PLN-0090
Surface Water Management Plan

Risk Statement: High

This document will be reviewed on a one yearly basis, unless a process change occurs earlier than this period.

Doc No.	Version No.	Next Review Date	Owner
PLN-0090	7.1	14/06/2024	Superintendent - Environment & Farms

Revision Summary

First Issue	Issue Date	Implementation Requirements	Approved By
1	1 Aug 14	Sent for approval to DPE	MP

Version No.	Revision Date	Summary of Revision Details	Approved By
2	30 Sep 2016	Updated to new format and included SRK information. Reformatted document to follow order of requirements from PA 11_0060 Schedule 6, Condition 3.	MP
3	May 2017	Update to include EPA comments and update for water infrastructure changes around TSF1 & TSF2 infill.	MP
4	May 2018	Minor updates	C Dingle
5	29 July 2020	Update following annual review	C Higgins
6	30 August 2021	Address recommendations from 2020 Independent Environmental Audit	C Higgins
7	May 2023	Administrative update following approval of MOD6 and to include EPL updates. Approved by DPE on 1st November 2023	C Higgins
7.1	Mar 2024	Update to Evolution	

Approval Position	Automatic Notifications
Department of Planning	N/A

Publicly Available Locations	Associated Documents to be reviewed
Northparkes Website	PLN-0056, PLN-0091

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1. OVERVIEW

This Surface Water Management Plan (SWMP) forms Appendix B of the Northparkes Water Management Plan (WMP). This SWMP applies to all surface water related activities undertaken at Northparkes Mines, as approved under DC 11_0060.

The WMP document hierarchy is presented as Figure 1.

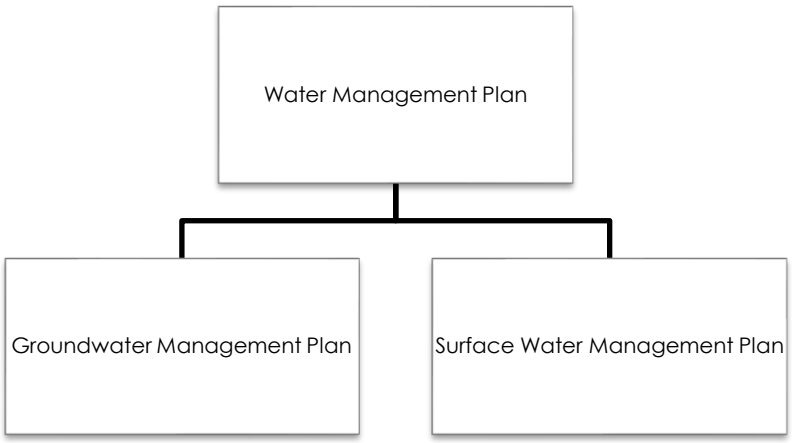


Figure 1 WMP document hierarchy

This SWMP describes:

- The regulation requirements relating to surface water.
- The surrounding surface water environment, including baseline data.
- The Northparkes Mines surface water management system.
- The surface water monitoring program and other monitoring requirements.
- Surface water assessment criteria and trigger levels.

2. PURPOSE / OBJECTIVES

The purpose of this SWMP is to comply with the relevant parts of Schedule 3, Condition 23 and Schedule 6, Condition 3 of DC 11_0060.

3. STATUTORY REQUIREMENTS

The overarching statutory requirements for water management are detailed in the WMP. The purpose of this section is to summarise the statutory requirements for surface water management, addressed in this SWMP.

3.1 Environmental Planning and Assessment Act 1979

This SWMP has been developed in accordance with Schedule 3, Condition 23 and Schedule 6, Condition 3 of DC 11_0061, as well as the Statement Of Commitments (SoC) from the Northparkes Mines Step Change Project Environmental Assessment (EA) (Golder Associates, 2013). Table 1 summarises where relevant conditions and commitments are addressed within this SWMP.

Table 1 Surface Water Management Plan requirements

Condition	Requirement	Section
PA 11_0060 Schedule 3 Condition 23	ii) The Surface Water Management Plan must include: - Detailed baseline data on water flows and quality in the waterbodies that could be affected by the Project	4, 7
	- A detailed description of the water management system on site	5
	- Detailed plans, including design objectives and performance criteria, for the • Tailings storage facilities • Final voids	5, 5.1.14 Final voids are managed by the Rehabilitation Management Plan
	- Detailed performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the Project. • the water management system (clean, dirty and contaminated)	8.1, 8.4
	• downstream surface water quality	8.3, 8.4
	• downstream flooding impacts; and	8.2, 8.4
	• stream and riparian vegetation health for surrounding creeks;	8.2, 8.4
	- A program to monitor and report on: • The effectiveness of the water management systems (clean, dirty and contaminated);	6.1
	• Surface water flows and quality, stream and riparian vegetation health in the watercourses that could be affected by the project; and	6.1, 6.2
	• downstream flooding impacts;	6.2
	- Reporting procedures for the results of monitoring program; and	9
	- A plan to respond to any exceedances of the performance criteria, and mitigate any adverse surface water impacts of the project.	8.4
PA 11_0060 Schedule 6 Condition 3	The proponent shall ensure that the management plans required under this approval are prepared in accordance with the relevant guidelines, and include: a) detailed baseline data	4, 7
	b) a description of • the relevant statutory requirements (include any relevant approval, licence or lease conditions);	3
	• any relevant limits or performance measures/criteria	8
	• 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	8
	c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria	5
	d) a program to monitor and report on the:	6

