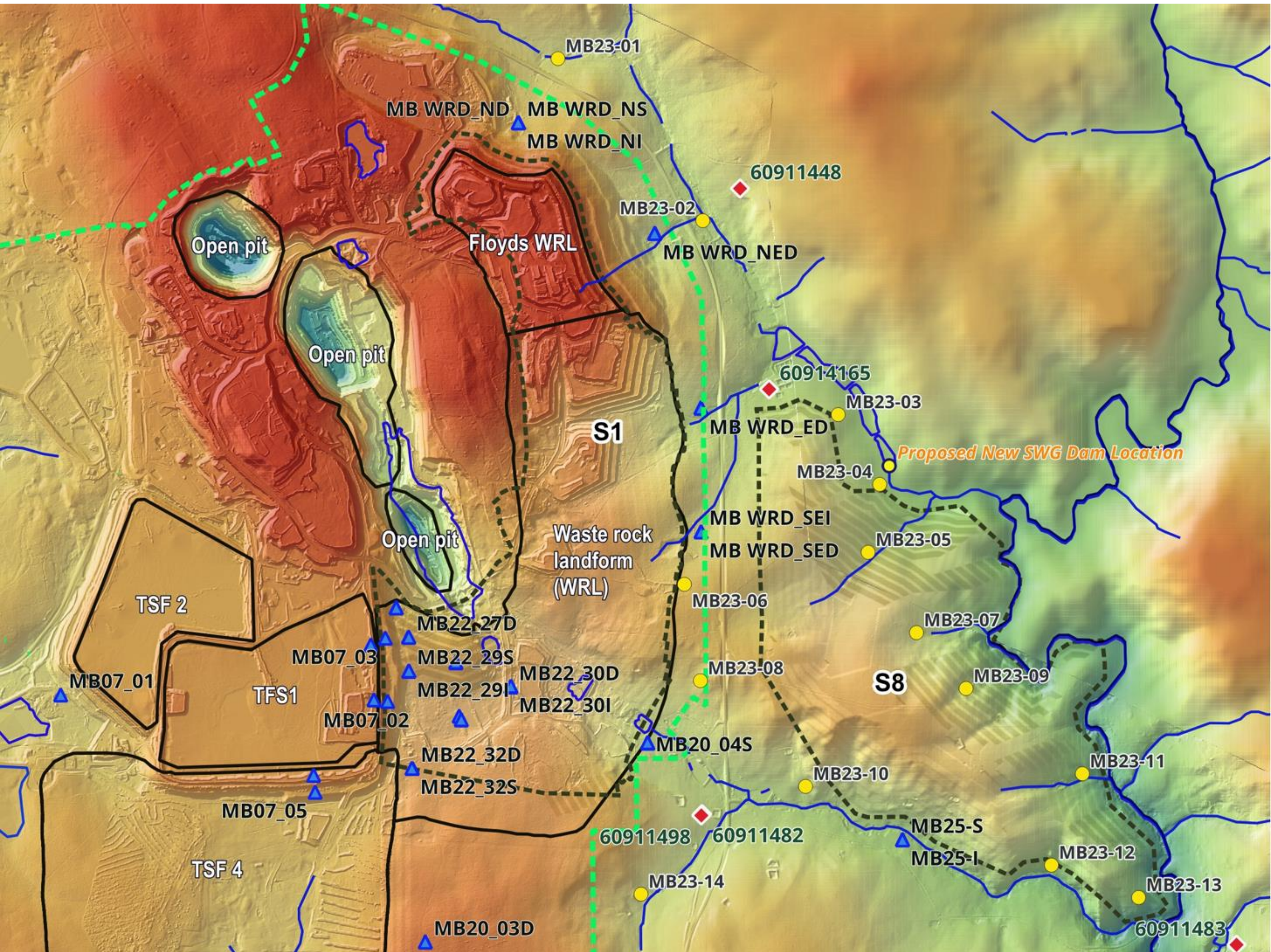
# Eastern Catchments Hydrology Study

## Monitoring Plan

Talison Lithium Pty Ltd

29 August 2023

→ **The Power of Commitment**



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**The Power of Commitment**

# Contents

# Table index



# Figure index



# Appendices

# 1. Introduction

## 1.1 Purpose of this Report

GHD Pty Ltd (GHD) was engaged by Talison Lithium Pty Ltd (Talison) to undertake the Eastern Catchment Hydrology Study (the Study) which entails the hydrological and hydrogeological assessments of proposed new facilities on the mine site and the subsequent assessment of the environmental and human health risks arising from these activities. These facilities are:

– Construction and operation of a new water storage, namely Saltwater Gully (SWG) Dam.
– Establishment of a new S8 Waste Rock Landform (WRL)[1].
– Reuse of all or part of Tailings Storage Facility #1 (TSF1) following removal of existing material for reprocessing, either for tailings or waste rock deposition.

A plan of the proposed facilities is provided in **Figure 1.1**. Conceptual designs of these facilities are being developed in parallel to this Study.

The aim of the Study is to provide a preliminary indication of the potential impacts that the proposed facilities will have on the beneficial uses of the surface water and groundwater receiving environments during operations and after closure. The Study is also intended inform the need for management measures for incorporation into the facility designs as well as to guide the development of a future management plan for possible adverse impacts. In doing so, the Study will support the applications for the various environmental approvals for the facilities.

The Study deliverables are:

– Data Review and Gap Analysis (GHD, 2023a).
– Conceptual Site Model (GHD, 2023b).
– Water Resources Monitoring Plan (this report).
– Risk Assessment (GHD, 2023c).

This report presents a Monitoring Plan for the Eastern Catchments, the purpose of which is to present a program for the establishment of baseline surface water and groundwater conditions within the likely impact footprint of the proposed new activities at site, including:

– A network of monitoring infrastructure and sampling locations; and
– Protocols and procedures for monitoring and sampling.

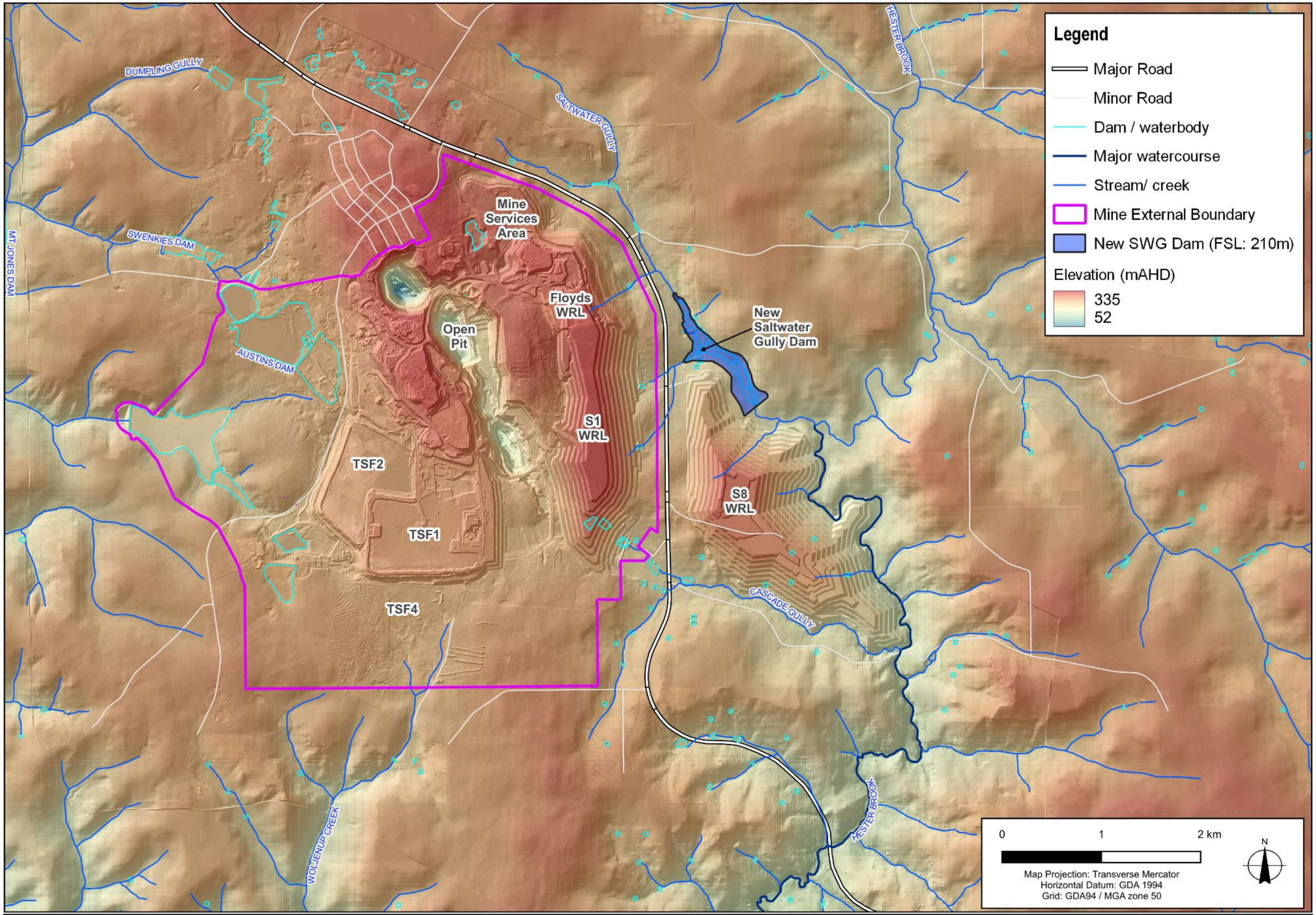
## 1.2 Scope and Limitations

### 1.2.1 Scope

The scope covered by this report includes:

– An overview of the site characteristics to provide an understanding of the site hydrology and hydrogeology.
– A preliminary assessment of the Sources-Pathways-Receptors (SPR) relationships and linkages resulting from the proposed facilities and identification of Contaminants of potential Concern (CoPCs).
– Development of surface water and groundwater monitoring programs to establish baseline conditions, which are informed by the site hydrology and hydrogeology, the SPR relationships, and the identified CoPCs.

[1] The S1 expansion of Floyds WRL has already been approved and this will form part of the baseline for the risk assessment.




Data Source: GHD - New SWG Dam (2023), WRL Landform (2023). Talison - Mine External Boundary (2022), Elevation (2023). Landgate - Major Road/ Minor Road (2020). Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020), Elevation (2020).

*Figure 1.1: Plan of the Proposed Facilities*

### 1.2.2 Limitations

This report has been prepared by GHD for Talison and may only be used and relied on by Talison for the purpose agreed between GHD and Talison as set out in **Section 1.1** of this report.

GHD otherwise disclaims responsibility to any person other than Talison arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

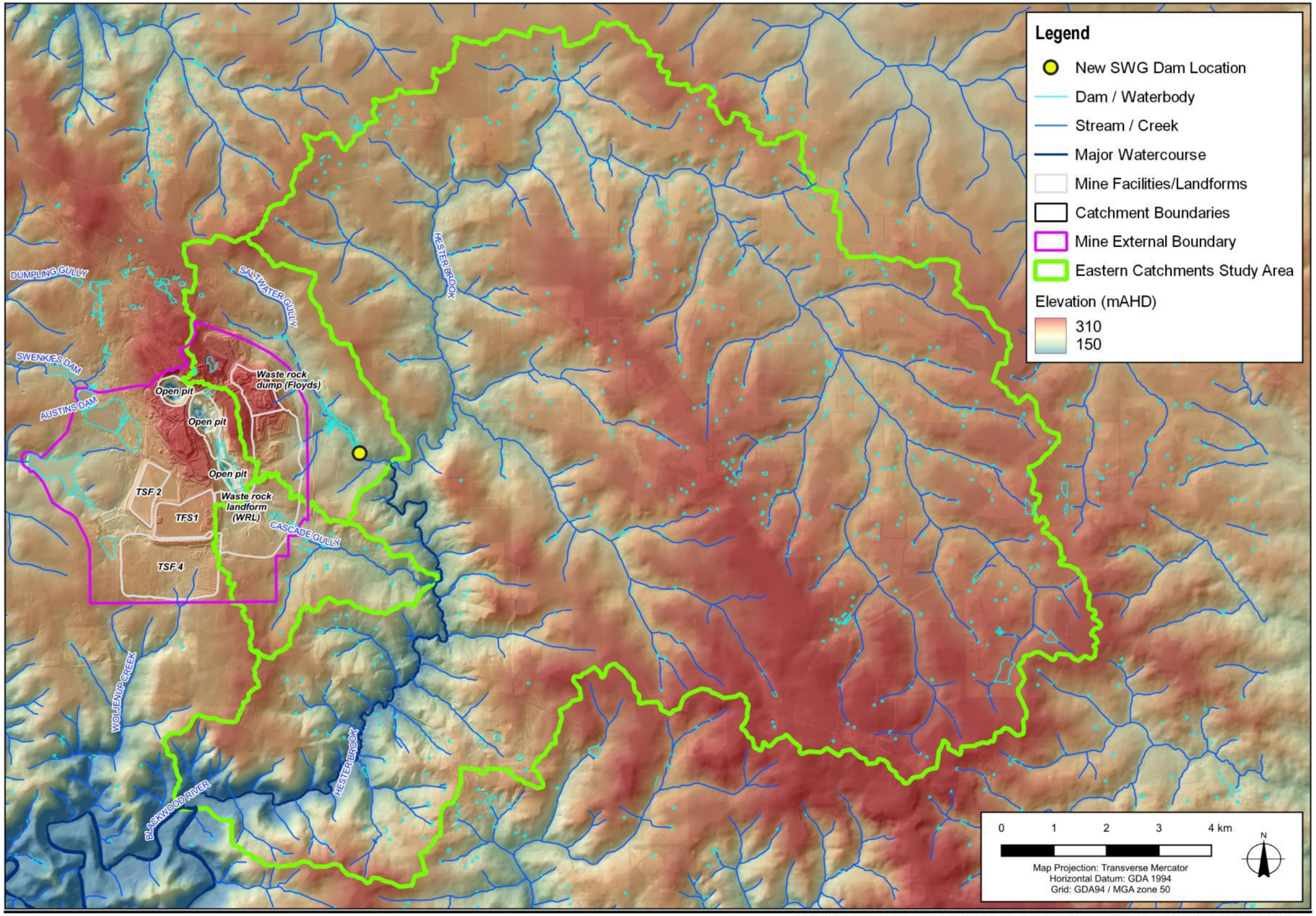
The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described throughout this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Talison and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

