Appendix C – Surface Water Monitoring Plan

The surface water monitoring plan will be undertaken throughout mine construction, operations and closure to assess for potential contamination and altered flow conditions.

The purpose of the monitoring is to establish existing conditions, inform the development of trigger and threshold criteria and inform if the management action or environmental criteria are being achieved, and when trigger level actions or threshold contingency actions will be implemented.

Surface water and sediment monitoring

Impacts on the WPW and EPW will be determined by sampling water and sediment quality and physical properties. As a reflection of the ephemeral nature of surface flows within the proposal area, proposed monitoring comprises surface water sample collection following flow events, with annual sediment sampling proposed as a proxy for water quality.

The proposed parameters have been developed to meet the likely variable monitoring requirements over the life of the mine, including pre-development, mine operations and post closure, based on the current mine layout. Following collection of sufficient baseline data the proposed parameters, and associated trigger criteria, will be revised.

Changes to the mine plan may necessitate selection of alternative monitoring points. Additional infill monitoring may also be required as the mine is developed and infrastructure is constructed, including water storages, drainage and process waters.

Eleven water sampling and sediment sampling locations have been selected based on the findings of the desktop assessment and initial site visit, completed to support the Surface Water Assessment (GHD 2019). The monitoring sites are depicted in Figure 5 with a summary site description and proposed elements to be monitored detailed in Table C-1.

The following three sites are noted to require further investigation:

- **Site SW02:** UC-01, background. The sample site identified during the initial site visit is considered unsuitable for ongoing monitoring, and it is recommended that further exploration for a more well-defined channel within the vicinity of sample site SW02 is undertaken. Should no defined channel be identified, this monitoring site should be discontinued.
- **Site SW07:** WPW upstream of mine site. The sample site identified during the initial site visit is considered unsuitable for ongoing monitoring, and it is recommended that further exploration for a more well-defined channel within the vicinity of sample site SW07 is undertaken. Should no defined channel be identified, this monitoring site should be discontinued.
- **Site SW08:** Alluvial plain south of processing plant. The sample site identified during the initial site visit is considered unsuitable for ongoing monitoring, and it is recommended that further exploration for a more well-defined channel within the vicinity of sample site SW08 is undertaken, ideally further north of the preliminary site. Should no defined channel be identified, this monitoring site should be discontinued.

Table C-1 Surface water and sediment monitoring sites

Site name	Easting	Northing	Description	Element		
				Flow	Water quality	Sediment
SW01	484590	6867595	WPW downstream of the mine site, north of the Salt River.	✓	✓	✓
SW02	482446	6872172	UC-01, background.		✓	✓
SW03	482061	6875528	WPW downstream of the mine site and south-east of the proposed Mine Pit.	✓	✓	✓
SW04	482760	6877370	Alluvial plain downstream of SW09 and the mine site and south-east of the proposed Waste Rock Facility and inland delta.		✓	✓
SW05	480389	6875962	UC-02 upstream of the mine site and east of the water hole and existing drilling work.		✓	✓
SW06	478866	6878299	UC-03 upstream of the mine site and west of the proposed Mine Pit and east of the salt pan.		✓	✓
SW07	478844	6879533	WPW upstream of mine site.		✓	✓
SW08	482180	6878914	Alluvial plain south of processing plant.		✓	✓
SW09	486947	6882539	UC-04 upstream of the mine site and north-west of the inselberg.		✓	✓
SW10	487845	6880649	EPW within the mine site and south-west of the inselberg.		✓	✓
SW11	488960	6876633	EPW downstream of the mine site and SW10 and south of the inselberg.		✓	✓

Surface water flow

It is recommended that maximum water stage heights be monitored on an event basis through installation of maximum height records and staff gauges at key gauging points both upstream and downstream of the proposed proposal site as part of the site's ongoing monitoring. It should be noted that these instruments will not provide data on the duration of the flow event, however, they are a cost-effective monitoring option.

Theoretical rating curves will be developed for the channel reaches at the two surface water flow monitoring sites to enable conversion of the measured water depths to flow rates. Rating

curves should be established through topographical surveys of the channel reaches and hydraulic modelling.

Surface water quality

Passive Flow Samplers are proposed at sample sites SW01, SW03, SW04, SW09, SW10, and SW11. Given the channel depths are not sufficient for installation of such samplers at the remaining sites, along with the proximity of these sites to key site infrastructure, it is proposed that opportunistic manual grab sampling be undertaken following flow events at the remaining locations (SW02, SW05, SW06, SW07, SW08).