Condition	Requirement	Section
	• Impacts and environmental performance of the project;	
	• Effectiveness of any management measures (see c above)	6.1
	e) a contingency plan to manage any unprecedented impacts and their consequences;	8.4
	f) a program to investigate and implement ways to improve environmental performance of the project overtime;	11
	g) a protocol for managing and reporting any; • incidents; • complaints; • non compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria; and	8.4
	A protocol for periodic review of the plan	11.2
PA 11_0060 Schedule 3 Condition 22	The proponent must comply with the performance measures including: • Minimise the use of clean water on site	Refer to WMP
	• Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction • Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2007) • Design, installation and maintenance of creek crossings generally in accordance with the Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, 2003) and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003)	5.1.3 5.2
	• Design, install and maintain the clean water system to capture and convey the 100 year ARI flood	4.2, 5
	• Maximise the diversion of clean water around disturbed areas on site	5
	• Design, install and maintain the dams generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries • Designed to capture the 90th percentile 5-day duration rainfall event	5.1
	• Nil discharge from site • On-site storages (including tailings dams, mine infrastructure dams, groundwater storage and treatment dams) are suitably lined to comply with a permeability standard of < 1 x 10-9 m/s in line with the NSW Environmental Guidelines for Solid Waste Landfills (EPA, 1996) • Design, construct and maintain other aspects of the tailings dams in accordance with the standards set out in the Environmental Guidelines – Management of Tailings Storage Facilities (VIC DPI, 2006), including a requirement to maintain a minimum freeboard of 600 mm or a sufficient freeboard to accommodate a 1 in 100- year ARI, 72 hour rainfall event without overtopping at all times, whichever is greater • Design and construct the tailings storage facilities in accordance with the requirement of the Dam Safety Committee [now Dam Safety NSW]	5
	• Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards	5.3
Statement of Commitments for Step Change Project Surface Water		
SoC 6.10.1	Northparkes will continue to manage its operations in accordance with its existing Water Management Plan, which will be updated to reflect the proposed amendments to the surface water catchments and additional monitoring and management measures. This will involve updates to the existing Northparkes Water Management Plan and environmental monitoring program.	Completed

Condition	Requirement	Section
SoC 6.10.2	Additional catch drains will be developed around operational mining areas to intercept sediment-laden runoff and direct this material to new sediment dams. Consistent with the existing water management system, these works will seek to maintain separation between the three classifications of water on site (clean, dirty and contaminated water). To manage potential flood risk, Northparkes proposes to include a 1 m high bank at the toe of the proposed waste rock stockpiles which will incorporate the proposed catch drain.	Not triggered, proposed waste dumps to east and west of E26 not constructed 5.2
SoC 6.10.3	Northparkes will continue to manage contaminated water on site as a closed circuit process designed to manage runoff up to and including a 1 in 100 year [sic] average recurrence interval, 72 hour design storm event.	Ongoing 5
SoC 6.10.4	All erosion and sediment control measures will continue to be carried out in accordance with the relevant guidelines for erosion and sediment control, including *Managing Urban Stormwater: Soils and Construction* (the Blue Book) Volume 1 and Volume 2E Mines and Quarries (DECC, 2008).	Ongoing 5.2

3.2 Protection of the Environment Operation Act 1997

Northparkes holds EPL 4784, which requires surface water monitoring as described in Section 6.1 .

3.3 Water Management Act 2000

Northparkes Mines is located within the Macquarie Bogan Unregulated and Alluvial Water Sources. Northparkes does not hold any surface water access licences or works approvals within this water source. However, operations at Northparkes are supplied by surface water extracted from Macquarie River, as described in the WMP.

Northparkes Mines is located in the Central Division of NSW. Under the harvestable rights order, Northparkes is entitled to capture up to 10% of the annual average rainfall runoff from its contiguous landholdings in dams located on first and second order streams.

Dirty and contaminated water storages for the capture, containment and recirculation of drainage to prevent the contamination of a water source located on first and second order streams are exempt from requiring a works approval, water use approval or water access licence. The management of these structures is outlined in Section 5.

3.4 Dams Safety Act 2015

Dam safety is regulated by Dam Safety NSW under the Dam Safety Act 2015 (DS Act). A 'declared dam' is a dam gazetted in accordance with Section 4 of 2019 regulations of the DS Act.

The 'Northparkes Rosedale Tailings' (Rosedale TSF), 'Northparkes Tailings Dam No 2' (TSF2), 'Northparkes Tailings' (TSF1), Northparkes Infill Tailings Storage Facility' (Infill TSF) and 'Northparkes E27-Estcourt Tailings' (Estcourt TSF) are declared dams, pursuant to Declared Dams Order 2021 (NSW Government gazette number 164).

Requirements for tailings dams relevant to water management are described in Section 5.

3.5 Surface water policies and guidelines

3.5.1 Managing Urban Stormwater; Soils and Construction ("Blue Book")

The *Managing Urban Stormwater, Soils and Construction* (Blue Book) (Landcom 2004) provides guidance in the design and management of erosion and settlement control measures. The purpose of the guidelines is to help mitigate land disturbance activities on soils, landforms and receiving waters. Principles outlined in the Blue Book aim to control erosion of soil, control sediment as near the source as practicable and enable stability of water and soil management structures for a given design storm event.

Requirements for sediment basins relevant to surface water management are described in Section 5.

3.5.2 Guidelines for Controlled Activities on Waterfront Land

Guidelines for controlled activities on waterfront land (NRAR 2018; formerly DPI 2007) provide recommendations for the design and construction of instream works and an indication of the width of riparian zones to be considered. The guidelines focus on maintain hydrologic and geomorphic processes, use of rock protection and inspection and maintenance during construction.

Requirements for watercourse crossings relevant to surface water management are described in Section 5.

3.5.3 Why Do Fish Need to Cross the Road? Fish Passage for Waterway Crossings

Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003) applies the principles of *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, 2003). The guidelines aim to minimise impacts on fish passage and general aquatic wildlife by providing practical guidelines to those involved in the planning, design, construction and maintenance of waterway crossings.

Requirements for watercourse crossings relevant to surface water management are described in Section 5.

