboratory retest the sample.
- ❒ Taking an additional sample for field testing and if pH and conductivity are within normal range, a full re-sampling will be undertaken and sent to the laboratory.
- ❒ Additional samples to be taken at any upstream site which may have caused the exceedance.
- ❒ Identify any changes in the flow paths or operational changes that may have given rise to results. This would include recent dam level changes, pumping variations or recent earthworks in the vicinity.
- ❒ Take additional water samples further downstream to determine if there has been any additional spread of contamination.

A report will be prepared in relation to the investigation including laboratory results and any external consultant report and provided to relevant government agencies. Heron will then implement the requirements of government agencies as a result of this investigation.

5.4 Reporting Procedures

All environmental monitoring requirements specified in EPA licences and approvals are undertaken and the data kept on site. Copies are provided to the Mine Manager, who in consultation with the site Environment Manager, reviews the data on a monthly basis. A summary of the data is provided to regulatory authorities as required by statutory approvals. Other data collected as part of projects or auditing procedures are reported internally in accordance with the EMS verification procedures.

An Annual Review will be provided to the following agencies:

- ❒ NSW Department of Industry, Resources and Energy.
- ❒ Department of Planning and Environment.
- ❒ Water NSW.
- ❒ Goulburn Mulwaree and Palerang Councils.
- ❒ NSW Department of Primary Industries (Water).
- ❒ Office of Environment and Heritage.
- ❒ NSW Environment Protection Authority.

- NSW Roads and Maritime Services.

5.5 Non-Conformance, Corrective Action and Adaptive Management

Responsibility for identifying non-conformances will rest with a number of personnel to ensure that any non-conformances are identified as soon as possible. Primary responsibility rests with the Mine Manager who is supported by the Environmental Officer. All non-conformances are reported to the Mine Manager in the first instance and then to the Project Manager for action.

Corrective actions should be implemented as soon as practicable on identification of any non-conformances, and records of such are to be maintained. Corrective actions are to be in line with Tarago Operations environmental policy and current best practice within the industry and ensure that appropriate guidelines are met.

As part of the Project Approval conditions, corrective action will be form part of the Adaptive Management process where any exceedance of the criteria and/or performance measures has occurred.

In such cases, Woodlawn Mine will at the earliest opportunity:

- take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
- implement remediation measures as directed by the Director-General, to the satisfaction of the Director-General.

5.6 Preventative Action Procedures

Preventative action will consist predominantly of monthly inspections undertaken by the Environmental Officer as well as external audits required under the Project Approval. Steps will be taken to ensure that any potential non-conformances do not occur. Any preventative actions will be commensurate with the environmental impact anticipated.

Any changes in procedures resulting from corrective and preventive action will be documented and the appropriate personnel notified, including Tarago Operations management team.

5.7 Record Keeping

Records are kept of all environmental monitoring, audits and actions taken under this Water Management Plan. Records will be legible, identifiable and traceable to the activity and stored and maintained so that they are readily retrievable and protected against damage, deterioration or loss.

5.8 Auditing Procedures

The Project Approval requires that an independent environmental audit be undertaken within one year of commencing construction of the project, and every three years thereafter for the life of the mine. Separate internal audits may be carried as part of any specific project or activity, or to assess the effectiveness of existing

environmental controls and procedures. These audits may be formal or informal and aim to highlight any areas for improvement in environmental risk control.

The independent audit carried out in accordance with the Project Approval must:

- ❒ be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Director-General;
- ❒ include consultation with the relevant agencies;
- ❒ assess the environmental performance of the project and assess whether it is complying with the requirements in this approval and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals);
- ❒ review the adequacy of strategies, plans or programs required under the abovementioned approvals; and
- ❒ recommend appropriate measures or actions to improve the environmental performance and rehabilitation of the project while on care and maintenance or following mine closure.

An annual internal audit of the Water Management Plan will also be undertaken to ensure that it conforms with planned arrangements for environmental management and the requirements of the Project Approval, Environment Protection Licence, and that the system has been properly implemented and maintained. Outcomes of the audit will be used to review and update the plan.

5.9 Management Review

The purpose of management review of the WMP is to identify any weaknesses or out of date procedures. The aim is to maintain the WMP in line with current industry and Australian standards and changes to environmental legislation.

Management will review the WMP on an annual basis. The management review process will ensure that the necessary information is collected to allow management to carry out this evaluation and the review document.

The management review should address the possible need for changes to policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement.

5.10 Continuous Improvements

A key component of the overall Environmental Management Strategy (EMS) for the Woodlawn Mine is the commitment to continuous improvement. This will be measured by formal and informal criteria. Formal measures will include internal and external inspection and action plans, monitoring data and reporting. These reports will be used to establish trends in non-compliance and environmental performance. The level of non-compliance with both statutory and company standards will then be summarised in the Annual Review.