Sampling of surface water samples should be undertaken in accordance to the Australian Standard (1998) 5667.1 *Water Quality Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS 5667.1:1998).

The following general surface water analytical suite is recommended:

- **Physicochemical parameters:** pH, Electrical conductivity (EC), Total Dissolved Solids (TDS), Suspended Solids (SS), Biochemical Oxygen Demand (BOD)
- Dissolved Organic Carbon (DOC)
- **Anions:** Chloride (Cl), Sulphate (SO4), Alkalinity [Carbonate (CO3), Hydrocarbonate (HCO3), Hydroxide (OH-), Total Alkalinity, Fluoride (F)
- **Cations:** Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg) + Hardness
- **Nutrients:** Total Nitrogen (Total N), Total Kjeldahl Nitrogen (TKN), Total Oxidised Nitrogen (NO_x-N), Nitrite-N (NO_2-N), Nitrate-N (NO_3-N), Ammonia-N (NH_3-N), Total Phosphorus (Total P), Reactive Phosphorus (Reactive P)
- **Metals:** Arsenic (As), Beryllium (Be), Boron (B), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Mercury (Hg), Lead (Pb), Nickel (Ni), Manganese (Mn), Selenium (Se), Zinc (Zn)
- **Hydrocarbons:** Total Recoverable Hydrocarbons (TRH) after Silica Gel Clean-up

A number of analytes (pH, EH, turbidity, total alkalinity and microbial parameters) have holding time limits of 24 hours, which may not be achieved due to difficulty in accessing monitoring points after flow events and due to the remoteness of the site. It is recommended that these parameters are assessed in-situ where possible, and remain included in the analyses for indicative purposes only.

Sediment quality

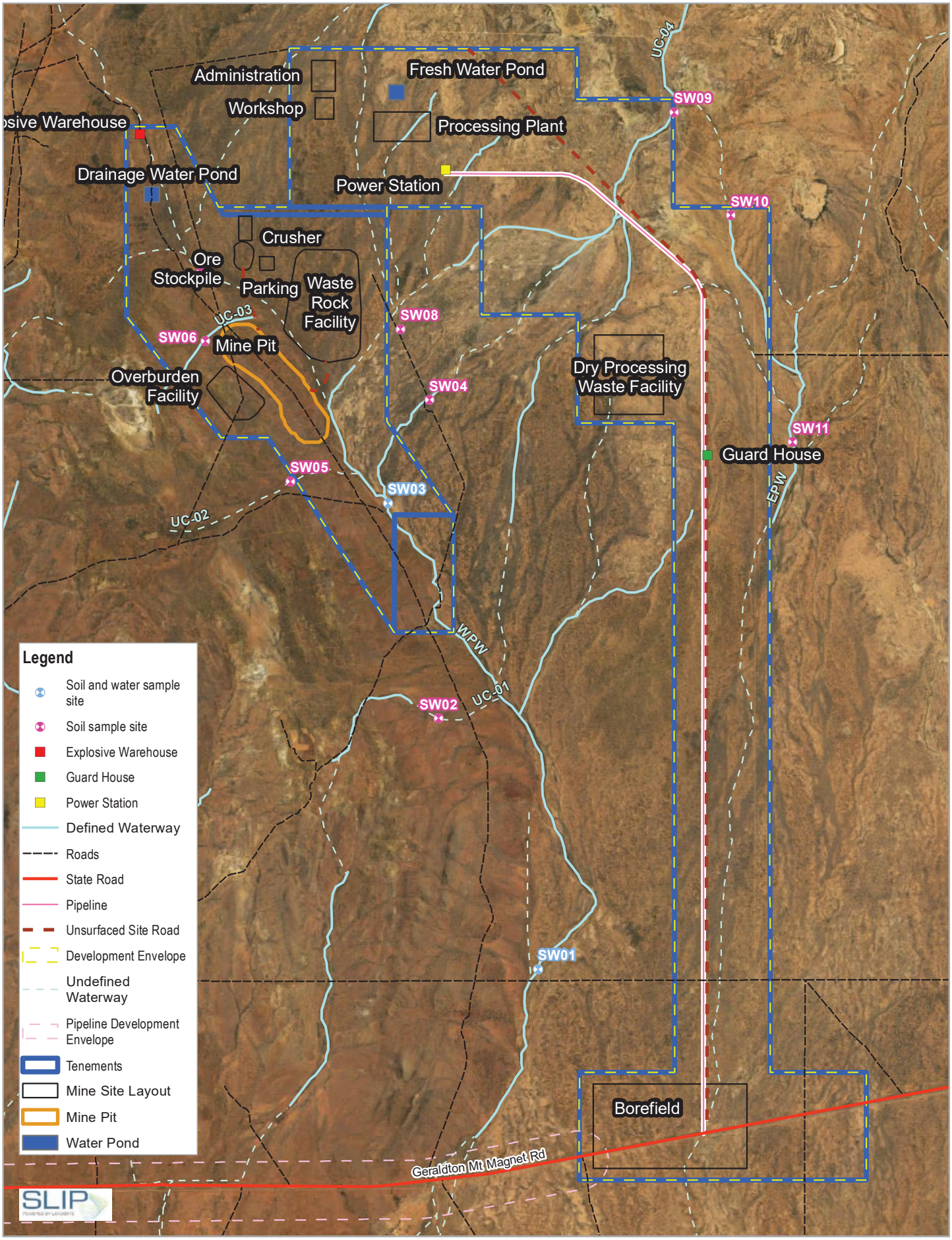
Sampling of river bed sediments was based on the Australian Standard – *Guide to the investigation and sampling of sites with potentially contaminated soil* (AS 4482.1-2005).