3.5.4 Environmental Guidelines – Management of Tailings Storage Facilities

Environmental Guidelines – Management of Tailings Storage Facilities (VIC DPI 2006) seeks to ensure that a TSF throughout its operational life and after closure is designed, constructed, operated, monitored and closed in accordance with the Australian National Committee on Large Dams' Guidelines on Tailings Dams – Planning, Design, Construction, Operation and Closure, other ANCOLD guidelines, is safe and structurally stable, managed to minimise impact on public safety, public infrastructure and the environment and rehabilitated to minimise social impact, adverse visual amenity and long-term risks to the environment.

The requirements of this guidelines relevant to surface water management are described in Section 5.

4. ENVIRONMENT

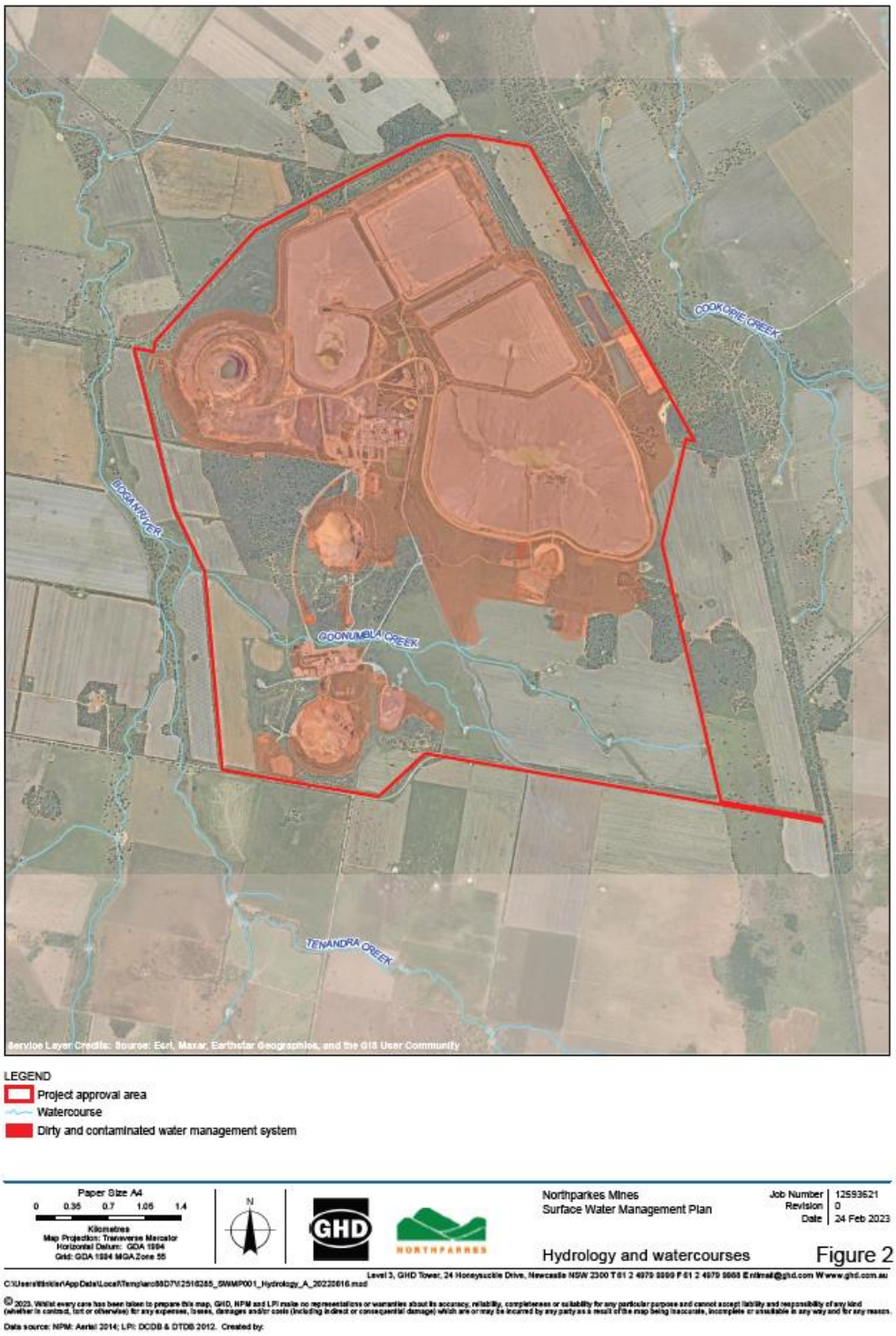
4.1 Local hydrology

The site is located within the catchment of the Bogan River that rises approximately 11 km to the south and joins the Darling River near Bourke, 620 km to the north-west. To the west of the site, the north flowing Bogan River is ephemeral and is joined by other ephemeral tributaries: Tenandra Creek, Goonumbla Creek and Cookopie Creek.
The local hydrology is shown in Figure 2.

4.2 Flooding

Flood modelling completed as part of the Step Change Project (Umwelt, 2013a) indicated that all existing and proposed mining activities, water management and associated infrastructure is located outside of the 100 year Average Recurrence Interval (ARI) flood extent.

Figure 2 Hydrology and watercourses



5. SURFACE WATER MANAGEMENT

The objectives of the surface water management system are to:

- Divert clean water around operational areas of the mine.
- Capture and contain dirty and contaminated water.
- Maximise reuse of dirty and contaminated water to minimise the raw water demand.

Water is classified as clean, dirty or contaminated. The water management system at Northparkes Mines is zero discharge up to the relevant design criteria. The surface water management infrastructure at Northparkes Mines comprises drains, bunds, dams, pumps and pipes. Surface water at Northparkes is classified as summarised in Table 2.