The auditing will also provide an assessment of housekeeping and general environmental awareness of the operation, how the site has adopted new technology, maintenance of pollution control systems, preventative actions, community consultation and responded to incidents and corrective action plans. This information will be used to provide a general trend in environmental performance.

5.11 Environmental Training

The EMS requires that all future employees at Woodlawn receive an appropriate level of environmental awareness training. This training will be tailored to suite the mine and covers the following levels:

- ❒ Site Managers and supervisors.
- ❒ Surface workforce.
- ❒ Underground workforce.
- ❒ Induction level for visitors.

Competency based training will be provided to key personnel. This training will cover environmental legislation, performance criteria, details of specific pollution control system for the site and emergency planning.

General surface workforce will be trained in specific site procedures and management of pollution control systems while all employees are made aware of the Woodlawn Project's environmental obligations and statutory requirements.

5.12 Community Complaints

As required by the Project Approval and Environment Protection Licence, the Woodlawn Mine will maintain a community complaints register that identifies actions required to resolve community issues. The main phone line will be advertised in the white pages and will be used as the designated community complaints line. The complaints register will record the following details:

- ❒ Complainant name and contact details
- ❒ Nature of the complaint (noise, dust, traffic etc)
- ❒ Time and date of the complaint
- ❒ Specifics of the complaint
- ❒ Actions taken to resolve the complaint
- ❒ Confirmation that the complaint has been resolved.

In the event that an issue is unresolved, the register will include details of the outstanding issues and any actions that are required. It is recognised that some issues may not have a simple resolution and have resulted in multiple complaints. These form part of the ongoing environmental improvement program for the operation.

Co-ordination between Veolia and Tarago Operations will be necessary to avoid duplication of effort but more importantly inadvertent identification of complaints between the two operators on site.

6 REFERENCES

6.1 External documents or legislative

DOC ID	TITLE
07_0143MOD2	Woodlawn Mine Project Approval
EPL 20821	Woodlawn Mine Environment Protection Licence
40WA411642	Water Access Licence Lachlan Fold Belt
WAL42034	Water Access Licence Goulburn Fractured Rock
SML20	Special Mining Lease 20

6.2 Heron documents

DOC ID	TITLE
TOP-SSE-MAN-0039	Environmental Management Strategy

7 READ AND UNDERSTOOD DOCUMENT REQUIREMENTS

All employees have a legal obligation to follow safe work practices and procedures when carrying out any work task. Following the requirements of this document and other documents applicable to the task being performed is critical in protecting the safety of all operators, co-workers and visitors to the site.

All employees must strictly adhere to these requirements. Failure to do so could result in a serious safety breach with consequences as part of the Code of Conduct. You are signing this acknowledgement sheet agreeing to work to this procedure and have either read the document personally or had the document read and explained to you and, have clearly understood the requirements.

You also acknowledge that at any time you may not be sure of the requirements and the contents contained within this and/or any other documents, you are to ask for a copy so that you are familiarised again with the contents and requirements allowing you to operate this equipment and perform your work safely.

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Print Full Name:	*Full Signature:*	*Date:*