The following general sediment analytical suite is recommended:

- **Physicochemical parameters:** pH, EC, and particle size distribution by sieve and hydrometer;
- Total Organic Carbon (TOC);
- **Nutrients:** Total N, TKN, NO_x-N, NO_2-N, NO_3-N, NH_3-N, Organic Nitrogen (Organic N), Total P
- **HCl Extractable Metals:** As, Be, B, Cd, Co, Cr, Cu, Hg, Pb, Ni, Mn, Se, Zn
- **Total Metals:** As, Be, B, Cd, Co, Cr, Cu, Hg, Pb, Ni, Mn, Se, Zn

- **Hydrocarbons:** TRH after Silica Gel Clean-up
- **Cations:** Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg)

The above analytical suites should be reviewed and revised following the pre-development phase.



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

FI Joint Venture Pty Ltd
Environmental Management Plan

Project No. 61-37117
Revision No. 0
Date 18 Mar 2020

Preliminary Surface Water and Soil Sampling Locations

FIGURE 5

Data source: MRWA: State Roads - 20171024; FIJV: Mine Tenements, Mine Site Layout, Development Envelope, Pipeline Development Envelope - 20171025; GHD: Sample points - 20181003; Landgate: Roads - Imagery. Created by: cgverzosa

Climate monitoring

Climatic parameters are required to derive rainfall-runoff relationships for the proposed project site to validate surface water flow data. Such data are also important for other environmental reporting requirements such as air and noise modelling, particularly given the proximity of the Yalgoo townsite.

An automatic weather station and rain gauge is recommended for installation at an appropriate site adjacent to the proposed mine.

The proposed weather station should be capable of logging data at a number of different time scales, and should be set up to log at half-hour intervals. Daily climate statistics should be determined from the logged data sets.

The following climatic parameters are recommended for ongoing monitoring on a continuous basis:

- Rainfall;
- Solar radiation;
- Wind speed and direction;
- Temperature;
- Relative humidity; and
- Barometric pressure (for adjustment of non-vented groundwater level data).

Appendix D – Relocation procedures and monitoring for Western Spiny-tailed Skinks

1. Determine relocation sites and essential habitat requirements

Potential relocation site		Habitat requirements	Food Requirements
Easting	Northing		
485597	6880794	• This rock-inhabiting form (population) of the Western Spiny-tailed Skink has specialised habitat requirements. It inhabits granite outcrops ranging from large formations to small rocky areas where sufficiently deep and extensive rock cracks and crevices provide suitable shelter from predators and extreme weather. Also found in areas where small outcrops have some degree of proximity and connectivity to additional rocky areas that comprise larger local and regional rock formations that can support genetically sustainable populations. Also inhabits quartz outcrops and occasionally Banded ironstone formations. • Arid and semi-arid areas Low open shrubland vegetation • Houses and ruins (esp. old corrugated iron) • Protection of habitat remnants and creation of new habitat where required for populations to exist • Trial artificial refugia (as described by Arida and Bull 2008; Mensforth and Bull, 2008) in areas where logs have been largely removed. Other potentially suitable material for artificial refugia may include piles of relocated large rocks and / or building rubble such as pieces of concrete slab or pipe. Note: the habitat requirements listed refer only to the locally relevant rock-inhabiting form of *Egernia stokesii badia* that inhabits granite outcrops and similar rock formations within the northern Wheat belt and Murchison areas of mid-west WA.	• Partly vegetarian/herbivorous (Storr 1978) • includes plant and arthropod material • been observed eating fruits from Nitraria shrubs • seeds are common in faecal pellets (D. Pearson, pers. obs. 2008) • Swan (1990) listed grasshoppers, grubs, moths, beetles, spiders and plants as the main dietary items. • Juveniles tended to eat more insects relative to body mass than adults.
485602	6881003		
486511	6876482		
483459	6883206		