Table 2 Surface water management infrastructure

Water class	Definition	Relevant performance criteria	Water storages / processes	Total water storage capacity (ML)
Clean water	Surface runoff from undisturbed areas not affected by mining operations	Minimise interception of clean water Capture and convey the 100 year ARI flood	Clean water diversions	NA
Raw water	Water supplied from the Lachlan River and Lachlan Borefield to supplement on site water sources	Minimise raw water use	Raw water tank Water treatment plant Potable water tank	NA
Dirty water	Sediment-laden runoff from temporary disturbed areas during construction	In accordance with Managing Urban Stormwater (Landcom 2004	As required if outside the water management system, including use of existing farm dams.	Varies with construction activity
	Sediment-laden runoff from temporary disturbed areas during construction near named watercourses	In accordance with *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018) and *Why Do Fish Need to Cross the Road* (NSW Fisheries 2003)		
	Sediment-laden runoff from permanently disturbed areas, including waste rock stockpile areas, areas undergoing rehabilitation and surface infrastructure areas that are not classified as contaminated	Capture sediment laden runoff Capacity for the settling zone to contain runoff from 90th percentile 5-day duration rainfall event and sediment storage zone for minimum 2 months (Landcom, 2004 Table 6.1) A spillway sized in accordance with Figure 6-4 of Landcom (2004)	**Settlement ponds** SP3, SP15,	42.0
Contaminated water	Runoff and process water associated with mining, ore processing and tailings storage	Capture contaminated runoff Nil discharge Maintain a minimum freeboard greater of 600 mm or to capture and contain 100 year ARI 72 hour duration rainfall event	**Retention ponds** RP1-9 RP12, RP13, RP15, RP16, RP19, RP20-28 RP32-33, RP34, RP35, RP36	304.7 (to be confirmed at completion of RP34, RP35, RP36)
			Surge Dams 1 and 2	7.1
			E22 open cut void	27,000 (estimated to top of bank)
			Process Water Dam	200

Water class	Definition	Relevant performance criteria	Water storages / processes	Total water storage capacity (ML)
		Suitably lined equivalent to 900 mm depth of 1 x 10^{-9} m/s	**Caloola storages**	1088.5
			Rosedale storages	To be surveyed as part of commissioning as a water storage
			E31 and E31S pits	Approx. 5000 each at completion
		Additionally, any other requirements of Dam Safety NSW	**Tailings storage facility:** TSF1, TSF2, Estcourt TSF, Infill TSF, Rosedale TSF	Varies with tailings deposition

5.1 Water management infrastructure

5.1.1 Clean water diversions

Clean water diversions divert clean water around disturbed and contaminated areas to minimise the volume of dirty and contaminated water that requires management.

5.1.2 Farm dams

Farm dams for agricultural purposes within and surrounding the project approval area are not utilised as part of the water management system. Notwithstanding, farms dams may be suitable for temporary use as settlement ponds during approved construction activities.

5.1.3 Watercourse crossing structures

There are six vehicular and conveyor crossings of Goonumbla Creek that use wide-spanning structures across the flood way. The design, installation and maintenance of these structures is in accordance with the provisions of Schedule 2, Condition 22 of DC 11_0060 for the construction and operation of linear infrastructure.

5.1.4 Raw water tank

The Raw Water Tank receives water from the Lachlan River and Lachlan Borefield under a supply agreement with Parkes Shire Council (PSC). This tank supplies water to the Water Treatment Plant with excess water transferred to the Process Water Dam.

5.1.5 Potable Water Treatment Plant

The Water Treatment Plant treats raw water supplied by PSC for:

- Dust suppression in the rill towers, the concrete batching plant and the processing plant
- Supply to the administration and office buildings, contractor's yard, dust suppression (truck fill point), truck washdown and the underground mining operations via the Potable Water Tank.

Excess treated water is transferred to the Process Water Dam.

5.1.6 Settlement ponds

A total of three settlement ponds collect and store sediment-laden runoff from disturbed areas. The required minimum freeboard in accordance with performance criteria in Table 2 is maintained by pumping water to the Process Water Dam for reuse in ore processing.

5.1.7 Retention ponds

A total of 25 retention ponds collect and store surface water runoff from mining and ore processing areas. The required minimum freeboard in accordance with performance criteria in Table 2 is maintained by pumping water to the Process Water Dam for reuse in ore processing. In rare rainfall events that exceed the design criteria of the retention ponds, off-site discharge may occur.

5.1.8 Caloola storages

The Caloola Dam are three adjacent large water storages formed in former clay borrow pits. The Caloola Dams provide short term storage of contaminated water inventory and flood storage capacity for the tailings storage facilities (TSFs). The Caloola Dams store and supply contaminated water to the Process Water Dam for reuse in ore processing.

5.1.9 Rosedale storages

The Rosedale storages are expected to be formed by approved clay borrow pits located adjacent to the Rosedale TSF. East Rosedale is to enhance flood water storage capacity from the Rosedale TSF. Area 2 and the Rosedale Borrow Pit are expected to be used as part of the contaminated water system to store water pumped from the E31 and E31S open cut pits.

5.1.10 Surge dams

Dewatering from the underground workings sumps reports to the Surge Dams. The Surge Dams are turkeys nest dams with no external catchment. The Surge Dams transfer water to the Process Water Dam for reuse in ore processing.

5.1.11 E22 void

The E22 void is large void formed by previous open cut mining activities. E22 currently provides flood storage for the TSFs and longer term water inventory storage and may be dewatered to the Process Water Dam for reuse in ore processing.

The final form, function and performance of the E22 void is addressed by the Rehabilitation Management Plan.

5.1.12 E31 and E31S open cut pits

The E31and E31S open cut pits were approved under MOD6 with water management requirements being consistent with the current approval conditions. The approved open cut pits are to be managed as part of the contaminated water system, consistent with current approval conditions. Where feasible: clean water diversions will be constructed around the E31 and E31S open cut pits to minimise interception of clean water by the contaminated water system. The diversions will direct water into the existing clean water management system. E31 and E31S open cut pits are to be dewatered to the contaminated water management system.

Runoff from approved waste rock emplacements WD1 and WD2 would be captured by the proposed retention ponds and recirculated to the contaminated water management system. Construction of the proposed retention ponds 34, 35 and 36 will occur when required, coinciding with the construction of the respective waste rock emplacements.