8 APPENDICES

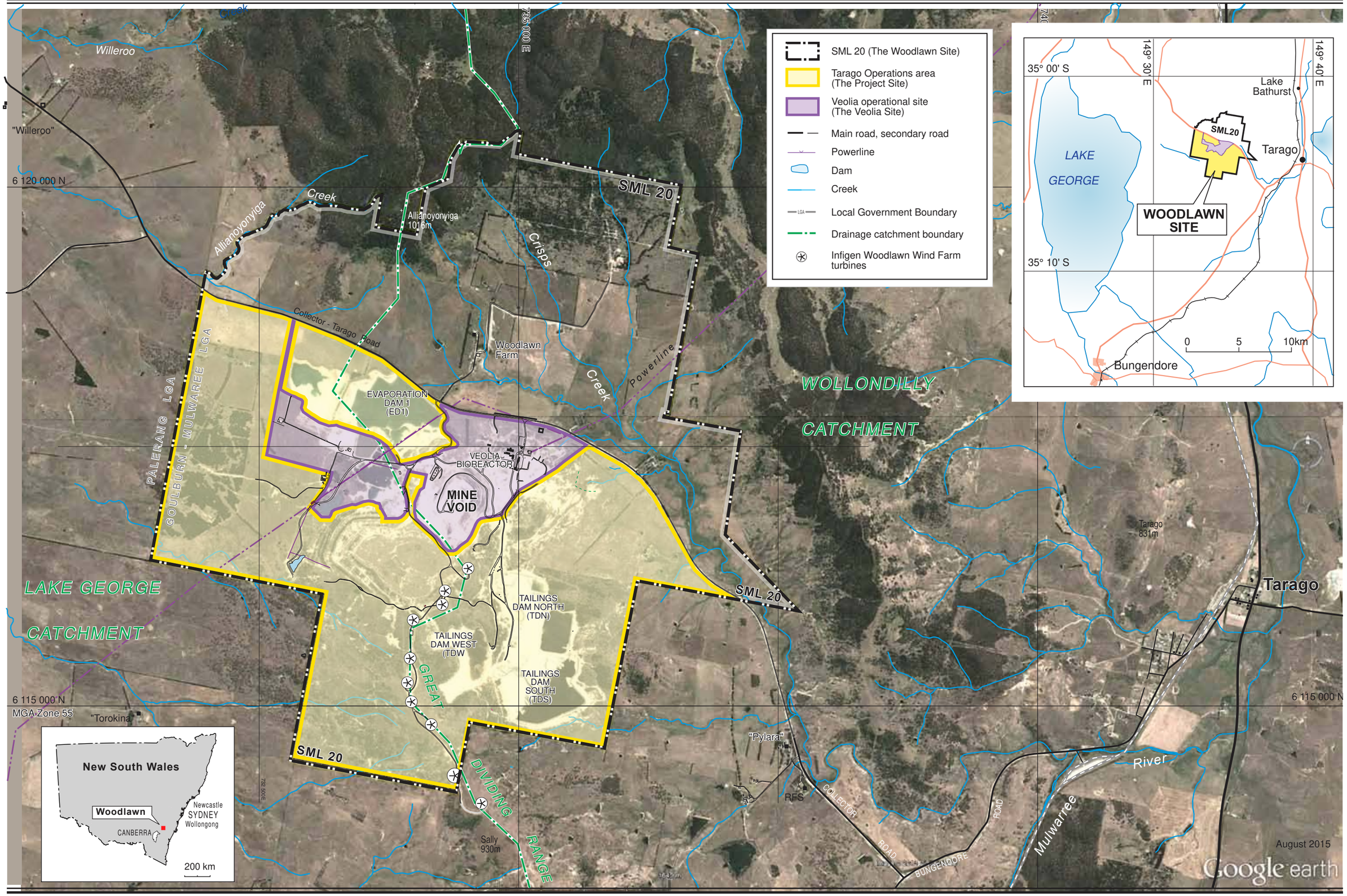
Appendix 1 – Plans

Appendix 2 - Definitions

Appendix 3 – Roles and Responsibilities

Appendix 4- Consultation Log – Water Management Plan

Appendix 1 – Plans

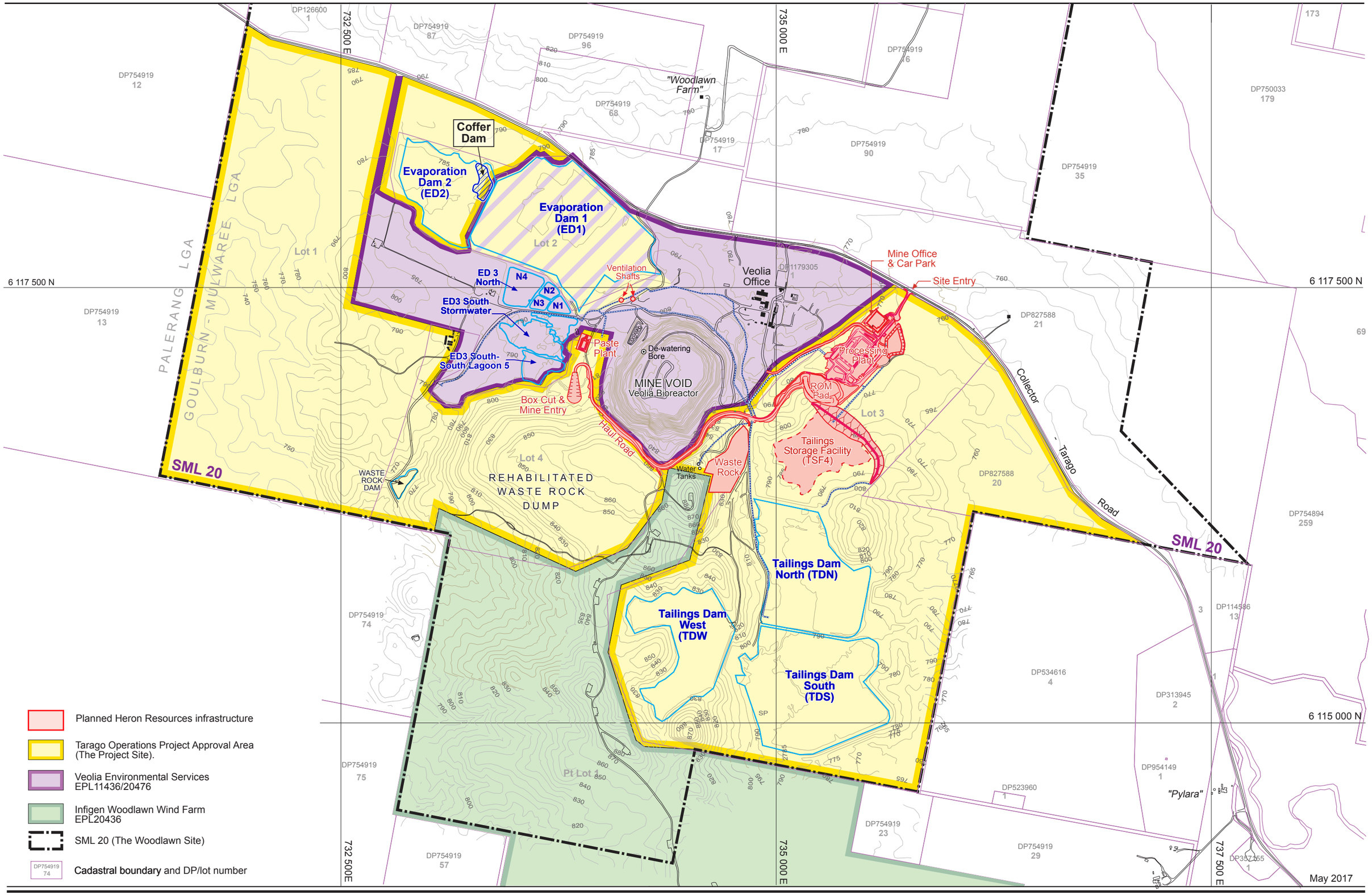


Topographic map source : Lake Bathurst 8827-4-N

0 500 1000 1500 2000 metres

N

Plan 1
Woodlawn Site - Locality Plan



PLAN 2
Woodlawn Mine - Site Details

735000E
735500E
736000E
6117000N
6117000N
VEOLIA SITE
Light Vehicle Access Road
Temporary sediment pond during construction only
CURRAWANG - TARAGO ROAD
Office and Change House Area
Sewage Treatment Plant
Site Runoff Dam
Process Water Dam
WORKSHOPS
PROCESSING AREA
Light Vehicle Access Road
ABOVE GROUND PIPELINES
Existing Pond
ROM PAD
PIPELINE
ABOVE GROUND PIPELINES
HAUL ROAD
Tailings Storage Facility (TSF4)

WATER MANAGEMENT
- Clean water diversion channel
- Site water flow
- Site drains
- Natural drainage
- Rock protection
- Planned dam
- Existing dam

July 2017

0 50 100 200 metres
Scale 1:3000 at A3

N

PLAN 3
Woodlawn Processing Plant - Water Management

LEGEND

SITE CLEARING AND GRUBBING AREA (TBC)

NORTH

PASTE BACKFILL PLANT AREA

BOX CUT AND MINE ENTRY PORTAL

HAUL ROAD