2. Translocation of fauna

Translocation of fauna	Qualifications of Personnel	Capturing procedure	Reference point
	• Qualified Zoologist and/or Ecologist • ECA fauna training • Experience in fauna handling and relocation • Experience in fauna trapping for relocations, translocation and approvals assessment • Experience in capture and handling of Western Spiny-tailed Skink •	• Active hand searching to locate colony and hand capture of any easily-accessible skinks • Trapping using baited cage and box traps, and follow-up surveillance using remote cameras to ensure all skinks have been removed. • Intrusive searching of each colony for any remaining skinks by physical removal / of rocks and crevices to detect and physically extract of skinks safely from rock crevices • Fauna taking (relocation) licence	• wildlifelicensing@dbca.wa.gov.au • Job Hazard Risk Assessment
		• Translocations to conform to DWER's translocation protocols and animal ethics requirements • Plastic containers in their original family groups (colony relocated together in new site). • Adhere to SOP Hand Capture of Wildlife. • Individual skinks should measured, weighed, and photographed (dorsal and lateral for spot ID).	• Policy Statement 29: CALM 1995 • https://www.dpaw.wa.gov.au/images/documents/plants-animals/monitoring/sop/sop_hand_capture_of_wildlife_v1.1_2017.pdf • https://www.dpaw.wa.gov.au/images/documents/plants-animals/monitoring/sop/sop_transport_and_temporary_holding_of_wildlife_v1.1_2017.pdf • As per DBCA licence conditions

Translocation of fauna	Qualifications of Personnel	Capturing procedure	Reference point
		• Where possible, translocate some of the materials under which they had been sheltering • Relocate some of the scat material with the colony at new colony site.	• https://www.dpaw.wa.gov.au/images/documents/plants-animals/monitoring/sop/sop_transport_and_temporary_holding_of_wildlife_v1.1_2017.pdf • As per DBCA licence conditions
		• Use remote cameras for monitoring of new site to confirm establishment of colony/individuals and new site, ongoing occupancy, and feral predator presence.	

3. Ongoing management of relocation process to ensure actions are delivered and monitored effectively

Targeted surveys	Type of survey	Equipment required	Frequency of monitoring	Monitor evidence of habitat	When	Known Activity patterns of species
	Active hand searching	• Collection containers, bags, • Nets • Gloves • Cro-bar/ Pry-bar • Remote Cameras • Weigh scales	• Within fortnight of translocation (baseline) • Monthly • 3 monthly • Bi annual • annual	• Scat piling outside refuges • Individuals (based on remote camera images showing spot pattern • Family groups • Crevices or close to hollows	• Morning time • Spring/Summer • Winter monitoring using remote (motion) cameras may be effective	• Diurnal species • Overtly bask either alongside crevices or close to its hollow in morning sunshine • Very wary • Likely to forage for short periods in close proximity to its refuge • Use an ambush strategy to dart and grab invertebrate prey • Mating tends to occur in late September to early November with young born in February to March (R. How, pers. comm. 2008). •

4. Identify threatening process and techniques to mitigate their impact

- the clearance of habitat for mining and mining infrastructure and farming (particularly remnant woodlands in the wheatbelt)
- Removal of logs and hollow trees for firewood
- Removal and / or damage to rocky outcrops through human activities
- Landholders/farmers removing house infrastructure in particular corrugated iron sheets which have provided refuges where woodlands have been cleared
- Degradation of rocky habitat due to feral herbivores such as goats
- Predators such as domestic cats, carpet pythons and foxes (Pearson, unpublished data)
- Large monitor lizards (Varanus species) and some elapid snakes, especially the Mulga Snake (Pseudechis australis)
- birds-of-prey are also probable predator

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