5.1.13 Process Water Dam

The Process Water Dam receives water from the Raw Water Tank and excess water from the Water Treatment Plant and Potable Water Tank, in addition to water pumped from the retention ponds, underground workings and water recovered from the administration and office buildings.

5.1.14 Tailings Storage Facilities

The TSFs receive tailings from the processing plant generated by ore processing. The tailings settle out and supernatant water and runoff is contained and decanted to the Process Water Dam for reuse in the water management system. The proportion of water recovered from the TSFs is dependent on evaporation and the entrainment of water in the tailings.

All TSFs at Northparkes have been designed to achieve the following design objectives:

- Safe and permanent containment of all tailings solids.
- The recovery of free water for reuse within the processing plant.
- Containment of all water under extreme rainfall conditions, including the required minimum freeboard in accordance with performance criteria in Table 2.

- Containment of all chemical residues.

The final form, function and performance of the TSF's is addressed by the Rehabilitation Management Plan

5.1.15 Subsidence zones

The site has 2 subsidence zones over the E26 and E48 underground block caves. The subsidence zones differ to the E22 mining void which is used as part of the surface water management infrastructure.
The surface water management infrastructure as a system is designed to prevent surface water entering the subsidence zones and meet the rehabilitation objectives as described table 8 of DC 11_0060. Specifically:

- minimise the size and depth of the final voids and subsidence zones so far as is reasonable and feasible
- minimise the drainage catchment of the final voids and subsidence zones so far as is reasonable and feasible
- negligible high wall instability risk
- restrict access
- re-vegetate areas surrounding final voids and subsidence zones to minimise erosion
- minimise risk of flood interaction for all flood events up to and including the Probable Maximum Flood level

The final form, function and performance of the subsidence zones is addressed by the Rehabilitation Management Plan

5.2 Erosion and sediment control

The following activities have the potential to result in erosion and sediment laden runoff entering surrounding watercourses:

- Vegetation clearing.
- Top soil stripping and subsoil excavation and stockpiling.
- Construction activities, including roads and infrastructure, tailings storage facilities and waste rock dumping.
- Runoff from infrastructure and waste rock dumps.
- Construction and operation of linear infrastructure within 40m of a watercourse

Northparkes implements various practices to minimise erosion from disturbed areas:

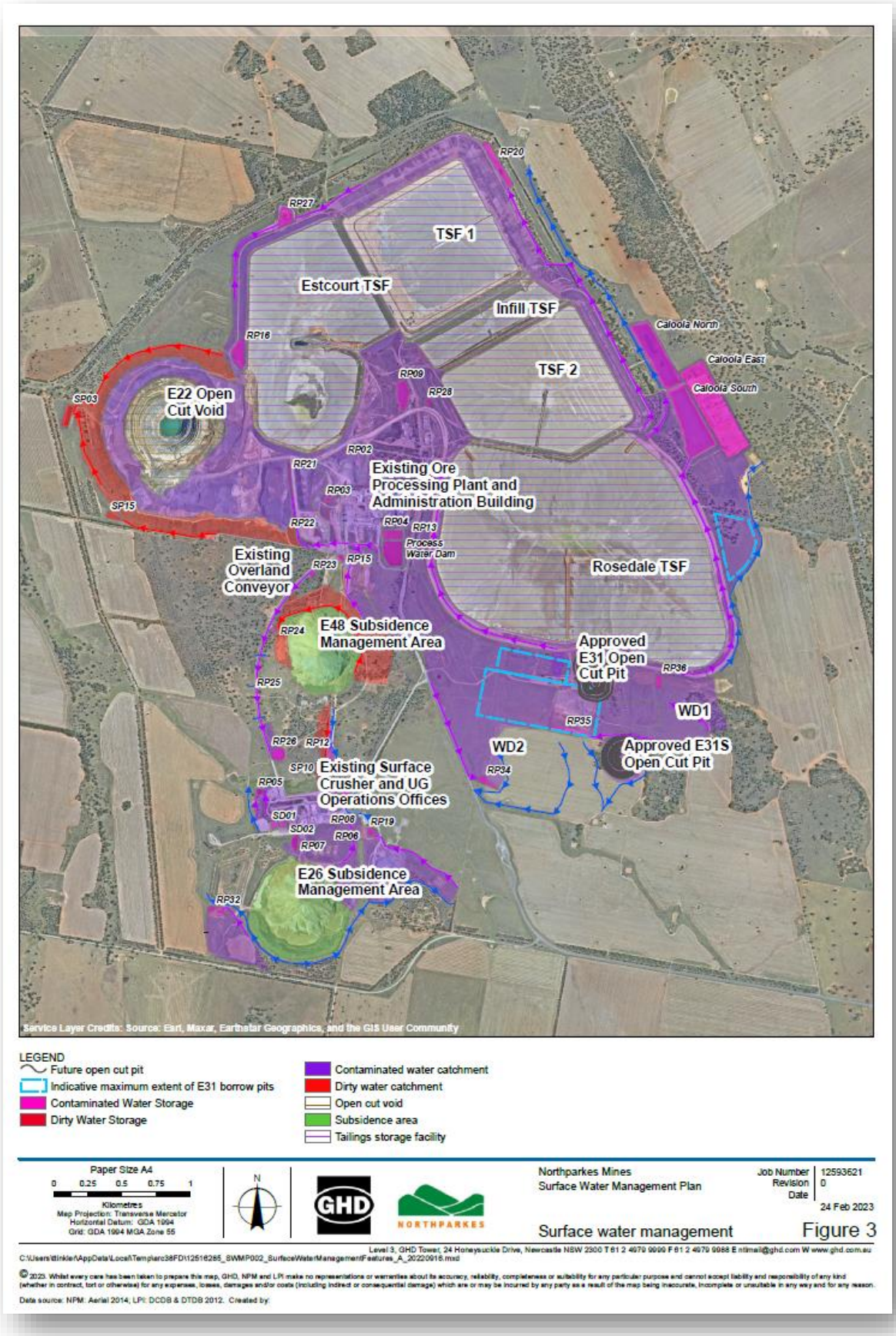
- Site disturbance permit process that assess individual clearing activities for their impact on water drainage and include specific controls where necessary.
- Where disturbance is outside the permanent water management system, run off is diverted to sediment ponds.
- Installation and maintenance of drainage lines, diversion bunds, culverts, sediment fencing, and catchment dams.
- Minimising cleared areas and promoting progressive rehabilitation.
- Restricted access to rehabilitated areas.