COLLECTOR ROAD

LIGHT VEHICLE ACCESS ROAD

ADMINISTRATION AREA

CONCENTRATE HANDLING AREA

TRUCK LOOP ROAD

FLOTATION AREA

WORKSHOP AREA

EXISTING POND

POLLUTION CONTROL DAM

ROM DUMP STATION AND TRANSFER CONVEYOR AREA

PROCESS WATER DAM

ROM PAD

PROPOSED MAINTENANCE TRACK TO ROM PAD

RECLAMATION AREA

FINE ORE STORAGE BIN

ROM PAD SKYWAY

TSF4 DAM

1

CLEARING AND GRUBBING PLAN

0 30 90 150m

SCALE 1:3000 AT ORIGINAL SIZE

DRAWING NO	TITLE	REV	DESCRIPTION	BY	DRG CHK	ENG CHK	DATE	APPROVED
		1	HEAVY VEHICLE ROAD REALIGNMENT	JPH	DVE	SST	26.06.17	SST
		0	ISSUED FOR CONSTRUCTION	JPH	DVE	SST	26.05.17	SST
REFERENCE DRAWINGS		DRAWING REVISIONS						

CLIENT HERON RESOURCES LIMITED

Heron Resources

CLIENT DRAWING NO

DRAWN	JPH	JAN '17
CHECKED	DVE	26.05.17
DESIGNED	JPH	26.05.17
LEAD ENG	SST	26.05.17
APPROVED	SST	26.05.17
	3644	
SCALE	1:3000	OR AS SHOWN
	DO NOT SCALE	A1

SEDGMAN

APPROVED FOR CONSTRUCTION

PROJECT WOODLAWN ZINC - COPPER PROJECT

TITLE
WOODLAWN ZINC - COPPER PROJECT
AREA 200 - CIVIL WORKS
GENERAL ARRANGEMENT
SITE CLEARING AND GRUBBING PLAN

PROJECT NO	DRAWING NO	REVISION
A719-P01	A719-03-01-0004__01	1

SML 20 (The Woodlawn Site)

Tarago Operations Project Approval Area (The Project Site).