## 1.3 Study Area

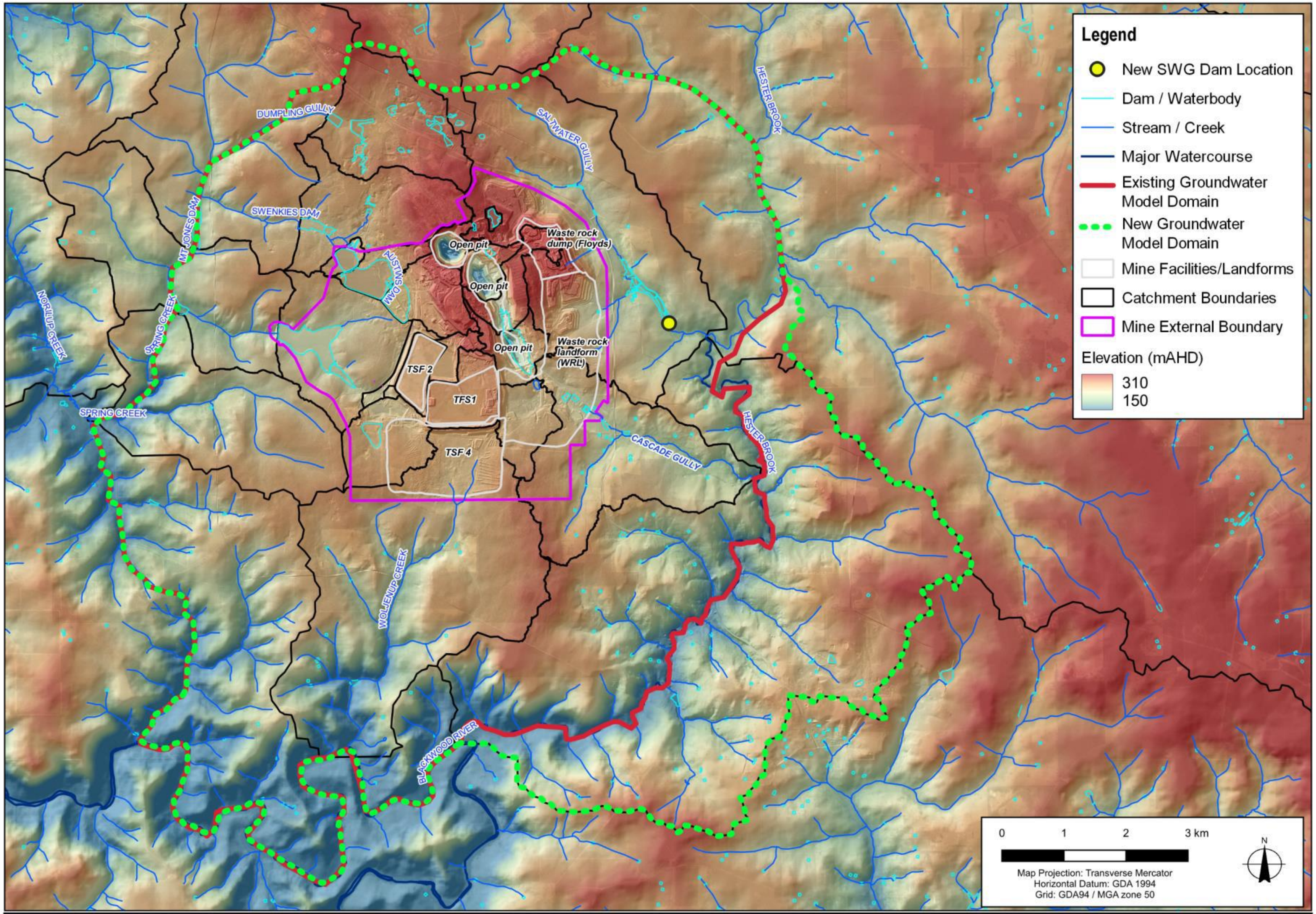
The Study Area is defined by the domains of the surface water and groundwater models:

– The surface water model domain encompasses the construction footprints of the S8 WRL, the new SWG Dam and TSF1, the upstream contributing catchment areas and the downstream receiving environment. This includes Hester Brook and its tributaries up to the confluence with Blackwood River. A plan of the surface water model domain is provided in **Figure 1.2**.
– The domain of the site-wide groundwater model has been extended to include the potential groundwater impact areas downgradient of the proposed facilities (i.e., to the southeast). A plan of the surface water model domain is provided in **Figure 1.3**.




Data Source: GHD - New SWG Dam Location (2023), Mine Facilities/ Landform (2022), Catchment Boundaries (2023). Talison - Mine External Boundary (2022), Elevation (2023). Landgate - Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020), Elevation (2020).

*Figure 1.2: Surface Water Model Domain*




Data Source: GHD - New SWG Dam Location (2023), Mine Facilities/ Landform (2022), Catchment Boundaries (2023), Groundwater Model Domain (2023). Talison - Mine External Boundary (2022), Elevation (2023). Landgate - Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020), Elevation (2020).

***Figure 1.3: Groundwater Model Domain***

# 2. Overview of Site Characteristics

## 2.1 Climate

The site has a Mediterranean climate characterised by warm dry summer and cool wet winters. The mean annual rainfall is ~918 mm (from 1900 – 2022) recorded at the Bureau of Meteorology (BoM) Station 009552 at Greenbushes, which is located immediately north of the site. A detailed assessment of the climate at the mine site is provided by (GHD, 2023b).

**Figure 2.1** illustrates monthly average rainfall and the evaporation data and highlights the seasonal nature of rainfall, with the highest values recorded between May and September. Some high rainfall events do however occur as summer storms. Monthly evaporation exceeds rainfall outside of the wet winter season and the average pan evaporation is ~1,315 mm per year in the Greenbushes area.

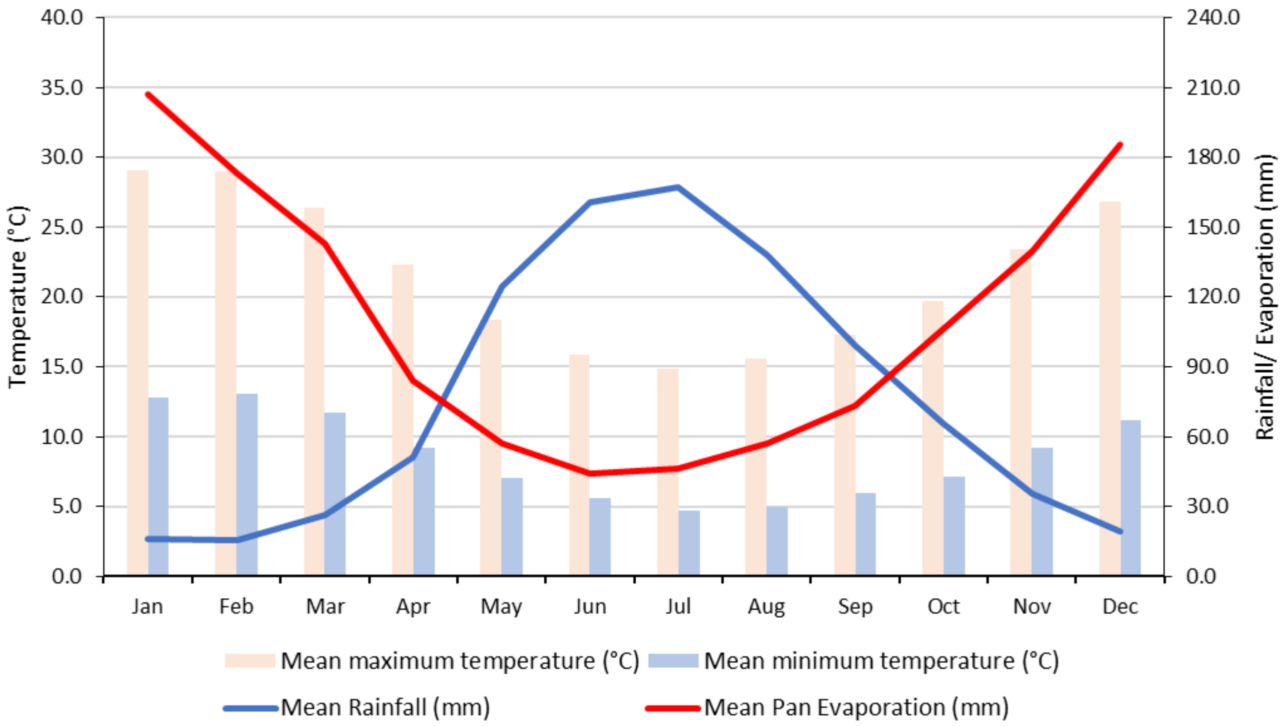


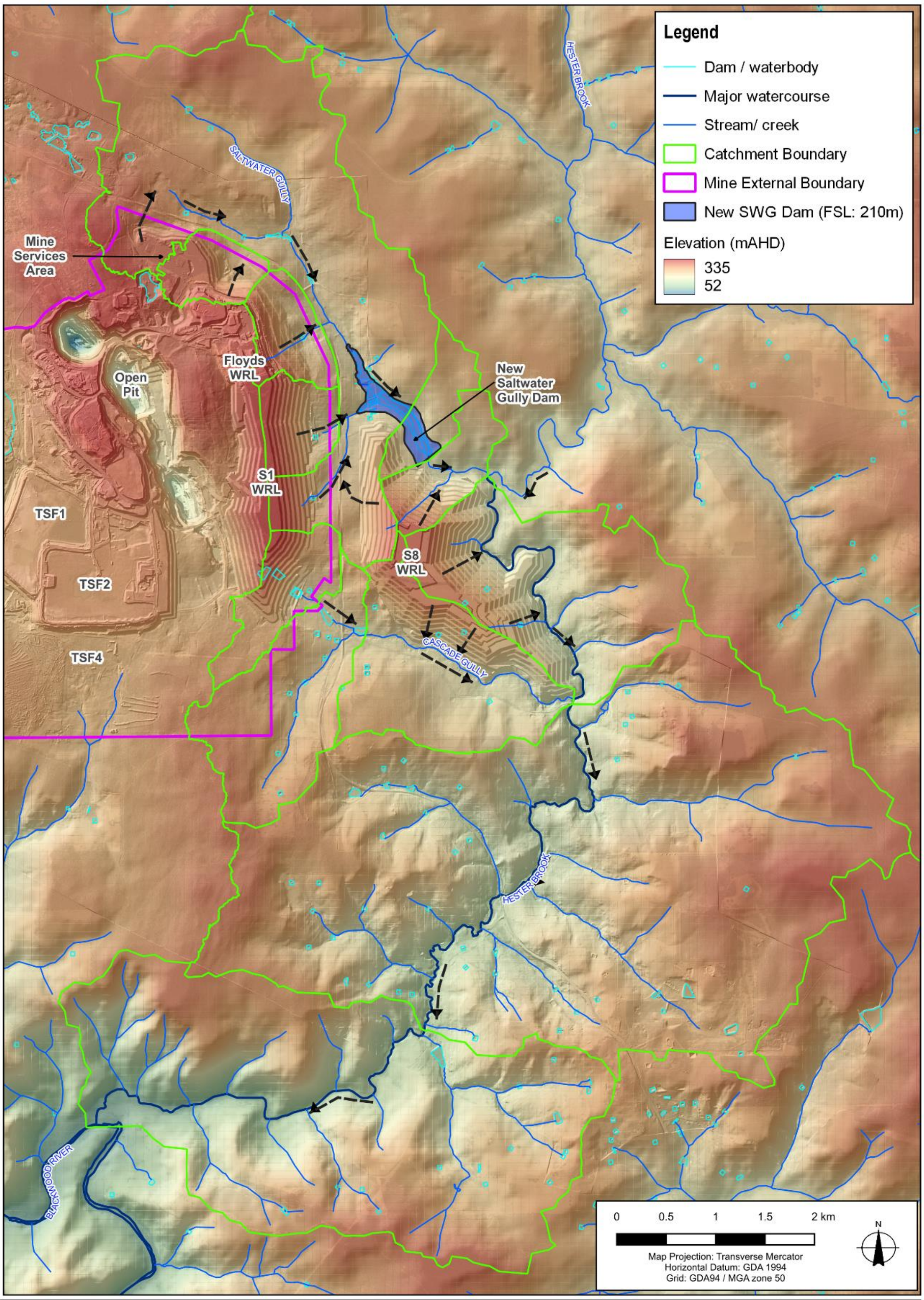

*Figure 2.1: Greenbushes Monthly Climate Statistics for Station 009552 (data from 1900 to 2022)*

Rainfall data over the last 30 years indicates a drying climate (BoM, 2023). The annual average rainfall has reduced from 830 mm for the 30-year period between 1990 and 2020, to 784 mm for the 20-year period between 2000 and 2020, and further reduced to 745 mm for the 10-year period between 2010 and 2020.

The mean monthly maximum temperature measured at Greenbushes ranges from ~14.9°C in July to ~29.1°C in January and the mean monthly minimum temperatures ranges from ~4.7 °C in July to ~13.1°C in February.

## 2.2 Site Drainage

The topography and drainage depicted in **Figure 2.2** indicates that the mine site is situated on a ridge with the footprints of the various WRLs generally sloping towards the east and southeast, where the surface water is expected to drain and discharge into the Saltwater Gully and Cascade Gully. A detailed overview of the site topography, drainage, and hydrology of the Eastern Catchments Study Area is provided by (GHD, 2023b).




Data Source: GHD - New SWG Dam (2023), WRL Landform (2023), Catchment Boundaries (2023). Talison - Mine External Boundary (2022). Landgate - Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020), Elevation (2020).

*Figure 2.2: Site Topography and Drainage*

## 2.3 Conceptual Hydrogeological Model

The Conceptual Site Model (CSM) for the Eastern Catchments Study Area was developed by (GHD, 2023b) and a summary is provided in the following sections.