Erosion and sediment controls measures implemented at Northparkes Mines follow the requirements and guidelines provided in Managing Urban Stormwater: Soils and Construction, Volume 1 and Volume 2E (Landcom, 2004; DECC, 2008).

5.3 Chemical and hydrocarbons

To manage the risk of contamination from the use and storage of chemicals and hydrocarbons, these products will be stored in bunded areas in accordance with the relevant Australian Standards and regularly inspected.

Figure 3 Surface water management



6. MONITORING REQUIREMENTS

6.1 Surface water quality monitoring program

The surface water monitoring program is the monitoring of water quality at surface water storages and specific locations on watercourses. The program is intended to monitor the:

- The effectiveness of the water management systems to achieve the performance criteria described in Section 5.
- Surface water quality in downstream watercourses of Goonumbla Creek, Bogan River, Cookopie Creek and Deception Creek downstream of Northparkes Mines.

Due to the ephemeral nature of the downstream watercourses and Northparkes Mines being a nil discharge site, no regular monitoring of surface water flow is required. Northparkes undertakes sampling of surface water flows whenever they occur in the ephemeral creek lines.

6.1.1 Methodology

Surface water quality sampling will be undertaken where sufficient water is present at the sampling location such that bed of the watercourse or dam is not physically disturbed by access to the sampling location or the sampling process.

Northparkes will utilise laboratories with NATA accreditation for the analysis of samples.

6.1.2 Monitoring locations

Northparkes monitor surface water quality at locations as summarised in Table 3.
EPL 4784 identifies two surface water monitoring locations:

- Point 7 (discharge from ore processing waste water treatment plant (WWTP) to PWD)
- Point 8 (discharge from surge dams to PWD)

EPL 4784 does not require any monitoring at these locations.

The monitoring locations of watercourses and surface water storages are shown in Figure 4.

Table 3 Surface Water Quality Monitoring Locations

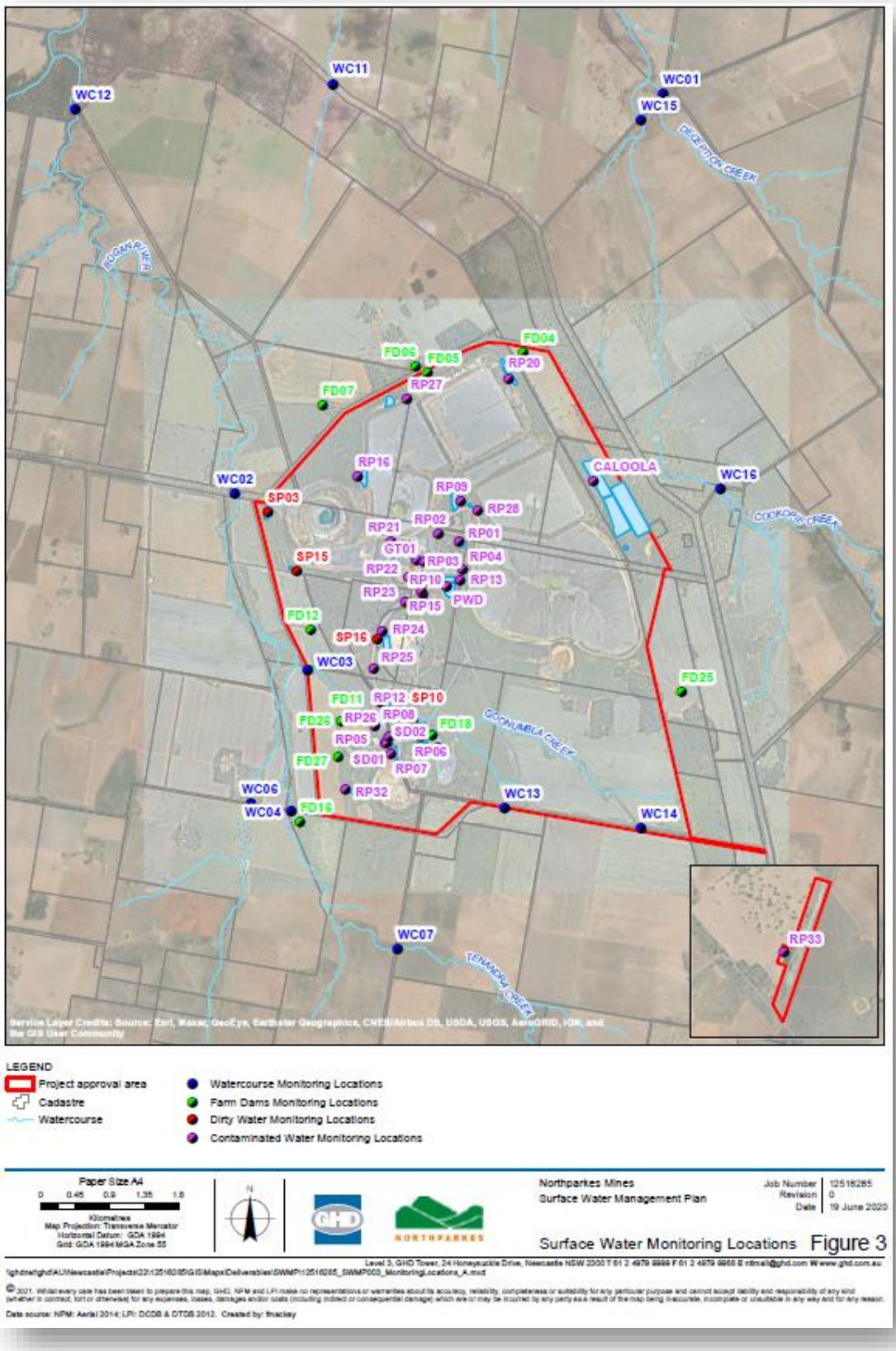
Clean water management system	Dirty water management system	Contaminated water management system
Upstream WC4. WC6, WC 7, WC13, W14 **Downstream** WC01, WC02, WC03, WC05, WC11 WC12, WC15, WC16 **Farm Dams** FD04, FD05, FD06, FD07, FD11, FD12, FD16, FD18, FD25, FD26, FD27	SP03, SP10, SP15,	RP01, RP02, RP03, RP04, RP05, RP06, RP07, RP08, RP09, RP12 RP13, RP15, RP16, RP19, RP20, RP21, RP22, RP23, RP24, RP25, RP26, RP27, RP28, RP32, RP33 RP34, RP35, RP36 (locations to be confirmed following construction) Grease Trap 2 (GT02), Process Water Dam (PWD), Surge Dam 1 (SD01) and Surge Dam 2 (SD02), Caloola Dams (CALOOLA).