Veolia Environmental Services EPL11436/20476

Infigen Woodlawn Wind Farm EPL20436

Planned Heron Resources infrastructure

DP754919 74 **Cadastral boundary** and DP/lot number

ENVIRONMENTAL MONITORING SITES & SITE NUMBER

- Groundwater
- Surface Water
- Dust
- Dust - HVAS (High Volume Air Sampler)
- EPA Sites
- Noise

OWNERSHIP OF MONITORING SITES

- Veolia Environmental Services EPL 11436
- Tarago Operations EPL 20821
- Shared EPL sites
- Tarago Operations SML 20 monitoring sites

Datum : GDA MGA Zone 55

0 500 1000 m

N

PLAN 5
Woodlawn Project
Environmental Monitoring Sites

May 2017
TOP-G-006

Appendix 2 – Definitions

TERM	DEFINITION
AEMR	Annual Environmental Management Report, same as Annual Review
AMD	Acid Mine Drainage
ANZECC	Australian and New Zealand Environment and Conservation Council
ANC	Acid Neutralising Capacity
ARI	Annual Recurrence Interval
Blue Book	Managing Urban Stormwater: Soils and Construction – 4th Edition, Landcom 2004
BOD	Biochemical Oxygen Demand
CCC	Community Consultation Committee
COD	Chemical Oxygen Demand
COO	Chief Operating Officer
Company	Heron Resources Limited - Tarago Operations Pty Limited
DPI Water	Department of Primary Industries - Water
DPE	Department of Planning and Environment
EA	Environmental Assessment
ED	Evaporation Dams
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
FRC	Farm Road Crossing
FWD	Fresh Water Dam
IEC	International Environmental Consultants

TERM	DEFINITION
Infigen	Woodlawn Windfarm
MB	Monitoring Bore
NAF	Non-Acid Forming
NAG	Net Acid Generation
NAPP	Net Acid Production Potential
NEPM	National Environment Protection (Assessment of Site Contamination) Measure
NPCD	New Pollution Control Dam
PAF	Potential Acid Forming
PCD	Plant Collection Dam
POEO Act	Protection of the Environment Operations Act 1997
Potential Acid Forming	Potential Acid Forming
ROM	Run-Of-Mine
RWRD	Rehabilitated Waste Rock Dump
SEPP	State Environmental Planning Policy
SML20	Special Mining Lease 20
TARP	Trigger Action Response Plan
TDN	Tailings Dam North
TDS	Tailings Dam South
TDW	Tailings Dam West
TOU	The Odour Unit
TSF4	Tailings Storage Facility 4
Veolia	Owner of the Woodlawn Bioreactor

TERM	DEFINITION
VES	Veolia Environmental Services (Australia) Pty Limited
WAL	Water Access License
WMA	Water Management Act
WMP	Water Management Plan
WRE	Waste Rock Emplacement

Appendix 3 – Roles and Responsibilities

The following outlines the responsibilities in relation to the compliance to this document.

ROLE	RESPONSIBILITY
Managing Director	The **Managing Director** has overall responsibility for the implementation of the EMS at Woodlawn Project as well as to review and approve expenditure and resources necessary to effectively implement the EMS and individual management plans.
Chief Operating Officer (COO)	The **Chief Operating Officer (COO)** reports to the Managing Director and is responsible for Project delivery and ultimate development and operation of the Project.
Project Manager	The **Project Manager** will ensure that the approved management provisions and requirements of the individual Environmental Management Plans (EMPs) and commitments are implemented. The Project Manager will review and evaluate the performance of the EMS program and environmental protection initiatives. This role may be merged with the Mine Manager during the construction period prior to commissioning.
Construction Manager	The **Construction Manager** will be responsible for the day to day management of the construction workforce, implementation of the Construction EMP and report directly to the Project Manager.
Mine Manager	The **Mine Manager** is responsible for the day to day management of the mine and overview role for environmental management systems on site, which will include: • Ensuring compliance with environmental requirements for the site. • Represent the on-site contact officer under the Environment Protection Licence and other statutes. • Report to the COO on a monthly basis on the environmental performance of mine. • Liaise with the Environmental Officer on environmental matters as required.
Environmental Manager	The **Environmental Manager** will provide the following assistance with the EMS: ❒ Provide technical assistance on environmental matters to the Mine Manager. ❒ Undertake the necessary environmental monitoring program. ❒ Organise external environmental experts as required. ❒ Organise external environmental audits of the site on an annual basis. ❒ Develop Corrective Action Programs in consultation with the Mine Manager and monitor their implementation. ❒ Develop and implement an Environmental Training Package for the Mine.