### 2.3.1 Hydrogeological Units

The following geological profile is inferred on the mine site and extending eastwards into the Study Area from geological logging from the drilling of the bores:

– An upper unit of surficial sands that is made up of fine to medium grained quartz sands, with gravels and clayey gravels, ranging from ~2 m to ~3 m in thickness. Transported materials associated with historical dredging operations and mine deposition occur in some of the drainage lines. Surficial laterite also occurs in places.
– An intermediate unit where the upper basement rocks typically develop lateritic weathering profiles ~20 m to ~50 m thick, with a saprolitic profile comprising upper and lower clay layers, which yield little groundwater flow and have low or negligible permeability. A transition zone of saprock/moderately oxidised bedrock defines the base of the saprolitic profile.
– A basement unit, which is fresh bedrock (not oxidised) and which exhibits a low permeability (fractured bedrock).

### 2.3.2 Groundwater Recharge and Discharge

Groundwater recharge mechanisms relate to TSF seepage, infiltration of rainfall through WRL material, and infiltration of rainfall falling directly on areas of surficial alluvial sands and gravels. Groundwater levels in the shallow groundwater system indicate seasonal and/or episodic surface water features can be categorised as expressions of the water table and represent recharge points in topographic lows within the mine boundary. These would also be discharge points at times when groundwater is expressed. Groundwater discharge points are reflected closely by the network of dams, creeks and streams in the Eastern Catchments Study Area as depicted in **Figure 2.3**.

### 2.3.3 Groundwater Levels and Flow Paths

The groundwater modelling reported in the preliminary risk assessment (GHD, 2023c) provides contours of the current groundwater levels depicted in **Figure 2.4**. The overall radial flow pattern exhibited outside the open pit operations suggests groundwater discharges into Cascade Gully, Saltwater Gully and potentially as far as Hester Brook.

The occurrence of groundwater within the alluvium is associated with the expression of groundwater at the surface. Within the shallow alluvial system, upon infiltrating the soil profile within recharge zones, groundwater flow will generally follow the local topography along current drainage lines and paleochannels. The paleochannels generally reflect surface water drainage lines along topographical lows and discharging to local water bodies or to the open pits of the mining operation itself.

Zones of lateritic caprock within the surficial profile create a preferential pathway for infiltration in the WRL areas. Rainfall infiltrates through the WRD material, then primarily moves laterally down-gradient through the thin laterite caprock along the top of the saprolitic profile, discharging into Saltwater Gully to the east, and joining the paleo-drainage channels flowing north into the open pits to the west.

Groundwater levels monitored to the east of TSF1 indicate groundwater flows through lenses of re-deposited gravel and clay within the mine boundary, confirming the heterogenous nature of the shallow groundwater system, assumedly because of the historical deposition of different mine waste materials. Within the immediate vicinity of TSF1 and the southern end of the open pit operations, groundwater flow is northwards, towards the open pits, while at the southern end of the WRL, groundwater flows in a south-easterly direction, beneath Cascade Gully.

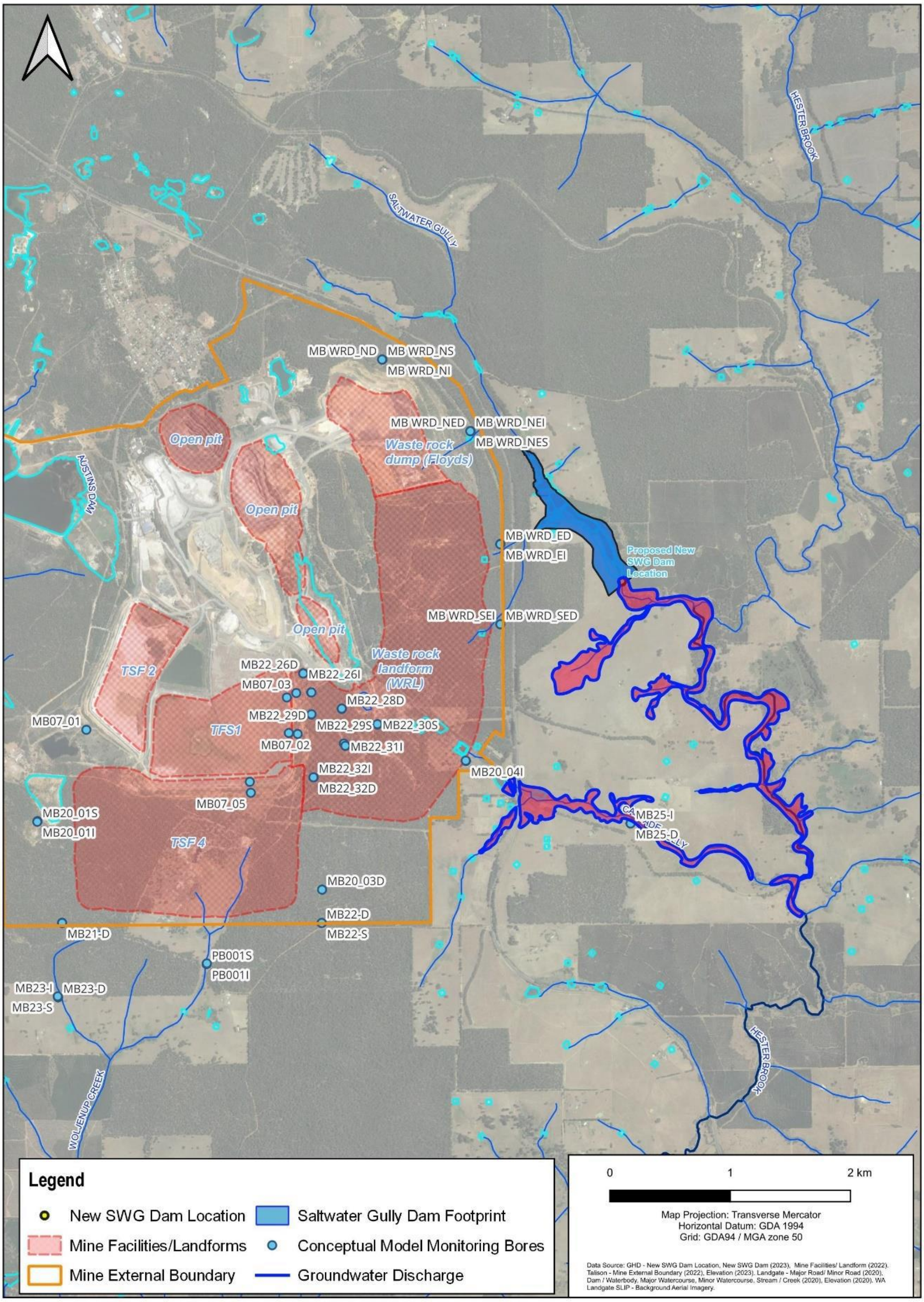



*Figure 2.3: Groundwater Discharge Points and Features*

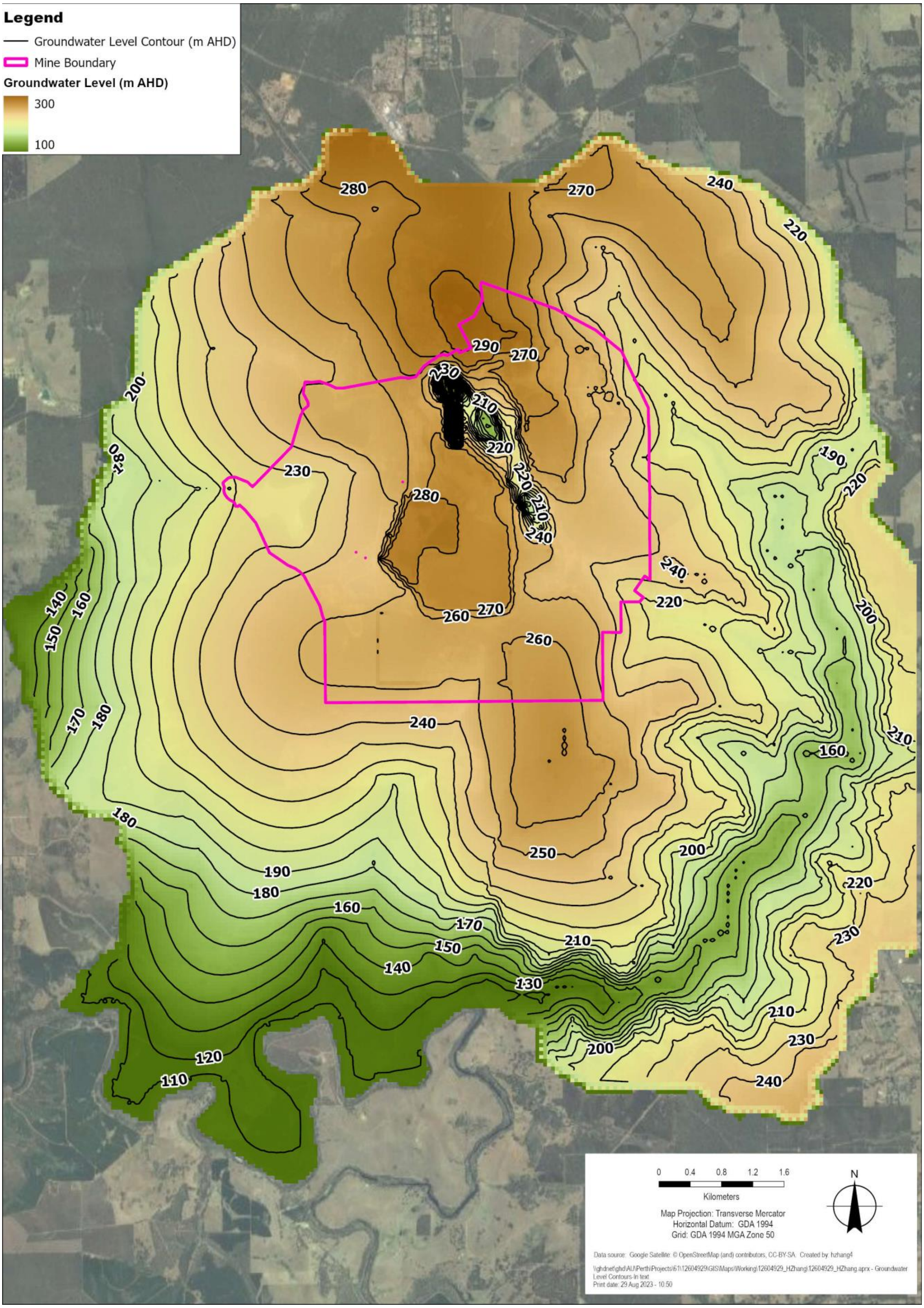



*Figure 2.4: Groundwater Level Contours*

# 3. Preliminary Source-Path-Receptor Model

## 3.1 Overview

This assessment is based on the Department of Water and Environmental Regulation (DWER) risk assessment guidelines (Department of Water and Environmental Regulation, 2020) and is structured on identifying the Source, Pathway and Receptors (SPR) relationships and linkages and considers only the risks associated with the mine facilities which drain into the Eastern Catchments Study Area. These facilities include the existing Mine Services Area (MSA) and Floyds WRL as well as the proposed developments (SWG dam, S8 WRL, and TSF1 reuse). It should be noted that the SPR relationships and linkages detailed in this report are preliminary and is likely to superseded by the risk assessment when complete (GHD, 2023c). Accordingly, the monitoring plan should be updated on completion of the risk assessment.

## 3.2 Potential Sources

### 3.2.1 Sources

The potential contaminant sources resulting from the proposed mine activities include:

- Leaching of Contaminants of Potential Concern (CoPCs) from WRLs (Floyds, S1 and S8) via rainfall infiltration.
- Seepage and drainage of CoPCs from TSF1, including decant (tailings slurry waters used to deposit the tailings) and leaching from the tailings solids materials and materials used to construct the TSF embankments.
- Seepage and runoff of CoPCs from the Mine Services Area (MSA), which is located immediately north of Floyds WRL, and which is used for maintenance and servicing of mine equipment and vehicles as well as potentially storing hazardous materials, hydrocarbon fuels and lubricants.

Although not necessity a primary source of contamination, CoPCs from impacted runoff and groundwater discharge from upstream mine facilities are likely to be captured and stored (and possibly attenuated) in SWG Dam.

### 3.2.2 Contaminants of Potential Concern

A number of studies have been undertaken to characterise the water quality emanating from these sources, including:

- Laboratory analysis of five decant samples (Talison, 2018).
- Decant analysis during sub-surface clay attenuation capacity testing undertaken for the TSF4 seepage assessment (GHD, 2023d).
- Leach testing of three tailings samples using ASLP and DI leaching methods (single leach) (GHD, 2019).
- Leach testing of four samples taken from the surface of TSF2 at the outlet areas associated with the processing plants CGP1, CGP2, TGP1 and TRP (LEAF 1314) (GHD, 2023e).
- Testing of seepage from seven locations from the foot of the current Floyds WRL (six locations) (GHD, 2022a)
- Leach testing of future waste rock comprising 52 samples of dolerite, amphibolite, granofels, and pegmatite waste (ALSP, LEAF 1313 and 1314).
- Decant concentrations (filtered and unfiltered) taken from the TSF2 decant pump by Talison in May 2023.

A short list of CoPCs has been derived from reviewing the above laboratory analysis results and studies (results not shown) and are summarised in Table 3.1. These CoPCs may be subject to change, based on the results of updated computer-based modelling and waste rock leach testing (underway).