Grease Trap 2 (GT02) is within the underground operations area and is a capture points for industrial runoff as a result of maintenance areas typically capturing oils, greases and other hydrocarbons. While the water quality from this areas is important to manage, the assessment of the monitoring against criteria is not expected to be of benefit for the purposes of surface water management as this area is managed through extraction.

Surge Dams 1 and 2 service the dewatering activities from the underground mining area. The surface water quality monitoring of these locations provides a representation of water typically dewatered from the underground. The assessment of this water quality against groundwater bore information can provide an indication as to the extent that activities in the underground workings are having an impact on water quality within the groundwater environment. These sediment dams are assessed as part of the contaminated water management system.

RP33, located at the Goonumbla Rail Siding, although not part of the water management system, is included in the surface water monitoring program.

Figure 4 Surface Water Monitoring Locations



6.1.3 Monitoring frequency and parameters analysed

Water quality sampling frequency and monitored parameters are summarised in Table 4.

Table 4 Monitoring frequencies and parameters

Water management systems	Monitoring Frequency	Monitoring Parameters
Clean water system – farm dams Dirty water management system – settlement ponds Contaminated water management system	Quarterly	pH, EC, TSS, TDS, Cu
	Annually	pH, EC, TSS, TDS, Cu, Na, K, Ca, Mg, Cl, SO_4, HCO_3, CO_3, Al, As, Ba, Be, Cd, Co, Cu, Cr, Fe, Mn, Hg, Mo, Ni, Pb, Se, Zn
Clean water systems – watercourses	Whenever watercourse is flowing but no more frequently than quarterly	pH, EC, TSS, TDS, Cu, Na, K, Ca, Mg, Cl, SO_4, HCO_3, CO_3, Al, As, Ba, Be, Cd, Co, Cu, Cr, Fe, Mn, Hg, Mo, Ni, Pb, Se, Zn

6.2 Watercourse stability monitoring program

Visual assessments of watercourse monitoring locations are to be undertaken to monitor:

- Stream and riparian vegetation health and downstream flooding impacts in Goonumbla Creek downstream of watercourse crossings.

Monitoring is visual and records are made (including photographic records) of watercourse bed and bank condition as well as riparian vegetation up and downstream of the watercourse at each monitoring location.

The watercourse monitoring locations are identified in Figure 4 and summarised in Table 5.

Table 5 Watercourse stability monitoring program

Location	Frequency	Assessment Requirements
WC13, WC14, WC03, WC05	Annually Following major flood event (indicated by evidence of flow outside the low flow channel of the watercourse).	Visual assessment of channel form, presence of instabilities in watercourse banks or in crossing structure (bridge/culvert). Photographs to be taken to provide visual evidence of the condition of the watercourse.
Crossing structures – Goonumbla Creek	Annually Following major flood event (indicated by evidence of flow outside the low flow channel of the watercourse).	Photographs to be taken to provide visual evidence of the condition of the watercourse.

7. BASELINE DATA

7.1 Surface water quality

Baseline surface water quality (pH, EC, TSS and Cu from 2005 to 2011) has been summarised from the Northparkes Step Change Project (Umwelt, 2013). In 2016, SRK were commissioned to review the available water quality data and the baseline data is reflected in the approved trigger levels detailed in Section 8.3.

Baseline surface water quality is statistically summarised in Table 6. Default guideline values (DGVs) are included for reference, but are only suitable for comparison to clean water watercourses.

Table 6 Baseline surface water quality data

Water class	pH	EC	TSS	Cu
DGV (ANZG 2018)	6.5 to 8.5	350 µS/cm	50 mg/L	0.0014 mg/L
Clean water – watercourses	Mean: 6.9 Range: 5.4 to 8.75	Mean: 142 µS/cm Max: 515 µS/cm	Mean: 119 mg/L Max: 740 mg/L	Mean: 0.04 mg/L Max: 0.634 mg/L
Clean water – farms dams	Mean: 8.0 Range: 6.0 to 9.1	Mean: 469 µS/cm Max: 4000 µS/cm	Mean: 48 mg/L Max: 369 mg/L	Mean: 0.03 mg/L Max: 0.25mg/L
Dirty water	Mean: 8.0 Range: 5.6 to 9.5	Mean: Not stated Max: 9000 µS/cm (one outlier at 22 000 µS/cm)	Mean: Not stated Max: 2600 mg/L	Mean: 0.07 mg/L Max: 0.351 mg/L
Contaminated water	Mean: 7.9 Range: 5.9 to 9.6	Mean: Not stated Max: 12 000 µS/cm	Not analysed	Mean: 0.122 mg/L Max: 3.8 mg/L

In summary:

- Copper concentrations are elevated compared to DGVs at both upstream and downstream sites, indicating elevated background concentrations.
- Generally higher pH and EC is farms compared to watercourses may reflect capture and concentration (by evaporation) of alkaline and saline sediment and dissolved solids.
- Generally higher TSS in watercourses at both upstream and downstream sites compared to farm dams may reflect elevated sediment during runoff events, or disturbance of bottom sediments during sampling.
- Copper and EC in the dirty water system is slightly elevated compared to, but still more similar to the clean water farm dams than the contaminated water system.
- Copper and EC is elevated in the contaminated water system compared to the dirty water system.