Appendix 4 – Consultation Log - Water Management Plan

Date	Form/Agency	Comments and Outcomes	Response/how addressed
3/7/2014	Initial consultation letter to: NSW Trade and Investment Environment Protection Authority NSW Office of Water Sydney Catchment Authority Office of Environment and Heritage Department of Planning and Environment	These letters were the initial consultation and sought specific advice from each agency according to the respective relevant management plan.	
7/7/2014	Letter from Trade and Investment	Requested meeting and briefing on site and staged approach to preparation and approval of management plans	On site meeting held
10/7/14	Letter from Sydney Catchment Authority	Providing contact details for consultation and requesting meeting	Phone followup and on site meeting held
23/7/2014	Meeting with Goulburn City Council	General Management and Planning Manager, general briefing no specific feedback	
29/7/2014	Letter from NSW Office of Water	**Site Water Balance** - Demonstrate that all sources of water for the proposal are appropriately authorised/licensed. This includes both direct take for consumptive use and indirect or incidental take such as dewatering of underground workings **Surface Water Licensing** - Any take of surface water beyond that authorised under harvestable rights provisions, or taken under exemptions contained within the harvestable rights order or *Water Management (General) Regulation 2011*, will require licensing under the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* or the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources* as applicable. The water management plan should identify all licences nominated to account for this take	Application made to DPI Water for a Works Approval. Approval Granted 12/4/16 No harvestable rights applicable, only one new pollution control dam required

Date	Form/Agency	Comments and Outcomes	Response/how addressed
		Groundwater Licensing - All groundwater take (including incidental take and any ongoing take post-operations) will require licensing under the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* or the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources* as applicable. The water management plan should identify all licences nominated to account for this take. **Surface Water Management** - Demonstrate appropriate measures to minimise potential impacts on surface water sources, including adequate design of water management infrastructure to prevent unauthorised take of water, for example through the separation of "clean", "contaminated" and "dirty" (sediment laden) water streams, and to prevent, monitor, and detect and respond to potential impacts to surface water quality. **Groundwater Management** - Demonstrate appropriate measures to prevent, monitor, and detect and respond to potential impacts to groundwater levels and quality as a result of the project. Groundwater management should be in accordance with the provisions of the NSW Aquifer interference Policy. **Reporting** - The water management plan should also outline annual reporting requirements to enable the Office of Water to understand the take and usage of water in each year, and how that relates to the licences held. Where possible, it is recommended all reporting be streamlined into existing reports required under the conditions of Project Approval. Other comments provided on Waste Rock Management Plan and Rehabilitation Management Plan	Groundwater licence modification applied and granted with new dewatering bore 12/4/16 Chapter 3 Section 3.3 added Section 3.4 expanded Chapter 4 First TARPs added in Section 3.9 Section 5.1
11/9/14	Letter to DPE	Seeking approval of Experts engaged in relevant management Plan	Approval provided
18/9/14	Site meeting with DRE	General briefing and site inspection, outline of Management Plans, finalised scope of MOP, Need for rehabilitation trials, standard environmental management provisions, control of acid generation	Noted
9/10/14	Email to Sandie Jones OEH	Copy of Planning Approval and plans of development area	Noted
10/10/14	Email to Julian Thompson and Michael Heinz EPA	Confirmation of meeting details	Noted
13/10/14	Meeting with EPA and OEH Queanbeyan Office	General project briefing, need for EPL separation with Veolia EPL, monitoring conditions, lack of archaeology sites and impact, need to define vegetation offset area and outcomes	Ongoing negotiation with EPA in relation to licensing requirements
16/10/14	Email to Fran Kelly SCA	Provision of MOP plans, details of water management structures, history of operation and copy of planning approval	Noted