*Table 3.1: List of Potential Source CoPCs*

| Metals | WRLs | TSF1 | SWG Dam[2] | MSA |
|---|---|---|---|---|
| Aluminium | | ✓ | | |
| Ammonia | ✓ | ✓ | ✓ | ✓ |
| Antimony | | ✓ | | |
| Arsenic | | ✓ | | |
| Cadmium | | ✓ | | |
| Caesium | | ✓ | | |
| Chromium | ✓ | | ✓ | |
| Copper | | ✓ | | |
| Lithium | ✓ | ✓ | ✓ | |
| Manganese | | ✓ | | |
| Rubidium | ✓ | ✓ | ✓ | |
| Thallium | ✓ | ✓ | ✓ | |
| Uranium | ✓ | ✓ | ✓ | |
| Vanadium | ✓ | ✓ | ✓ | |
| Zinc | ✓ | | ✓ | |
| Sulfates | ✓ | | ✓ | ✓ |
| Nitrates | | | ✓ | ✓ |
| Hydrocarbons | ✓ | | ✓ | ✓ |

## 3.3 Exposure Pathways

### 3.3.1 Surface Water Pathways

The surface pathways presented in **Figure 2.2** indicate that, where surface drainage is not captured within the mining area, the flow directions are as follows:

- Drainage from the MSA, Floyds WRL, the northern part of S1 WRL, and the western part of S8 WRL will migrate to and down Saltwater Gully eventually flowing into SWG Dam.
- Spills and releases from SWG Dam and drainage from the north-eastern part of S8 WRL will migrate down Hester Brook (from the confluence with Saltwater Gully to the confluence with Cascades Gully).
- Drainage from the southern parts of S1 and S8 WRLs will migrate down Cascades Gully eventually flowing into Hester Brook (downstream of the confluence with Saltwater Gully).
- All flows in Hester Brook eventually discharge into the Blackwood River.

### 3.3.2 Groundwater Pathways

Some seepage from the existing WRLs discharges to surface at the toe of the WRL (GHD, 2022a). Seepage from the base of TSF1 recharges groundwater and also discharges to surface at the toe of the eastern embankment and likely to the series of former dredge ponds and topographic low points to the east of TSF 1 that drain to the opencut.

Analysis of groundwater gradient and preferential flow paths indicates groundwater to the east of the divide defined by the higher topographic elevation of the Floyds WRL follow surface water features and drainage lines

[2] CoPCs derived from SWG Dam are assumed to be the same as the MSA and WRLs as the dam will receive runoff from these facilities.

closely, discharging along Cascade Gully, Saltwater Gully, and Hester Brook. Seepage mapping indicates that surface water is both gained and lost from/to the shallow groundwater system and seepage capture/storage dams as it migrates east along the drainage lines and flow paths. It is likely that the recharge/discharge relationships between the surface and groundwater systems are influenced by seasonal variation in streamflow and groundwater levels, resulting in sites being defined primarily either by recharge or discharge mechanisms depending on the time of year and conditions.

## 3.4 Potential Receptors

A review of the receiving environment has been provided in the Gap Analysis report (GHD, 2023a). The downstream aquatic ecosystems are a primary component of the receiving environment. In addition, a survey of downstream landholders conducted by Talison between September and November of 2021 indicates that the beneficial water uses of the receiving environment of the Saltwater Gully and Cascade Gully could include irrigation, livestock watering, domestic (non-potable) and drinking water (GHD, 2023b). However, the measured water quality of Saltwater Gully, Cascades Gully and Hester Brook indicates that the potability of this water is not fit for human consumption and is not known to be used for drinking water supply.

The key receptors potentially sensitive to changes in water quality, environmental flows and groundwater flows in the receiving environment may therefore include:

– Aquatic environments (aquatic organisms and ecological processes – rivers, creeks, and dams).
– Primary production (irrigation and stock watering – rivers, creeks dams and groundwater).
– Human use:
  - Potable use (access from rivers, creeks, dams/groundwater).
  - Recreational use (rivers, creeks, and dams).

## 3.5 Source-Pathway-Receptor Linkage

The exposure scenarios is presented in **Table 3.2**, which demonstrates the linkages that exist between the sources, pathways, and receptors. Both existing sources (current and approved facilities) and future sources (proposed facilities) have been considered in the SPR linkage assessment as there will be a need to differentiate these through monitoring. These scenarios indicate that almost all the SPR linkages are complete and that there is a potential for the existing and proposed sources to impact human health and ecology associated with the downgradient creeks. It should be noted that the pathways towards the active mining areas located to the west of the facilities have not been considered since it is assumed that these would be intersected by existing mine water systems and recirculated into the Mine Water System for ongoing management.

*Table 3.2: Preliminary Source-Pathway-Receptor Linkage Assessment*

| Source (CoPC)[3] | Off-site Pathway | Receptor or beneficial use | Exposure scenario complete? |
|---|---|---|---|
| Runoff from contaminated surfaces on MSA:<br>– Hydrocarbons | Runoff surcharging or bypassing drains and discharging into Saltwater Gully. | Saltwater Gully & Hester Brook:<br>– Aquatic environment<br>– Human use: Potable & recreational uses<br>– Primary production use: Irrigation and stock watering | Yes |
| Seepage from contaminated surfaces and leaching of materials in MSA embankment:<br>– Hydrocarbons<br>– Dissolved metals<br>– Sulfate, nitrate | Seepage through embankment and along underlying natural surface bypassing cutoff drains and discharging into Saltwater Gully. | | Yes |
| | Seepage through embankment into shallow groundwater and discharge of groundwater to surface water in drainage lines to Saltwater Gully. | | Yes |

[3] CoPCs identified in Table 3.1.

| Source (CoPC)[3] | Off-site Pathway | Receptor or beneficial use | Exposure scenario complete? |
|---|---|---|---|
| Waste rock leaching from Floyds WRL:<br>– Dissolved metals<br>– Sulfate, nitrate | Seepage through WRL and along underlying natural surface and discharging into Saltwater Gully. | | Yes |
| | Seepage through WRL into shallow groundwater and discharge of groundwater to surface water in drainage lines to Saltwater Gully | | Yes |
| Waste rock leaching from S1 WRL:<br>– Dissolved metals<br>– Sulfate, nitrate | Seepage through WRL and along underlying natural surface and discharging into Saltwater Gully and Cascades Gully. | Saltwater Gully, Cascades Gully & Hester Brook:<br>– Aquatic environment<br>– Human use: Potable & recreational uses<br>– Primary production use: Irrigation and stock watering | Yes |
| | Seepage through WRL into shallow groundwater and discharge of groundwater to surface water in drainage lines to Saltwater Gully and Cascades Gully. | | Yes |
| Waster rock leaching from S8 WRL:<br>– Dissolved metals<br>– Sulfate, nitrate | Seepage through WRL and along underlying natural surface and discharging into Saltwater Gully and Cascades Gully. | | Yes |
| | Seepage through WRL into shallow groundwater and discharge of groundwater to surface water in drainage lines to Saltwater Gully and Cascades Gully. | | Yes |
| Releases and spills of mine impacted water from SWG dam:<br>– Hydrocarbons<br>– Dissolved metals<br>– Sulfate, nitrate | Discharges into Saltwater Gully and Cascade Gully. | Saltwater Gully & Hester Brook:<br>– Aquatic environment<br>– Human use: Potable & recreational uses<br>– Primary production use: Irrigation and stock watering | Yes |
| Tailings leaching and decant seepage from TSF1:<br>– Dissolved metals<br>– Sulphate and nitrate | Seepage discharge to Cascade Gully (CSM indicates that all seepage retained and returned to Vultans Pit). | Cascade Gully & Hester Brook:<br>– Aquatic environment<br>– Human use: Potable & recreational uses<br>– Primary production use: Irrigation and stock watering | No |
| | Downwards migration of seepage into the subsurface and migration with groundwater flow. | Groundwater users:<br>– Human use: Potable<br>– Primary production use: Stock watering | Yes |
| | Discharge of groundwater to surface water | Cascade Gully & Hester Brook:<br>– Aquatic environment<br>– Human use: Potable & recreational uses<br>– Primary production use: Irrigation and stock watering | Yes |

# 4. Surface Water Monitoring

## 4.1 Approach

Potential surface water monitoring locations for streamflow gauging and water quality sampling were selected based on the desktop assessment undertaken for the Gap Analysis (GHD, 2023a). This assessment considered the current and approved mine operations (including S1 WRL), the proposed new facilities (SWG Dam, S8 WRL, and TSF1 reuse) as well as available site characteristics. Such characteristics included surface water drainage channels, creeks, catchment areas, topography, site geomorphology, desirable cross-section characteristics for flow monitoring, accessibility and health and safety considerations. Existing monitoring sites used by Talison have been utilised for this plan where possible.

## 4.2 Streamflow Gauging Locations

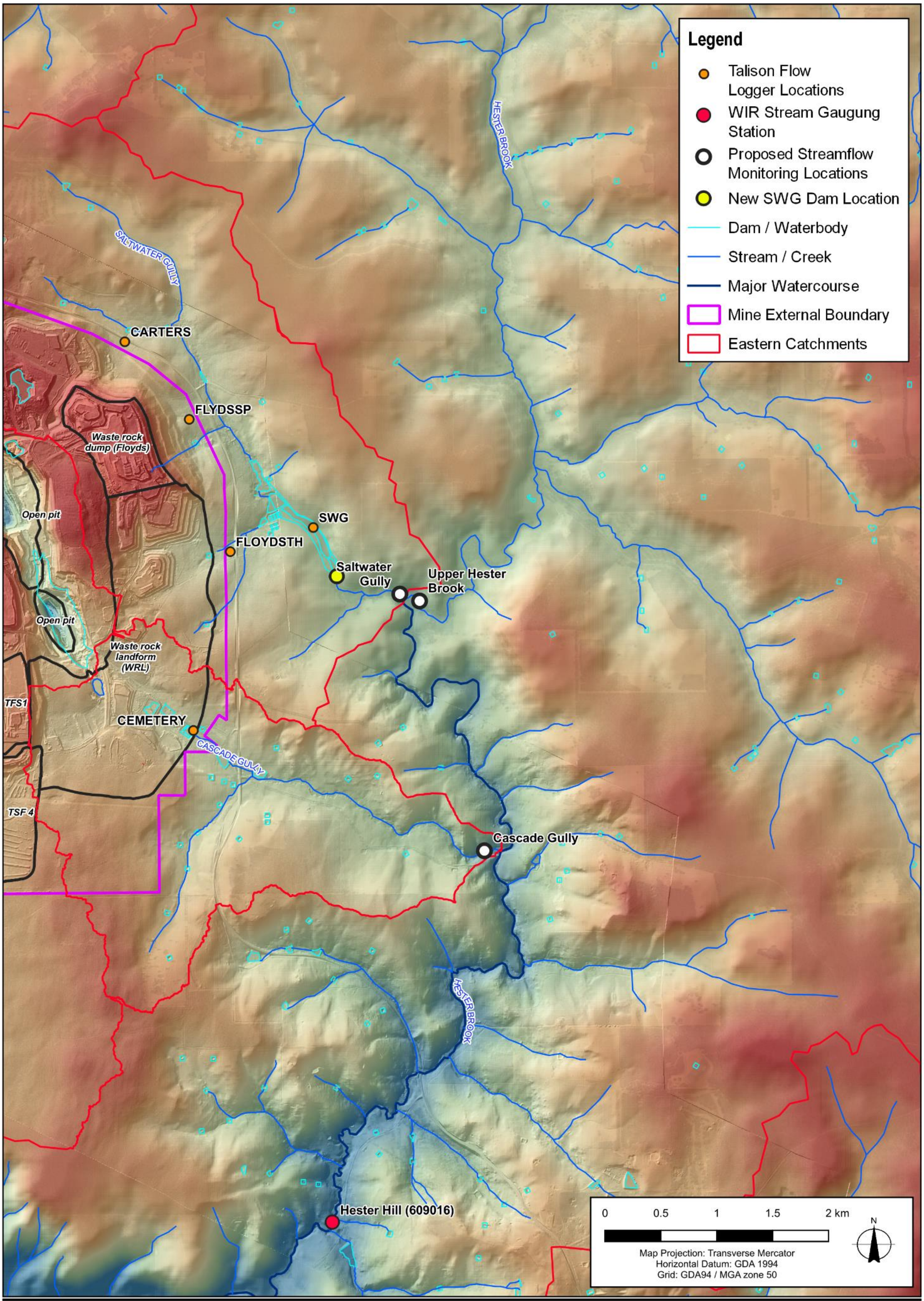
Streamflow in the Study Area is currently monitored at the locations detailed in **Table 4.1** and depicted in **Figure 4.1**. The Gap Analysis (GHD, 2023a) indicated that streamflow data are available from:

– Gauging undertaken by Talison as a condition to monitor flows at four licenced discharge points located east of the existing WRL, which have relatively short records from 2 to 9 years.

– A DWER gauge on Hester Brook (609016) that was operated for 22 years until 2005 when it was mothballed.

*Table 4.1: Existing and Proposed Streamflow Gauging Sites*

| Domain | Site ID | Purpose | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|
| Floyds WRL and MSA | CARTERS | Existing licenced discharge point, gauges runoff from north-east part of Floyds WRL & south-east part of MSA | 414,734 | 6,254,432 |
| | FLYDSSP | Existing licenced discharge point, gauges runoff from central part of Floyds WRL | 415,310 | 6,253,738 |
| | FLOYDSTH | Existing licenced discharge point, gauges runoff from southern part of Floyds WRL | 415,678 | 6,252,553 |
| | CEMETERY | Existing licenced discharge point, gauges runoff from approved S1 WRL | 415,347 | 6,250,952 |
| Saltwater Gully | SWG | Existing site to gauge overflows of existing dams in Saltwater Gully | 416,419 | 6,252,769 |
| | SW23-04 | Proposed site upstream of confluence of Hester Brook to gauge whole of sub-catchment flows and for model calibration | 417,194 | 6,252,173 |
| Cascade Gully | SW23-05 | Proposed site upstream of confluence of Hester Brook to gauge whole of sub-catchment flows and for model calibration | 417,951 | 6,249,875 |
| Hester Brook | SW23-03 | Proposed site upstream of confluence of Saltwater Gully to gauge whole of sub-catchment flows and for model calibration | 417,371 | 6,252,112 |
| | Hester Hill (609016) | Proposed site, reinstate recording of streamflow at mothballed DWER gauge to gauge discharges to Blackwood | 416,590 | 6,246,550 |




Data Source: GHD - New SWG Dam Location (2023), Mine Facilities/ Landform (2022). Talison - Mine External Boundary (2022). Landgate - Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020). WA Landgate SLIP - Background Aerial Imagery.