7.2 Surface water quantity

As described in Section 4.1, the Bogan River and its tributaries near the Northparkes Mines are ephemeral and no quantitative surface water flow baseline data are available.

8. TRIGGERS AND PERFORMANCE CRITERIA

The overall surface water assessment criteria are no surface water impacts more adverse than predicted in the EA (Umwelt 2013), particular:

- No significant impacts on the existing water qualities of the surrounding environment.
- No significant changes in annual flow volumes or flood regime within the Bogan River system.
- Negligible impacts to downstream water users.

8.1 Water management infrastructure

The water management system at Northparkes Mines is designed and operated in accordance with the relevant design criteria summarised in Section 5. The site has nil discharge of contaminated water and therefore downstream water quality impacts are not expected. Downstream surface water quality triggers are included in Section 8.3.

While the site is nil discharge, rare to extreme rainfall events that exceed the design criteria or unforeseeable failure of infrastructure has the potential to result in emergency offsite discharges. In accordance with the POEO Act, Pollution Incident Response Management Plan (PIRMP) and the conditions of EPL 4784, the EPA must be notified of incidents causing or threatening material harm to the environment.

8.2 Flooding and watercourse stability

As part of the Step Change Project (Umwelt, 2013a), flood modelling results indicated that all existing and proposed mining activities, water management and associated infrastructure is located outside of the 100 year Average Recurrence Interval (ARI) flood extent.

In the event the proposed waste rock dumps are constructed east and west of E26, a 1 m high berm will be constructed along Goonumbla Creek to mitigate potential flooding impacts.

However, there remains a potential for vehicular and conveyor crossings to result in watercourse instabilities in Goonumbla Creek, which may require restabilisation works.

8.3 Surface water quality trigger levels

Stage 1 and Stage 2 triggers were developed by SRK (2016) as summarised in Table 7. Insufficient data was available to develop triggers at some surface monitoring locations at the time of preparation of SRK (2016).

While exceedance of triggers in the dirty and contaminated water management system does not indicate the potential for actual impacts, it does indicate the potential for a higher consequence in the unlikely event of offsite discharges (refer to Section 8.1).

8.4 Response to trigger level exceedance

The appropriate response to a trigger being exceeded is outlined in the Trigger Action Response Plan in Appendix D of the WMP.

Table 7 Surface water quality triggers

Parameter	Units	Clean water Watercourses		Clean water Farm Dams		Contaminated water Process water		Contaminated water Retention Ponds		Dirty water Settlement Ponds	
		Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
EC	µS/cm	494	641	2133	2860	6820	8678	5734	7741	3718	4945
pH - Lower	pH units	5.1	4.4	5.6	4.6	5.9	5.1	6.6	5.5	5.3	4.4
pH - Upper	pH units	7.7	8.3	9.3	10.2	8.9	9.7	9.4	10.4	9	9.9
TSS	mg/L	549	749	137	187	83	109	83	113	160	216
As	mg/L	0.032	0.046	0.007	0.009	0.04	0.05	0.026	0.035	0.0065	0.0083
Cd	mg/L	NVD	NVD	0.0005	0.0006	0.00025	0.0003	0.0009	0.0011	0.00024	0.00029
Co	mg/L	0.012	0.015	0.009	0.011	0.002	0.002	0.006	0.007	0.012	0.017
Cr	mg/L	0.039	0.051	0.11	0.15	0.011	0.013	0.01	0.014	0.029	0.038
Cu	mg/L	0.12	0.17	0.17	0.25	0.48	0.64	0.73	1.03	0.36	0.49
Fe	mg/L	41.7	55	17	22.9	NVD	NVD	1.1	1.1	28.7	39.3
Pb	mg/L	0.018	0.024	0.011	0.014	0.0058	0.0071	0.008	0.0105	0.016	0.021
Mn	mg/L	0.86	1.14	0.76	0.97	NVD	NVD	0.31	0.4	0.56	0.75
Hg	mg/L	0.0013	0.0018	NVD	NVD	NVD	NVD	NVD	NVD	0.75	1
Mo	mg/L	0.006	0.008	0.029	0.039	0.21	0.23	0.24	0.33	0.137	0.188
Ni	mg/L	0.046	0.064	0.015	0.02	0.004	0.005	0.025	0.036	0.015	0.02
Se	mg/L	NVD	NVD	0.01	0.01	0.022	0.023	0.1	0.13	0.084	0.109
Zn	mg/L	0.09	0.11	0.04	0.05	0.03	0.04	0.08	0.11	0.07	0.09

9. REPORTING

Reporting requirements for the monitoring program described in Section 6 of this SWMP, are detailed in Section 5 the WMP.

10. RESPONSIBILITIES

Specific responsibilities are outlined in the WMP.

11. REVIEW

11.1 Surface water storage capacity review

The surface water storage capacity assessment will be reviewed following any changes to surface water catchments or surface water storages.

11.2 Plan review

This document will be reviewed as part of the WMP.

12. RELATED DOCUMENTS

Document Title	Doc ID No.
Water Management Plan	PLN-0056
Environment Monitoring and Measuring Schedule	REG-008
Monitoring and Measuring Procedure	PRO-0150
Auditing and Reporting Program	PRO-0114
Incident Management Procedure	PRO-0148
Rehabilitation Management Plan	RMP V1.01

13. REFERENCES

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