Date	Form/Agency	Comments and Outcomes	Response/how addressed
16/10/14	Email to Rohan Macdonald DPI	Confirmation of telephone conversation with R Byrnes, provision of plans and project details	Noted
8/11/14	Phone meeting with SCA	Phone discussion with Fran Kelly from SCA. General project briefing on water management issues, acid drainage, dam containment, soil and water management and construction details	Additional drawings from Landcom Blue Book inserted
19/1/14	Email to Fran Kelly and James Caddey SCA	Copy of Woodlawn EMS provided, Project Approval, and Construction EMP	
21/1/2015	Meeting with SCA	Site meeting with Fran Kelly and James Caddey from SCA. Meeting discussed construction details, soil and water management during construction, reprocessing of tailings, mine dewatering, acid mine drainage, potential leakages from surface dams, groundwater management, acid mine drainage	Additional section on Acid Mine Drainage included in Section 3.6
3/11/2015	Email to David Stephens DPI Water	Seeking advice on dewatering strategy and required licensing	Additional information provided separate to WMP
18/11/2015	Application report to DPI-Water	Application to Water Management Act Works Approval for dewatering mine workings	WMP updated with volume of underground water requiring removal
18/11/2015	Draft WMP emailed to WaterNSW	Draft WMP emailed to WaterNSW	Noted
18/11/2015	Draft WMP emailed to DPI-Water	Draft WMP emailed to DPI Water	Noted
29/1/2016	Letter from DPI Water	Review of draft Water Management Plan. Additional information request: ❒ Advice in relation to existing groundwater contamination and monitoring provisions ❒ Analysis of impact on any adjacent landowners to be impacted by mine dewatering ❒ Volume to be extracted from workings, location and timeframe ❒ Land use where groundwater is to be extracted ❒ Groundwater implications of paste fill operations ❒ Management of acid mine drainage ❒ Define how seepage collection, treatment and storage systems will be managed with regard to salt ❒ Update WMP to include Water Management Act works approval ❒ Update WMP to include correct cross references ❒ Provide comment on groundwater behaviour ❒ Provide justification on depth of monitoring bores	 Section 3.8 Included in TARPs Section 5.2 Updated Section 2.2 Included in Water Licence Section 4.4 Section 3.6 Section 5.1 Section 1.5 Noted and corrected Section 4.1

Date	Form/Agency	Comments and Outcomes	Response/how addressed
		❒ Provide monitoring frequency ❒ Provide advice on water quality triggers and groundwater decline trigger	Information provided separately Section 4.5, Section 5.1 Section 5.2
9/3/16	Meeting with Community Consultation Committee	Presentation to Woodlawn Community Consultation Committee which included overview of project, monitoring program, construction program, workforce numbers, exploration and environmental management plan preparation and content.	Draft EMPs provided on web page for download by committee members
12/4/16	Letter from DPI Water	Issue of Works Approval under Water Management Act 40WA411642	Included in WMP
26/5/16	Issue of revised WMP vs 5 to EPA, WaterNSW, DPI-Water, DRE, Infigen and Veolia	General email with copy of revised WMP	
20/7/16	Site meeting with SCA	Site meeting with Ravi Sundaram and James Caddey to discuss previous draft WMP and Construction Management Plan. Issues raised in relation to dam leakage, surface water management, soil and water management and environmental monitoring	Provision of addition soil and water management provisions in Section 3.4
9/8/16	Email from Ravi Sundaram SCA	Provision of historical data on groundwater and surface water quality and previous SCA reports on Woodlawn including leakage concerns from ED1/2	Noted
10/8/16	EPL Application to EPA	Application for new EPL covering Woodlawn Mine construction and operation	Noted
12/9/16	Issue of updated WMP vs 6 to DPE	Copy of WMP provided to DPE	Noted
12/10/16	Letter to DPE re additional Experts	Letter from Heron Resources requesting approval of additional experts engaged in management plan preparation	Noted and approved by DPE
12/10/16	Email from EPA re licence application	First draft EPL provided for comment with request for additional plans	6 emails to and from EPA and various phone calls in relation to comments on draft EPL
20/10/16	Letter from EPA re draft EPL	Provision of second draft EPL 20821 for the Heron operation	Noted
2/11/16	Email from Ravi Sundaram SCA	Comments provided on draft WMP: Site Water Balance is light on detail including inputs and outputs Include design capacity of dams Update plan to include location of water management measures and sedimentation control structures Include all new licence numbers and volumes More details of the proposed water treatment plant for various stages Provide more details of water volumes from each source including potable water supply	Water Balance noted as preliminary since the operation has yet to commence and actual data not yet available Plan updated Licence details provided