*Figure 4.1: Existing and Proposed Streamflow Gauging Locations*

Key points observed in the Gap Analysis (GHD, 2023a) are:

– The record at Hester Brook (609016) was sufficient to calibrate the hydrological model at this site, but the rainfall reduction experienced since 2005 may impact the reliability of the calibration.
– The records of streamflow leaving the mine site are relatively short, which may also impact the reliability of the calibration.
– There is no overlap in the calibration periods for the streamflow leaving the mine site and that in the receiving streams.
– There are no streamflow gauges at the following locations:
  - In the upper catchment of Hester Brook, upstream of the mine site.
  - In Cascade Gully downstream of Cemetery Dam.
  - In Saltwater Gully at the confluence with Hester Brook.

As a result of this paucity in streamflow data to achieve a reliable model calibration and to establish a reasonable baseline hydrology, additional streamflow gauging sites are proposed on Saltwater Gully, Cascades Gully and Hester Brook, the locations of which are detailed in **Table 4.1** and are depicted in plan in **Figure 4.1**.

Streamflow gauging structures with water level loggers should be installed at suitable locations in the vicinity of the proposed creek monitoring locations. The structures should provide a stable control section such as that depicted in **Figure 4.2**. The combination flume/weir depicted in the photo is accurate over a wide range of flows and provides stable conditions for long term monitoring.

*Figure 4.2: Typical Small-Scale Streamflow Gauging Structure*

## 4.3 Surface Water Quality Monitoring Locations

The Gap Analysis (GHD, 2023a) indicated that surface water quality data are available from:

– 19 Talison monitoring locations with varying record lengths.
– A single round of water and sediment quality sampling and laboratory analyses of samples taken from seven locations in Saltwater Gully and Hester Creek downstream of the confluence of these waterways (SLR, 2022).
– Background water quality sampling and laboratory analyses of samples taken from four locations in Hester Creek upstream of the confluence with Saltwater Gully for the ecological assessment study of Cowan and Norilup Brooks (University of Western Australia, 2019).

– Publicly available data for the Water Information Reporting (WIR)[4] database at two locations in Hester Brook below the confluence with Cascades Gully.

A summary of the existing water quality monitoring locations is presented in **Table 4.2**, the locations of which are depicted in **Figure 4.3**.

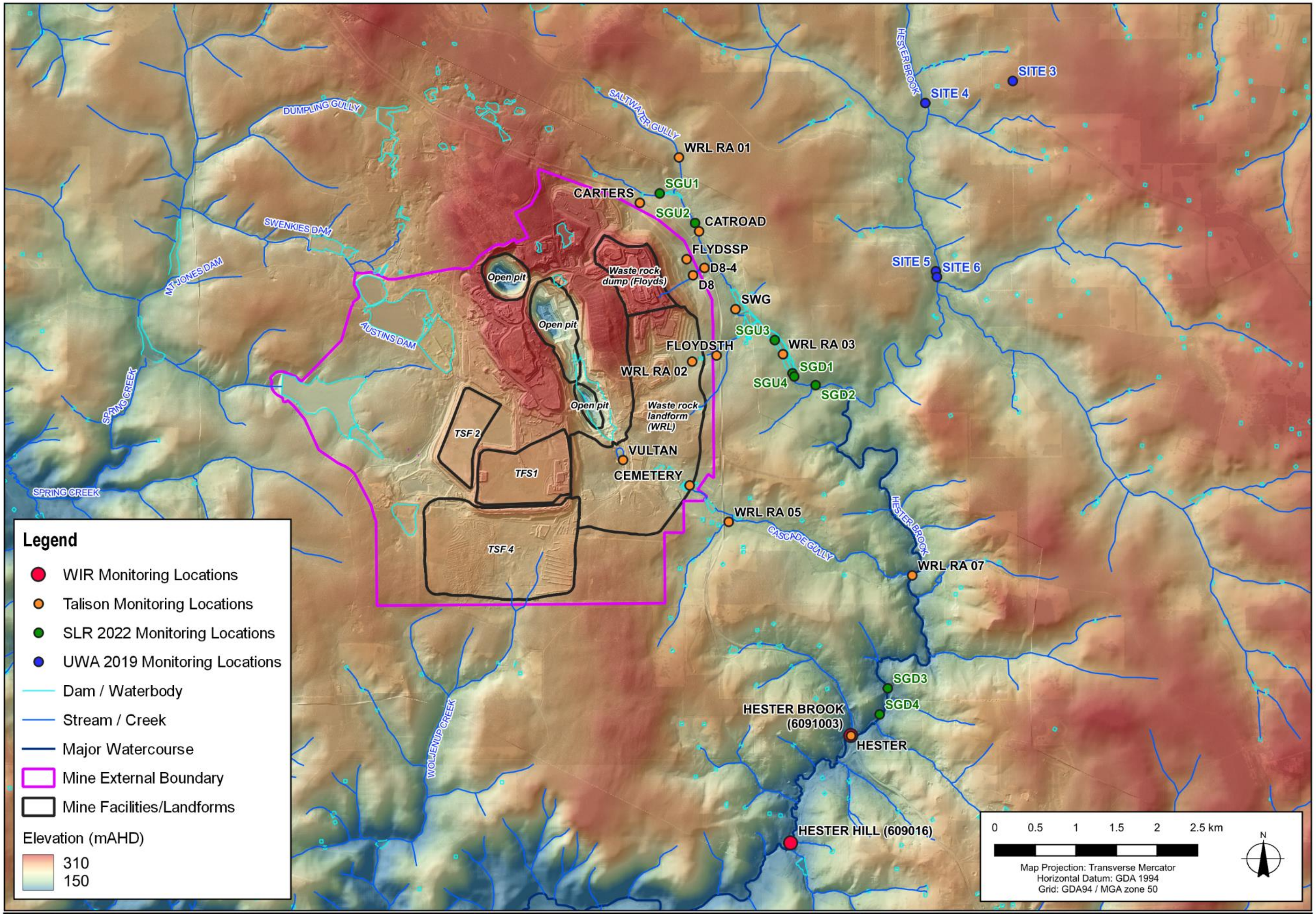
*Table 4.2: Existing Surface Water Sampling Sites*

| Domain | Site ID | Location/Purpose | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|
| **Talison Monitoring** | | | | |
| Floyds WRL and MSA | CARTERS | Licenced discharge point, provides current impacted water quality discharging from north-east part of Floyds WRL & south-east part of MSA | 414,734 | 6,254,432 |
| | FLYDSSP | Licenced discharge point, provides current impacted water quality discharging from central part of Floyds WRL | 415,310 | 6,253,738 |
| | D8 | Discharge point, provides current impacted water quality discharging from central part of Floyds WRL | 415,388 | 6,253,541 |
| | D8 4 | Discharge point downstream of D8, provides current impacted water quality discharging from central part of Floyds WRL | 415,529 | 6,253,631 |
| | FLOYDSSTH | Licenced discharge point, provides current impacted water quality discharging from southern part of Floyds WRL | 415,678 | 6,252,553 |
| | WRL RA 02 | Discharge point upstream of FLOYDSSTH, provides current impacted water quality discharging from southern part of Floyds WRL | 415,377 | 6,252,477 |
| | CEMETERY | Licenced discharge point, provides current impacted water quality discharging from approved S1 WRL and TSF1 | 415,347 | 6,250,952 |
| Hester Brook | S7 | Upstream of Saltwater Gully confluence, provides baseline water quality in upstream environment | 418,285 | 6,255,611 |
| | S6 | Upstream of Saltwater Gully, downstream of S7, provides background water quality in upstream environment | 418,423 | 6,253,138 |
| | WRL RA 07 | Downstream of Cascades Gully confluence, provides baseline/current impacted water quality in receiving environment | 418,086 | 6,249,844 |
| | HESTER | Same as DWER site 6091003. Provides baseline/current impacted water quality in receiving environment | 417,331 | 6,247,872 |
| Saltwater Gully | WRL RA 01 | Upstream of all mine impacted discharges, provides background water quality in upstream environment | 415,216 | 6,254,990 |
| | CATROAD | Downstream of some mine impacted discharges (MSA, Floyds), downstream of WRL RA 01, provides baseline/current impacted water quality in receiving environment | 415,463 | 6,254,081 |
| | SWG | Downstream of some mine impacted discharges (MSA, Floyds), downstream of CATROAD, provides baseline/current impacted water quality in receiving environment | 415,912 | 6,253,122 |

4 https://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx

| Domain | Site ID | Location/Purpose | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|
| | WRL RA 03 | Downstream of most mine impacted discharges (MSA, Floyds, S1, S8), downstream of SWG, provides baseline/current impacted water quality in receiving environment | 416,494 | 6,252,570 |
| Cascade Gully | WRL RA 05 | Downstream of CEMETRY, provides current impacted water quality discharging from approved S1 WRL and TSF1 | 415,827 | 6,250,502 |
| Blackwood River | BLKWDBT | Upstream of Hester Brook confluence, provides background water quality in upstream environment | 419,978 | 6,240,976 |
| | BLACKWD | Downstream of Hester Brook confluence, provides baseline water quality in receiving environment | 404,263 | 6,252,614 |
| | BLKWDSH | Between Hester & Norilup Brooks, provides baseline water quality in receiving environment | 404,138 | 6,247,913 |
| **SLR (2022) Monitoring** | | | | |
| Saltwater Gully | SGU1 | Downstream of CARTERS, provides current impacted water quality discharging from north-east part of Floyds WRL & south-east part of MSA | 414,978 | 6,254,548 |
| | SGU2 | Downstream of SGU1, upstream of FLYDSSP, provides current impacted water quality discharging from north-east part of Floyds WRL & south-east part of MSA | 415,413 | 6,254,185 |
| | SGU3 | Downstream of SGU2 and FLYDSSTH (in existing dam), provides current cumulated impacted water quality discharging from south-east part of MSA and all of Floyds WRL | 416,395 | 6,252,742 |
| | SGD1 | Provides current cumulated impacted water quality discharging from south-east part of MSA and all of Floyds WRL and baseline water quality for S1, SWG Dam | 416,635 | 6,252,294 |
| | SGD2 | | 416,898 | 6,252,187 |
| Hester Brook | SGD3 | Provides current cumulated impacted water quality discharging from south-east part of MSA and all of Floyds WRL and baseline water quality for S1, SWG Dam | 417,787 | 6,248,453 |
| | SGD4 | | 417,686 | 6,248,132 |
| **University of Western Australia (2019) Monitoring** | | | | |
| Hester Brook | Site 3 | Upstream of Saltwater Gully confluence, provides baseline water quality in upstream environment | 419,326 | 6,255,933 |
| | Site 4 | | 418,248 | 6,255,662 |
| | Site 5 | | 418,379 | 6,253,590 |
| | Site 6 | | 418,392 | 6,253,519 |
| **WIR Monitoring** | | | | |
| Hester Brook | 6091003[5] | Downstream of Cascades Gully confluence, provides current cumulated impacted water quality discharging from MSA and Floyds WRL and baseline water quality for S1, SWG Dam | 417,331 | 6,247,872 |
| | 609016 | Downstream of 6091003, provides current cumulated impacted water quality discharging from MSA and Floyds WRL and baseline water quality for S1, SWG Dam | 416,590 | 6,246,550 |

[5] This site is the same as HESTER.




Data Source: GHD - New SWG Dam Location (2023). Mine Facilities/ Landform (2022). Talison - Mine External Boundary (2022). Landgate - Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020). WA Landgate SLIP - Background Aerial Imagery.

*Figure 4.3: Existing Water Quality Monitoring Locations*

It should be noted that the various monitoring sites have been established for different objectives and that no consideration has been given to rationalisation of the monitoring. In addition, many of these records extend for short durations which are of limited value to establish baseline conditions. The sites considered to have sufficient lengths of record to establish the current impacted water quality discharging from the MSA and Floyds WRL and to establish the baseline water quality for assessment of S1 WRL, S8 WRL, and SWG Dam are:

– CARTERS
– FLOYDSTH
– FLOYDSSP
– CEMETERY
– D8-4
– D8
– CATROAD
– SWG
– HESTER

Surface water quality monitoring to establish baseline conditions should therefore be undertaken at these selected existing water quality monitoring sites as well as the existing and proposed new streamflow gauging locations. A summary of the 15 proposed surface water monitoring locations to establish baseline conditions is provided in **Table 4.4**.

*Table 4.3: Proposed Surface Water Sampling Sites to Establish Baseline Conditions*

| Domain | Site ID | Purpose | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|
| Floyds WRL and MSA | CARTERS | Existing licenced discharge point. Impacted water quality and flow. | 414,734 | 6,254,432 |
| | FLYDSSP | | 415,310 | 6,253,738 |
| | FLOYDSTH | | 415,678 | 6,252,553 |
| | CEMETERY | | 415,347 | 6,250,952 |
| | D8 | Existing monitoring site. Impacted water quality. | 415,388 | 6,253,541 |
| Saltwater Gully | WRL RA 01 | Existing monitoring site. Background water quality. | 415,216 | 6,254,990 |
| | CATROAD | Existing monitoring site. Current impacted and baseline water quality. | 415,463 | 6,254,081 |
| | SWG | Existing monitoring site. Current impacted and baseline water quality. | 415,912 | 6,253,122 |
| | SW23-04 | Proposed gauging site. Current impacted and baseline water quality and streamflow. | 417,194 | 6,252,173 |
| Cascade Gully | WRL RA 05 | Existing monitoring site. Current impacted and baseline water quality. | 415,827 | 6,250,502 |
| | SW23-05 | Proposed gauging site. Current impacted and baseline water quality and streamflow. | 417,951 | 6,249,875 |
| Hester Brook | SW23-03 | Proposed gauging site. Background water quality and streamflow. | 417,371 | 6,252,112 |
| | WRL RA 07 | Existing monitoring site. Current impacted and baseline water quality. | 418,086 | 6,249,844 |
| | HESTER | Existing monitoring site. Current impacted and baseline water quality. | 417,331 | 6,247,872 |
| | 609016 | Proposed reinstated gauging site. Current impacted and baseline water quality and streamflow. | 416,590 | 6,246,550 |

# 4.4 Analytical Suite

Suites of water quality parameters have been identified for monitoring to provide a comprehensive characterisation of the background surface water quality as well the potential contaminants from the mine and proposed expansion activities. The analytes were derived from the SPR analysis and identification of CoPCs in **Section 3**. The following analytical suite is recommended:

– **Physicochemical parameters:** pH, electrical conductivity (EC), total dissolved solids (TDS), oxidation-reduction potential (ORP), dissolved oxygen (DO), total suspended solids (TSS), turbidity.
– **Alkalinity:** Carbonate/bicarbonate/hydroxide ($CO_3$/$HCO_3$/OH), total as $CaCO_3$, hardness as $CaCO_3$
– **Major Anions:** Chloride (Cl), Sulfate ($SO_4$), Fluoride (F)
– **Major Cations:** Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K)
– **Nutrients:** Total Nitrogen (TN), Total Kjeldahl Nitrogen (TKN), nitrate and nitrite nitrogen ($NO_x$-N), ammonia ($NH_4$-N), Total Phosphorus (TP), Phosphate ($PO_4$)
– **Metals (dissolved and total):** Aluminium (Al), antimony (Sb), arsenic (As), cadmium (Cd), caesium (Cs), chromium (III +VI) (Cr), cobalt (Co), copper (Cu), iron (Fe), lithium (Li), manganese (Mn), molybdenum (Mo), nickel (Ni), rubidium (Rb), thallium (Tl), thorium (Th) uranium (U), vanadium (Va), zinc (Zn),
– **Hydrocarbons:** TRH; BTEX; PAHs

# 4.5 Surface Water Monitoring Program

A summary of the proposed surface water monitoring program for establishing the baseline conditions in the receiving creeks is presented in **Table 4.4** and the monitoring methods and procedures are presented in **Appendix A**. If possible, this program should be rationalised during construction and for ongoing operations.

*Table 4.4: Summary of Surface Water Monitoring Program to Establish Baseline Conditions*

| Site ID | Frequency | Duration[6] | Parameters[7] | Reporting frequency |
|---|---|---|---|---|
| – CARTERS<br>– FLYDSSP<br>– FLOYDSTH<br>– CEMETERY<br>– SW23-04<br>– SW23-05<br>– SW23-03<br>– 609016 | Monthly | Year 0 to Year 2 | – Streamflow: Continuous logging of flows<br>– Physicochemical parameters: pH, EC, TDS, ORP, DO, TSS, turbidity<br>– Alkalinity: $CO_3$/$HCO_3$/OH, total as $CaCO_3$, hardness as $CaCO_3$<br>– Major Anions: Cl, $SO_4$, F<br>– Major Cations: Ca, Mg, Na, K<br>– Nutrients: TN, TKN, $NO_2$-N, $NO_3$-N, $NH_4$-N, TP, $PO_4$<br>– Metals: Al, Sb, As, Cd, Cs, $Cr_{III}$, $Cr_{IV}$, Co, Cu, Fe, Li, Mn, Mo, Ni, Rb, Tl, Th, U, Va, Zn<br>– Hydrocarbons: TRH; BTEX; PAHs | Annually |
| – D8<br>– WRL RA 01<br>– CATROAD<br>– SWG<br>– WRL RA 05<br>– WRL RA 07<br>– HESTER | Quarterly | | As above except for streamflow | |



6 Year zero indicates start of monitoring period, nominally 2023.
7 Laboratory limits of reporting to below WQGs as follows:
< 1 mg/L: major ions/nutrients; < 0.1 mg/L: Mn; < 0.01 mg/L: Al, Cs, Mo, Ni
< 0.001 mg/L: Sb, As, Cs, Cr, Li, Rb; <0.0001 mg/L: Cd, Cu, U; <0.00001 mg/L: Tl, V

## 4.6 Reporting and Evaluation of Surface Water Monitoring Data

The evaluation of surface water monitoring data should include the assessment and reporting of the following:

– Presentation of the baseline surface water flows and quality at the licenced discharge points and within the various downstream creeks (with which to compare any future impacts).
– Assessment of concentrations of CoPCs and major ions and loads of CoCPs in the various creeks over time (graphs with trend analysis).
– Summary of quality control and sampling methods (QA/QC).

The above data and information should be included in an annual report for the regulator.

Identification of baseline CoPC concentrations in the receiving creeks should be considered as the as the seasonally adjusted median concentrations following a minimum of three years of monitoring prior to construction.

# 5. Groundwater Monitoring

## 5.1 Approach

The Gap Analysis (GHD, 2023a) indicates that historical datasets reflecting hydrogeological conditions across the Study Area outside the existing mine boundary lack sufficient detail and spatial/temporal distribution to define the baseline groundwater conditions. Existing groundwater monitoring programs targeting existing mine facilities and surrounds provide a template for establishing a robust baseline dataset from which to reference ongoing monitoring data.

Baseline conditions and monitoring for areas surrounding TSF4 (GHD, 2023d) and TSF1 (GHD, 2023e) is ongoing, as is Talison's routine monitoring program across the mine site. The Conceptual Site Model (GHD, 2023b) and the preliminary characterisation of the source water quality, exposure pathways and potential receptors (see **Section 3**) inform the conceptual understanding of hydrogeological characteristics in the Study Area. These studies, along with the groundwater modelling reported in the risk assessment (GHD, 2023c), form the basis from which the groundwater monitoring program has been developed.

The establishment of baseline conditions and subsequent ongoing monitoring program is designed to maximise consistency and compatibility between related programs and the mine facilities and activities. Ongoing monitoring for the duration of operations should continue to inform established baseline hydrogeological conditions across the broader region and their periodic review. Data analysis should identify trends over numerous Groundwater Monitoring Events (GME's) and be assessed alongside monitoring data generated by related monitoring programs.

Baseline groundwater monitoring should include, in addition to the insitu measurement of specified groundwater parameters, a full laboratory suite including those CoPCs identified by the preliminary SPR assessment. Monitoring should be of sufficient frequency and duration to characterise the seasonal variations in groundwater levels and quality. If necessary, the recommended groundwater monitoring program could be rationalised for ongoing operations and following closure, with the monitoring locations, the frequencies of monitoring, and the parameters being reviewed during and following facility expansion, and ongoing operations respectively.

## 5.2 Groundwater Monitoring Locations

Groundwater within and adjacent to the Study Area is currently monitored by Talison at the locations detailed in **Table 5.1**, the locations of which are depicted in **Figure 5.1**. Continued monitoring of these bores is proposed.

***Table 5.1: Existing Talison Groundwater Monitoring Locations***

| Functional area | Site ID | Location | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|
| TSF1 | MB07_02 | Western embankment of TSF1 | 413936 | 6251067 |
| | MB07_03 | Western embankment of TSF1 | 413924 | 6251408 |
| | MB07_04 | Within western boundary of TSF1 | 413862 | 6251075 |
| | MB07_06 | Within western boundary of TSF1 | 413846 | 6251371 |
| TSF2 | MB07_01 | Southwest embankment of TSF2 | 412180 | 6251102 |
| TSF4 | MB07_05 | Inside northern boundary of TSF4 | 413546 | 6250579 |
| | MB07_07 | Inside northern boundary of TSF4 | 413538 | 6250670 |
| | MB20_01 | 300m west of TSF4 western boundary | 411773 | 6250341 |
| | MB20_03 | 200m east of TSF4 eastern boundary | 414138 | 6249774 |
| | MB21 | Outside southwestern corner of TSF4 | 411979 | 6249499 |
| | MB22_32 | Outside northeastern corner of TSF4 | 414068 | 6250708 |
| | MB22 | Forrest Park Rd. southeastern corner of TSF4 | 414135 | 6249498 |
| S1/S2 WRL | MB22_26 | Between TSF1 and south end of open pits | 413982 | 6251571 |

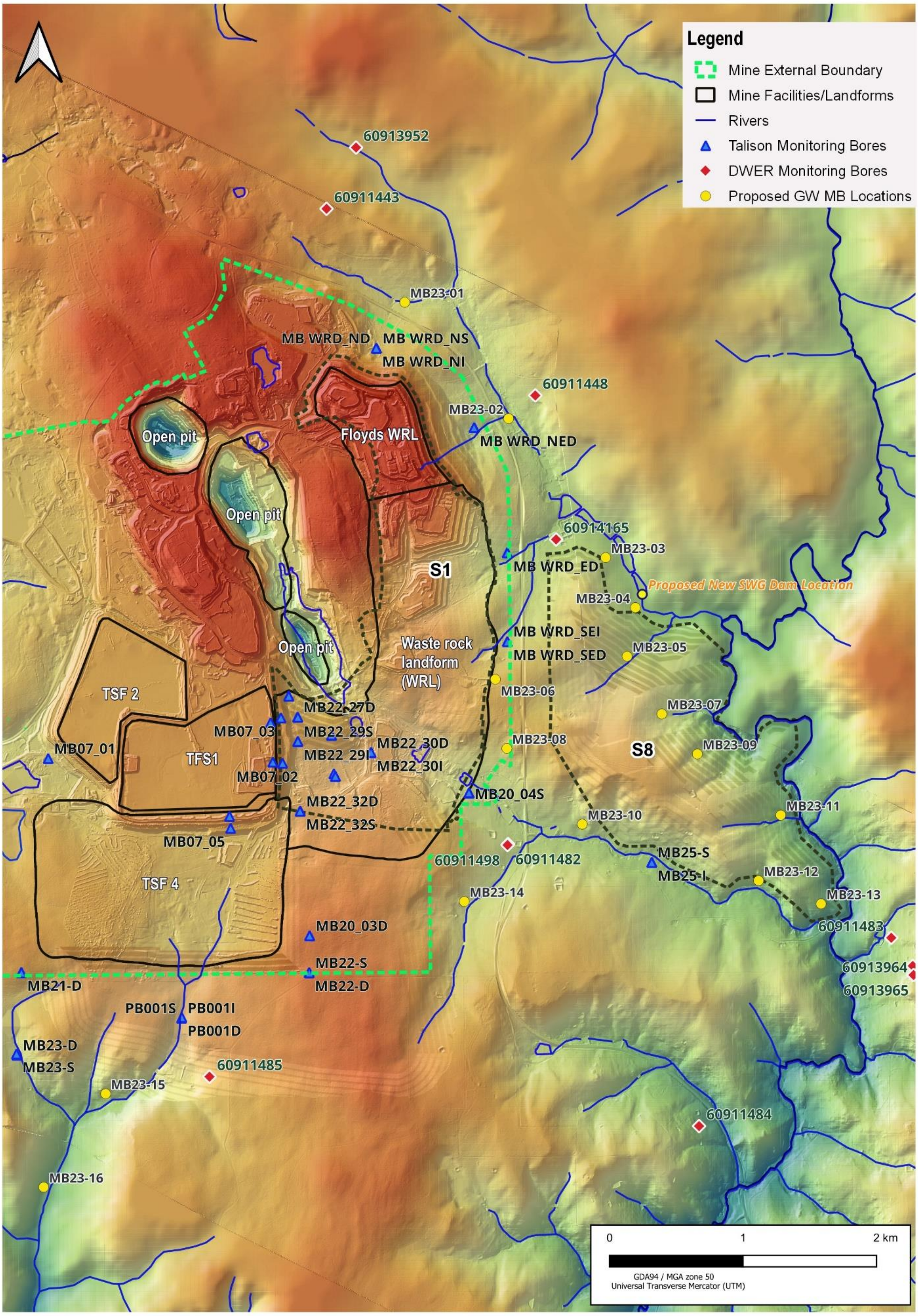
| Functional area | Site ID | Location | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|
| | MB22_27 | Between TSF1 and south end of open pits | 414049 | 6251413 |
| | MB22_28 | Between TSF1 and south end of open pits | 414302 | 6251277 |
| | MB22_29 | Between TSF1 and south end of open pits | 414050 | 6251230 |
| | MB22_30 | South of open pit on pit access road | 414598 | 6251147 |
| | MB22_31 | Dredge ponds east of TSF1 | 414332 | 6250968 |
| | MB WRD_E | Outside WRL east boundary, 150m north Wilkes Rd | 415619 | 6252644 |
| | MB WRD_SE | Outside WRL east boundary, 200m south Wilkes Rd | 415619 | 6251979 |
| Cascade Gully | MB20_04 | Cascade Gull at southeastern mine boundary | 415333 | 6250845 |
| | MB25 | Hester Cascades Rd, 1km west of Southwestern Hwy | 416702 | 6250325 |
| Floyds WRL | MB WRD_N | Northen end of Floyds WRL | 414639 | 6254177 |
| | MB WRD_NE | 400m east of WRL east boundary | 415371 | 6253583 |
| Woljenup Creek | MB23 | 500m NE Woljenup Creek line, south of TSF4 | 411943 | 6248886 |
| | PB001 | Woljenup Creek line, 350m south of TSF4 | 413180 | 6249159 |

Historical monitoring has also been reported in the WIR[8] for the private bores detailed in **Table 5.2**, the locations of which are also depicted in **Figure 5.1**. Some of these bores are potentially located within potential groundwater impact zones whilst others are located some distance away. Monitoring of these bores would be valuable to provide a baseline for groundwater use and the quality thereof. An audit of the private bores should be undertaken to assess whether these are suitable for monitoring and whether permission for monitoring will be given by the landowners.

***Table 5.2: Existing Private Bores with Monitoring Data***

| Name | Site ID | Location | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|
| Catterick Bore West | 60911443 | Saltwater Gully North | 414265 | 6255222 |
| Catterick Bore East | 60913952 | Saltwater Gully North | 414486 | 6255681 |
| Catterick Bore - 1690 | 60911448 | Saltwater Gully East Bank | 415829 | 6253823 |
| Catterick Bore - 1686 | 60914165 | Saltwater Gully Dam | 415985 | 6252744 |
| Greenbushes - 1687 | 60911482 | Cascade Gully & SW Hwy | 415625 | 6250461 |
| Greenbushes – 1688 Well | 60911498 | Cascade Gully & SW Hwy | 415621 | 6250454 |
| Maranup – 1697 Well | 60911485 | Woljenup Creek East | 413388 | 6248718 |
| Maranup – No 9 | 60911480 | Woljenup Creek West | 411230 | 6248909 |
| Hester Brook - 1691 | 60911484 | Hester Brook & SW Hwy | 417056 | 6248348 |
| Catterick Well - 1685 | 60911446 | Hester Brook – NE of confluence with Saltwater Gully | 418751 | 6252794 |
| Hester Brook - 1689 | 60911483 | Hester Cascades Rd – Farm Dam | 418496 | 6249759 |
| Hester Brook Well | 60914174 | Hester cascades Rd – Homestead | 419107 | 6249600 |
| Hester Brook Spring 1 | 60913964 | Hester Brook Spring North | 418657 | 6249548 |
| Hester Brook Spring 2 | 60913965 | Hester Brook Spring South | 418663 | 6249480 |

8 https://wir.water.wa.gov.au/Pages/Water-Information-Reporting.aspx




Data Source: GHD - New SWG Dam Location, New SWG Dam (2023), Mine Facilities/ Landform (2022). Talison - Mine External Boundary (2022), Elevation (2023). Landgate - Major Road/ Minor Road (2020), Dam / Waterbody, Major Watercourse, Minor Watercourse, Stream / Creek (2020), Elevation (2020). WA Landgate SLIP - Background Aerial Imagery.