Date	Form/Agency	Comments and Outcomes	Response/how addressed
		Details of current condition of water management structures and the need for additional works to ensure appropriate functioning Water use/supply figures should be provided in either daily, weekly or monthly values Details of monitoring activities between Veolia and Heron Resources Details of any historical discharges from the site even though the site is currently nil discharge Provide discussion about managing acid forming materials and how groundwater will be protected Expand Trigger Action Response Plan to include summary of background monitoring results Provide frequency of groundwater monitoring Response to triggers should include proposed rectification actions Noted typos and report inconsistencies	Section 2.2 - Requires update when operational and treatment requirements are better understood Values provided as monthly Monitoring details updated Section 5.1 Section 3.6 Section 5.2 Section 5.1 Section 5.2 Noted and corrected
13/1/17	Meeting with EPA Queanbeyan	Meeting with EPA to discuss licence finalisation and amendments to allow dewatering of the underground workings to commence. Advice received to seek an amendment to the existing Veolia EPL 114336 and to include details of staged dewatering and treatment	Additional consultants commissioned and dewatering strategy developed
17/1/17	Email to DPE	Copies of consultation letters and correspondence in relation to the management plans provided to DPE	Noted
20/1/17	Email from EPA	Draft letter to amend EPL 11436 to allow dewatering to commence	Noted
21/2/17	Letter to EPA	Provision of dewatering strategy and details of monitoring breakdown between Veolia and Heron	Noted
15/3/17	Email from EPA re EPL	Updated Woodlawn Mine EPL for comment	Various emails and calls to finalise EPL and attachments
30/3/17	Email from EPA with final EPL 20821	Final EPL issued to Heron Resources	Noted
10/4/17	Letter to EPA	Final Dewatering Strategy provided to EPA.	Incorporated into Section 2.2.1
19/4/17	Email from DPE	Comments on WMP version 8 ❒ Consider adding a new section outlining details of consultation. Including dates, recommendations from government departments and proposed response by the proponent. ❒ Consider including consultation letters and emails as an appendix to the Water Management Plan.	Log of consultation provided in Appendix C Details of correspondence can be provided separately if required

Date	Form/Agency	Comments and Outcomes	Response/how addressed
		❒ Include the design objective/criteria 'manage water onsite with no offsite discharges' in Section 3.3.	Section 3.3 updated
		❒ Water criteria, including specific measurable criteria should be developed for key parameters. Should be included in one overall trigger action response plan (TARP) covering aspects such as surface water and groundwater quality, contamination, seepage and odour. This TARP should also cover the final dot point in this sub condition relating to mitigate or offset impacts that cause material harm.	Overall TARPs provided in new Section 5.2
		❒ Review the Figures within the MP as a comparison of Figure 2 from the EIS Mod and Plan 2 from the Water Management Plan illustrates a minor change in the layout for TSF4 (increase), changes around processing plant/ROM area and removal of proposed ventilation shafts.	Figures updated Separate overlaid versions showing progressive changes can be provided
		❒ Ensure all mitigation measures from the Statement of Commitments are included in the Water Management Plan.	Statement of Commitments added.
		❒ Consider adding a new section outlining details of consultation. Including dates, recommendations from government departments and proposed response by the proponent.	Consultation Log includes details of consultation with EPA in relation to water storages
		❒ DPE notes that evidence of agency consultation regarding the recent changes to water storages arrangement is required.	Baseline data updated to most recent
		❒ S3.1 - baseline data should include 2007 to latest feasible date.	Revised Section 5.1 to align with MOP
		❒ Additional detail to be added on post closure water quality monitoring. Include a commitment for when this would be determined (e.g. 5 years from Closure).	Additional Section 4.2.3
		❒ Add details of existing groundwater contamination and monitoring program. Possibly new sub section with Section 4. Include details of the progressive program as per EIS.	Additional data provided in Section 5.1 and new EPL attached as Appendix C
		❒ Expand the details of the proposed surface water monitoring program (briefly described in s3.2) including locations (onsite water storages and creeks), frequency and proposed parameters in the text/table and reference a Plan/figure with these locations.	Additional comments made however separate investigation underway and will be reported separately
		❒ Additional detail regarding monitoring of seepage tailings and evaporation dams (within Section 3.2) is required – as per previous comment.	Section 4.2.2
		❒ Add details of existing groundwater contamination and monitoring program. Possibly new sub section with Section 4. Include details of the progressive program as per EIS.	New Section 4.4

Date	Form/Agency	Comments and Outcomes	Response/how addressed
		❒ Although there are some details on potential groundwater inflow, some additional information should be added regarding monitoring of the volume and quality of groundwater inflow into underground workings. ❒ There is some detail about the paste fill operations, but further details should be provided regarding potential groundwater quality impacts from paste fill operations. There appears to be little information in the EIS. ❒ Review the key commitments from the EA and incorporate into the document. ❒ Update the reference of "Annual Environmental Management Report (AEMR)" to "Annual Review". ❒ Update the Management Plan to include requirements of – Schedule 6 Condition 3.	Paste Fill Management Plan in preparation. Addition to Table 2 Corrected Included in Table 2 and new Sections 5.2 to 5.12
21 June 2018	DPI-Water	Teleconference with DPI-Water Wagga Office to discuss groundwater TARPs	Draft new TARPs provided to DPI Water 25 June 2018
16 August 2018	DPI-Water	Email received with comments on groundwater TARPs	Amendments made
23 August 2018	DPI-Water	Confirmation of acceptance of groundwater TARPs	Confirmed TARPs including in Water Management Plan