*Figure 5.1: Existing and Proposed Groundwater Monitoring Locations*

Key points related to groundwater investigations and monitoring in the Gap Analysis (GHD, 2023a) are:

– TSF1:
  - Bore density appears sufficient to characterise the seepage flow paths, but there is a low density of monitoring bores within the central areas of the TSF1 footprint.
  - Aquifer parameter information is generally sufficient to characterise the seepage flow paths, however, there is an absence of permeability data on the western margins and beneath the footprint of TSF1 (e.g., former dredge channel).
  - Groundwater quality data generally sufficient for areas surrounding the TSF1.
  - There appears to be a significant amount of logging data available on the lithology (including depths and properties of tailings, liner/under-drain [if present], saprolite/saprock and fracturing/defect spacing within fractured rock), but this has not been collated into a geological model.

– S8 WRL:
  - Monitoring/investigation bores are required within the footprint of S8 and surrounding areas to confirm the hydrogeological conceptual model, including lithology, water levels, aquifer parameters, and water quality.

– SWG Dam:
  - Monitoring/investigation bores are required upgradient of and within the margins of the Dam to confirm the conceptual model, including, lithology, water levels, aquifer parameters, and water quality.

New investigation and monitoring bores are proposed within and adjacent to the footprint of S8 WRL (8 of) and in key locations associated with SWG Dam (4 of), the locations of which are detailed in **Table 5.3** and are also depicted in plan in **Figure 5.1**. Bores at additional infill sites are also proposed between S1 and S8 WRLs (2 of).

*Table 5.3: Proposed Additional Groundwater Monitoring Bores*

| Functional area | Site ID | Proposed Location | Estimated Depth (mBGL)[9] | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|---|
| Saltwater Gully Dam | MB23-01 | Topographic low, NTH SWG, NE of MB WRD_N | S = 6<br>D = 14 | 414851 | 6254521 |
| | MB23-02 | Follows flow path from WRL & MB WRD_NE, joins SWG | S = 8<br>I = 10<br>D = 14 | 415629 | 6253650 |
| | MB23-03 | Western bank of SWG Dam | S = 4<br>I = 9<br>D = 12 | 416356 | 6252608 |
| | MB23-04 | Downstream SWG Dam | S = 5<br>I = 8<br>D = 12 | 416579 | 6252233 |
| S8 WRL | MB23-05 | SWG tributary | S = 4<br>I = 8<br>D = 12 | 416517 | 6251868 |
| | MB23-07 | Hester Brook inflow north | S = 5<br>I = 8<br>D = 12 | 416777 | 6251436 |
| | MB23-09 | Hester Brook north | S = 5<br>I = 8<br>D = 12 | 417043 | 6251136 |
| | MB23-11 | Hester Brook inflow south | S = 4<br>I = 8<br>D = 14 | 417668 | 6250678 |

[9] S – Shallow depth targeting the upper sands, laterite and upper clays.
I – Intermediate depth targeting the saprolite clays.
D – Deep bores targeting the weathered basement rocks.

| Functional area | Site ID | Proposed Location | Estimated Depth (mBGL)[9] | Easting (MGA94) | Northing (MGA94) |
|---|---|---|---|---|---|
| | MB23-13 | Cascade Gully/Hester Brook confluence | I = 8<br>D = 14 | 417970 | 6250013 |
| | MB23-12 | Cascade Gully east | S = 6<br>I = 10<br>D = 15 | 417502 | 6250187 |
| | MB23-10 | Cascade Gully west | S = 4<br>I = 11<br>D = 16 | 416181 | 6250610 |
| | MB23-14 | Cascade Gully south | S = 4<br>I = 10<br>D = 16 | 415297 | 6250031 |
| S1 WRL | MB23-06 | Waster Rock Landform north | S = 4<br>I = 14<br>D = 21 | 415530 | 6251696 |
| | MB23-08 | Waste Rock Landform south | S = 4<br>I = 14<br>D = 21 | 415616 | 6251178 |

To better establish baseline conditions and provide ongoing monitoring locations, a network of nested bores is recommended (shallow, intermediate, and deep piezometers at each site), nominally set at the base of surficial sands (if present), the base of the saprock layer, and in fractured bedrock in the more elevated areas. An indication of the depths of the nested bores is provided in **Table 5.3**.

All bore drilling and construction activities should be conducted in accordance with the regulatory requirements set by DWER under the Minimum Construction Requirements for Water Bores in Australia developed by the National Uniform Drillers Licensing Committee (NUDLC, 2020).

Optimal drilling methods for the construction of the additional groundwater monitoring bores are mud rotary, rotary air, or rotary air with down-hole hammer methods, using a bit size of between 140 mm and 150 mm in diameter. Casing and screens should be a minimum Class PN 9 PVC-U pressure pipe, with Class PN 12 for bores with a total construction depth greater than 26 m below ground level (BGL). Bore screens should be of machine-cut 1 mm aperture construction with an end cap attached.

Annular fill should consist of 1.6 mm to 3.2 mm graded gravel to a minimum depth of 2 m above the top of the screen (gravel to 1 m above the screen assembly is acceptable for bores with a total depth less than 10m BGL). Bore annuluses should be sealed directly above top of the gravel with a seal of minimum thickness of 2 m constructed of bentonite pellets (a bentonite seal between 1 m and 2 m thick is acceptable for bores with a total construction depth less than 10 m BGL. Bores should be cement grouted to surface from the top of the bentonite seal. Suitable backfill material can be used as annular fill for deeper bores, though a cement grout surface seal should extend a minimum 2 m BGL.

Blank casing (stick-up) is to extend between 0.5 m to 1 m above ground level and an end cap used at Top of Casing (TOC). Headworks should consist of a 500mm x 500mm x 250mm concrete plinth with a lockable steel standpipe cemented into plinth.

## 5.3 Groundwater Levels and Quality

The standing groundwater levels (SWLs) should be measured from the top of casing prior to sampling. Discharge at the wellhead should be monitored insitu for basic groundwater parameters (listed below as physicochemical parameters). Final readings should be recorded as per standard field observation procedures for purging and/or low-flow sampling techniques, with standard parameter stabilisation criteria applying (Sundaram, 2009). The suites of water quality parameters were derived from the preliminary SPR analysis and identification of CoPCs in **Section 3**. The following analytical suite is recommended:

- **Physicochemical parameters:** pH, electrical conductivity (EC), total dissolved solids (TDS), oxidation-reduction potential (ORP), dissolved oxygen (DO), temperature.
- **Alkalinity:** Carbonate/bicarbonate/hydroxide ($CO_3$/$HCO_3$/OH), Total as $CaCO_3$, Hardness as $CaCO_3$
- **Major Anions:** Chloride (Cl), Sulfate ($SO_4$), Fluoride (F)
- **Major Cations:** Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K)
- **Nutrients:** Total Nitrogen (TN), Nitrate nitrogen ($NO_3$-N), Total Phosphorus (TP), Phosphate ($PO_4$).
- **Organic Indicators:** Sulfur as S
- **Dissolved Metals:** Aluminium (Al), antimony (Sb), arsenic (As), cadmium (Cd), caesium (Cs), chromium (**III** +V**I**) (Cr), cobalt (Co), copper (Cu), iron (Fe), lithium (Li), manganese (Mn), molybdenum (Mo), nickel (Ni), rubidium (Rb), thallium (Tl), thorium (Th) uranium (U), vanadium (Va), zinc (Zn),

# 5.4 Groundwater Monitoring Program

A summary of the proposed groundwater monitoring program for continued monitoring of mine site conditions and for establishing the baseline conditions in the Studt Area is presented in **Table 4.4** and the monitoring methods and procedures are presented in **Appendix A**. If necessary, this program should be rationalised during construction and for ongoing operations.

*Table 5.4: Summary of Groundwater Monitoring Program*

| Site ID | Frequency | Duration[10] | Parameters[11] | Reporting frequency |
|---|---|---|---|---|
| **Existing sites:** | | | | |
| – MB07_01<br>– MB07_02<br>– MB07_03<br>– MB07_04<br>– MB07_05<br>– MB07_06<br>– MB07_07<br>– MB20_01<br>– MB20_03<br>– MB20_04<br>– MB21<br>– MB22_26<br>– MB22_27<br>– MB22_28<br>– MB22_29<br>– MB22_30<br>– MB22_31<br>– MB22_32<br>– MB22<br>– MB23<br>– MB25<br>– MB WRD_N<br>– MB WRD_NE<br>– MB WRD_E<br>– MB WRD_SE<br>– PB001 | Quarterly: March, June, September & December | Ongoing | – Standing water level<br>– Physicochemical parameters: pH, EC, TDS, ORP, DO, temperature<br>– Alkalinity: $CO_3$/$HCO_3$/OH, total as $CaCO_3$, hardness as $CaCO_3$<br>– Major Anions: Cl, $SO_4$, F<br>– Major Cations: Ca, Mg, Na, K<br>– Nutrients: TN, $NO_3$-N, TP, $PO_4$<br>– Metals: Al, Sb, As, Cd, Cs, $Cr_{III}$, $Cr_{IV}$, Co, Cu, Fe, Li, Mn, Mo, Ni, Rb, Tl, Th, U, Va, Zn | Quarterly: Groundwater Monitoring Report,<br>Annual: Groundwater Monitoring Review |

[10] Year zero indicates start of monitoring period, nominally 2023.
[11] Laboratory limits of reporting to below WQGs as follows:

| | | |
|---|---|---|
| < 1 mg/L: major ions/nutrients | < 0.1 mg/L: Mn | < 0.01 mg/L: Al, Cs, Mo, Ni |
| < 0.001 mg/L: Sb, As, Cs, Cr, Li, Rb | <0.0001 mg/L: Cd, Cu, U | <0.00001 mg/L: Tl, V |

| Site ID | Frequency | Duration[10] | Parameters[11] | Reporting frequency |
|---|---|---|---|---|
| **Proposed sites:** | | | | |
| – MB23-01<br>– MB23-02<br>– MB23-03<br>– MB23-04<br>– MB23-05<br>– MB23-07<br>– MB23-09<br>– MB23-11<br>– MB23-13<br>– MB23-12<br>– MB23-10<br>– MB23-14<br>– MB23-06<br>– MB23-08 | Bi-monthly: January, March, May, July, September, November | Year 0 to Year 1 | As above | Bi-monthly: Groundwater Monitoring Report<br>Annual: Groundwater Monitoring Review |
| | Quarterly: March, June, September, December | Ongoing after Year 1 | | Quarterly: Groundwater Monitoring Report<br>Annual: Groundwater Monitoring Review |
| **Private sites:** | | | | |
| Depends on bore audit | Quarterly: March, June, September, December | Ongoing | As above | Quarterly: Groundwater Monitoring Report<br>Annual: Groundwater Monitoring Review |

## 5.5 Reporting and Evaluation of Groundwater Monitoring Data

The evaluation of groundwater monitoring data should include the assessment and reporting of the following:

– Groundwater flow directions (contour plans and tables of groundwater level data).
– Presentation of baseline groundwater quality (with which to compare any future impacts).
– Identification of CoPC concentrations in groundwater which can be attributed to WRL leachate seepage, based on comparison of the groundwater laboratory results to the baseline groundwater quality.
– Graphs and trend analysis of CoPCs and major-ion concentrations against time.
– Migration direction and rate of any impacts identified as derived from the existing mine site (MSA) and proposed reuse of TSF1, construction and operation of SWG Dam, and establishment of the S8 WRL
– Summary of quality control and sampling methods (QA/QC).

The above data and information should be included in an annual monitoring review report for review by the regulator.

# 6. References


Australian Sandard. (1998). *Water Quality - Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling samples.*

Department of Environment and Science. (2018). *Monitoring Sampling Manual - Environmental Protection (Water) Policy 2009.*

Department of Water and Environmental Regulation. (2020). *Guideline - Risk Assessments - Part V, Division 3, Environmental Protection Act 1986.*

GHD. (2019). *Talison Leaching Study: Stage 2 AMD Testing Results. Report prepared for Talison Lithium Australia Pty Ltd, Ref 6136960.*

GHD. (2022a). *Talison - Greenbushes Lithium Mine, Waste rock landform leaching risk assessment, prepared for Talison Lithium Pyt Ltd, May 2022, Ref. 12536556.*

GHD. (2023a). *Eastern Catchment Hydrological Study - Gap Analysis. Report prepared for Talison Lithium Pty Ltd. May 2023.Ref 12604929.*

GHD. (2023b). *Eastern Catchment Hydrological Study - Conceptual Site Model. Report prepared for Talison Lithium Pty Ltd. May 2023.Ref 12604929.*

GHD. (2023c). *Eastern Catchment Hydrological Study - Preliminary Risk Assessment. Report prepared for Talison Lithium Pty Ltd. August 2023.Ref 12604929.*

GHD. (2023c). *TSF4 Seepage Assessment: Baseline Monitoring Report. Report prepared for Talison Lithium Pty Ltd. July 2023, Ref. 12575610.*

GHD. (2023d). *TSF4 Seepage Assessment: Baseline Monitoring Report. Report prepared for Talison Lithium Pty Ltd. July 2023, Ref. 12575610.*

GHD. (2023d). *TSF4 Seepage Assessment: Sub-surface Clays Attenuation Capacity Testing. Report prepared for Talison Lithium Pty Ltd. February 2023, Ref. 12575610.*

GHD. (2023e). *TSF1 Monitoring: Monitoring Report for May 2023. Report prepared for Talison Lithium Pty Ltd. June 2023, Ref. 12606044.*

GHD. (2023e). *TSF4 Seepage Assessment: Tailings LEAF Leach Testing. Report prepared for Talison Lithium Pty Ltd. February 2023, Ref 12575610.*

GHD. (2023h). *TSF4 Seepage Assessment: Risk Assessment. Report prepared for Talison Lithium Pty Ltd. August 2023. Ref 12575610.*

NEPC. (1999). *Holding times are the recommended maximum times before sample extraction (NEPC 1999). Recommended holding times for soil are listed in Table 1 AS/NZS 5667.1-1998 (Australian Sandard, 1998).*

NUDLC. (2020). *Minimum Construction Requirements for Water Bores in Australia, 4th edition, 2020. National Uniform Drillers Licensing Committee.*

SLR. (2022). *Saltwater Gully New Water Storage Aquatic Ecological Assessment. Report prepared for Talison Lithium Pty Ltd.*

Standards Ausralia. (1998). *Water Quality-Sampling, Part 1: Guidance on the design and sampling programs, sampling techniques and the preservation and handling of sample; As/NZS 5667.1:1998.*

Standards Australia. (1998). *Water Quality Sampling; Part 11: Guidance on sampling of groundwaters; AS/NZS 5667.11-1998.*

Standards Australia. (2005). *Guide to the investigation and samping of sites with potentially contaminated soil; AS 4482.1-2005.*

Sundaram, B. F. (2009). *Groundwater Sampling and Analysis – A Field Guide. Geoscience Australia, Record 2009/27 95 pp.*

Talison. (2018). *Tabulated Data from Analyses of Five Decant Samples.*

University of Western Australia. (2019). *2019 Ecological Assessment Study for Cowan and Norilup Brook at the Talison Lithium Mine, Greenbushes, Western Australia. Report prepared for Talison Lithium Pty Ltd.*

# Appendices

# Appendix A

## Methods for Groundwater and Surface Water Monitoring

# *Monitoring Methods and Procedures*

# A-1 Groundwater Monitoring

## A-1-1 Groundwater Level Monitoring

Groundwater levels should be measured using an electronic interface water level meter prior to collection of groundwater samples during all groundwater monitoring events. The water level meter should be cleaned and washed between sampling locations using Decon90 detergent, tap water and deionised water.

## A-1-2 Groundwater Field Water Quality Parameters

Groundwater monitoring parameters should be recorded using a calibrated field water quality meter. The following parameters should be recorded during well purging:

– Temperature ($^oC$).
– pH (pH units).
– Electrical conductivity (EC; µS/cm).
– Dissolved oxygen (DO; mg/L).
– Oxidation-reduction potential (ORP).

Field measurements should be recorded on field sampling sheets. Field observations such as odours and colour should also be recorded on field sampling sheets.

For bores that are screened through entire saturated length, the water quality probe should be lowered into the column and a measurement taken one metre below the water surface and one metre above the base of the bore. For discretely screened bores, the measurements should be taken at the nominal centre of the screen intervals.

## A-1-3 Groundwater Quality Sample Collection

Groundwater bores should be purged prior to collection of groundwater quality samples to provide representative samples of in-situ groundwater. The static water level should be measured allowing a water column depth and purge volume to be calculated, which is essential to evacuate stagnant water in the bore prior to sampling. Purging of groundwater monitoring bores should be based on AS/NSZ 5667.11-1998 (Standards Australia, 1998).

Groundwater monitoring bores should be purged until stabilisation of field parameters has occurred over three consecutive readings.

Groundwater monitoring bores should be sampled using low-density polyethylene tubing coupled to an electric pumping system. Depending on bore type (i.e., diameter), and bore yield the pump may be either a peristaltic or micro purge ('low flow') pump system.

## A-1-4 Filtering of Groundwater Samples

Filtering is important process to remove suspended particulate that may affect sample results. Filtration of groundwater samples is generally limited to metal analysis.

Filtering can be completed in the field using in-line filters or a vacuum filter kit. Filtering of samples can also be completed by the laboratory, in which case, the samples should not be preserved and should be delivered to the laboratory within 24 hours of sample collection.

# A-2 Surface Water Monitoring

Sample collection, processing, transportation, storage, preservation and labelling of surface water samples should be conducted in accordance with the appropriate industry standards and general surface water sampling guidance AS/NZS 5667.1:1998 (Standards Ausralia, 1998).

## A-2-1 Field Parameters

Surface water monitoring parameters should be recorded using a calibrated field water quality meter. The following parameters should be recorded:

- Temperature (ºC).
- pH (pH units).
- Dissolved oxygen (DO; mg/L).
- Electrical conductivity (EC; µS/cm).
- Oxidation-reduction potential (ORP).
- Total dissolved solids (TDS).

Field measurements should be recorded on field sampling sheets. Field observations such as odours and colour should also be recorded on field sampling sheets.

## A-2-2 Surface Water Grab Sample Collection

Where the embankment of the water body is stable and the water body can be safely accessed, surface water samples should be collected by hand. Where possible, samples should be collected directly into the laboratory supplied sample containers. For samples that have preservatives, samples should be decanted into the laboratory supplied sample containers.

Where depth permits, the sample container should be positioned at least 10 cm below the surface water level, above the sediment bed and oriented with the capped opening facing downwards to avoid the collection of surface films. Once in position, the container cap should be removed to allow sample collection. Where sampling points cannot be safely accessed, surface water samples should be collected using a long-handled sampler and decanted into the laboratory supplied sample containers.

# A-3 Field Sampling Program

Field sampling should be completed in accordance with industry accepted standards (Standards Australia, 2005) using uniform and systematic methods to ensure collection of representative environmental samples. Key requirements of these procedures are as follows:

- Calibration of field equipment: The water quality meter should have calibration checks completed using appropriate calibration standards prior to use.
- Appropriately trained and experienced staff should conduct and document site activities. Field activities should be conducted in general accordance with based on accepted industry protocols for environmental sampling.
- Decontamination procedures: These include the use of new disposable gloves for the collection of each sample, decontamination of reusable sampling equipment between each sampling location, and the use of appropriate sampling containers provided by the primary laboratory.
- Sample identification procedures: Collected samples should be immediately transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers should be clearly labelled with a sample number, job number, sample depth and sample date. The sample containers should then be transferred to a chilled insulated container for sample preservation prior to and during shipment to the analytical laboratory.

- Chain of Custody (CoC) information requirements: A CoC form should be completed and forwarded to the testing laboratory with the samples. A CoC form should be used for every batch of samples submitted to the laboratory. Delivery and analysis of samples to the laboratory should comply with sample holding times.
- Duplicate and blank samples: As detailed in **Section A-4**.
- Decontamination methodology:
  - Where possible, single use sampling equipment which does not require decontamination should be utilised.
  - When needed, equipment should be cleaned and decontaminated using a triple rinse system.
- Logging procedures: All samples should be described using a recognised system.

Samples should be taken in accordance with the following guidelines:

- Australian Standard 5667.1998 Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (Standards Ausralia, 1998)
- Australian Standard 5667:1998 Water Quality – Sampling, Part 11: Guidance on the Sampling of Groundwaters (Standards Australia, 1998).
- Monitoring and Sampling Manual – Environmental Protection (Water) Policy, (Department of Environment and Science, 2018).

Samples should be taken in laboratory provided bottles and stored in a chilled container before being couriered to the NATA accredited laboratory.

# A-4 Laboratory Analysis Program

## A-4-1 Laboratory Analysis

Samples should be submitted for analysis at a National Association of Testing Authorities (NATA) accredited laboratory.

## A-4-2 Sampling and Analysis Control

The quality assurance samples to be collected during the assessment are described below.

### Field Blind Duplicate

Duplicate sample that is used to identify the variation in the analyte concentration between samples from the same sampling point. Field blind duplicates should generally be collected from a well-mixed sample of water. A stainless-steel bowl or bucket should be used for mixing water samples. Samples should be collected at a frequency of 1 in 20 samples. Typical nomenclature for field blind duplicates would be FD1, FD2 etc.

### Field Split Duplicates

Field splits are duplicate samples that are sent to different laboratories for analysis to assess the analytical proficiency of the laboratories. These samples should be collected using the same procedures as for field duplicates. Typical nomenclature for field split duplicates would be FS1, FS2 etc.

### Rinsate Blanks

Rinsate blank samples are used to estimate the amount of contamination introduced during the re-use of sampling equipment. Rinsate blanks should be collected when cross contamination of the samples is likely to impact on the validity of the analytical results, for example, where the investigation level for a contaminant is near the detection limit for the contaminant.

Rinsate blank samples should be obtained by pouring laboratory supplied deionised water over decontaminated sampling equipment (water quality meter) into laboratory supplied bottles. Rinsate blanks should then kept cool in insulated containers until delivery to the laboratory. Typical nomenclature for rinsate blanks would be RB1, RB2 etc.

### Transport Blanks

No trip blank samples are required since no volatile contaminants are included in the analytical schedule.

### Sampling Frequency

| QA/QC sample type | Rate |
|---|---|
| Field Blind Duplicate | 1 in 20 samples |
| Field Split Duplicate | 1 per day |
| Rinsate Blank | 1 per piece of reused equipment per day |
| Transport Blank | Not required |

## A-4-3 Laboratory QA/QC

### Laboratory Procedures

Laboratory quality verification is necessary to assess the accuracy and precision of analytical results and to identify assignable causes for atypical analytical results. The internal quality verification checks should consist of field and laboratory duplicate, blank and spike samples to quantify accuracy and precision and identify any problems with the sample results.

### Laboratory Duplicates

The variation between duplicate analyses should be recorded for each process batch to provide an estimate of the method precision and sample heterogeneity. There should be at least one duplicate per process batch, or two duplicates if the process batch exceeds 10 samples. If results show greater than 30% difference, the analyst should review the appropriateness of the method being used.

### Laboratory Control Simple (LCS)

A Laboratory Control Sample (LCS) comprises a standard reference material, or a matrix of proven known concentration, or a control matrix spiked with all analytes representative of the analyte class. Representative samples of either material should be spiked at concentrations equivalent to the midpoint of the preceding linear calibration or continuing calibration check, upon which sample quantification will be based. In this way, the concentrations should be easily quantified and be within the range of concentrations expected for real samples.

The LCS should be from an independent source to the calibration standard, unless an ICV (independent calibration verification) is used to confirm the validity of the primary calibration.

There should be at least one LCS per process batch.

### Matrix Spike Non-Compliances

A matrix is the component or substrate (e.g., water, soil) that contains the analyte of interest. A matrix spike is an aliquot of sample spiked with a known concentration of target analyte. A matrix spike documents the effect (bias) of matrix on method performance.

There should be one matrix spike per matrix (and soil type) per process batch.

Poor matrix spike recovery but an acceptable LCS results may indicate that it is the matrix, not the method, that may be the issue but it is not acceptable to assign poor recovery to matrix effects, without a reasonable investigation (NEPC, 1999)

### Method Blank

Method blank data should be reported with the primary sample data, thus enabling the site assessor to assess potential method bias for the relevant analytes.

There should be at least one method blank per process batch.

### Data Validation Procedures

Data validation is defined as a technical review of a set of analytical data using criteria for quality verification. Initially the reviewer should determine whether all analyses were performed as requested, whether holding times were met and whether all verification checks were reported with the data. The data should be assessed against the acceptance criteria using the procedures as described below. These criteria are estimates of the degree of uncertainty that is generally considered acceptable.

Data Quality Objectives (DQOs) should be established at the outset of the project to enable an appropriate level of comparison with the investigation objectives. Refer to Schedule B2 Appendix B of the NEPM (2013).

If the amount of data that does not conform to the acceptance criteria is significant, corrective action may be necessary. This could involve re-analysing the samples, re-sampling and analysing, altering the analysis method or detection limit, or accepting, explaining, and interpreting the data.

### Accuracy

The accuracy of the data should be determined by analysis of spiked samples (LCS, field spikes, matrix spikes and surrogate spikes).

Accuracy is calculated by:

$$\text{Recovery} = \frac{c-a}{b} \times 100$$

Where:

– a = measured concentration of the unspiked sample aliquot.

– b = nominal (theoretical concentration increase that results from spiking the sample.

– c = measured concentration of the spiked sample aliquot.

The QC acceptance criteria for spikes are generally ± 30% recovery (NEPC 1999).

### Precision

Precision of the data should be assessed by the RPD for field and laboratory duplicate samples. The RPD is a measure of the representativeness of duplicate samples and may be used to identify issues with laboratory analysis or field sampling methods.

The following equations are used:

$$\text{RDP} = \frac{X5-XD}{\frac{X5+XD}{2}} \times 100$$

Where:

– Xs = concentration obtained for the sample.

– XD = concentration obtained for the blind/split sample.

If the results show greater than 30% difference, a review should be conducted of the cause (e.g. instrument calibration, extraction efficiency, appropriateness of the methods being used).

Some common reasons for anomalies may be attributable to one or more of the following (but not limited to):

– Errors in duplicate sample collection (i.e., in appropriate mixing of sample before collected subsamples for sample analysis).

– Heterogeneity of sample providing inconsistent results (i.e., presence of ash/coal fragments of paint chips).

– Slight differences in sample analysis technique (i.e., mixing of sample in the laboratory by either shacking vigorously or tilting back and forth).

### Limit of Reporting

The Limits of Reporting (LOR) should be at or below the adopted criteria and should be equal to the lowest calibration standard.

### Holding Times

Holding times should be the recommended maximum times before sample extraction (NEPC, 1999). Recommended holding times for soil are listed in Table 1 AS/NZS 5667.1-1998 (Australian Sandard, 1998).

All tests should be carried out as soon as practicable after sampling, and according to any jurisdictional requirements.

### Data Reporting

Reporting of the analysis and interpretation of surface and ground water chemistry should demonstrate compliance with agreed standards and criteria such as the Australian and New Zealand Environment and Conservation Council guidelines for the protection of fresh and marine aquatic ecosystems. Examples of information that should be included in water quality reporting include:

– Water quality data and interpretation of this data (i.e., comparison to triggers).
– Identification of any issues (e.g., degrading water quality in a specific site/area).
– Potential causes of issues.
– Details of any incidents potentially affecting water quality.
– Details of actions taken to address any water quality issues.
– Commitments to specific areas for improvement in the next reporting period.

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