Appendix G Surface Water Assessment (WRM 2026a)

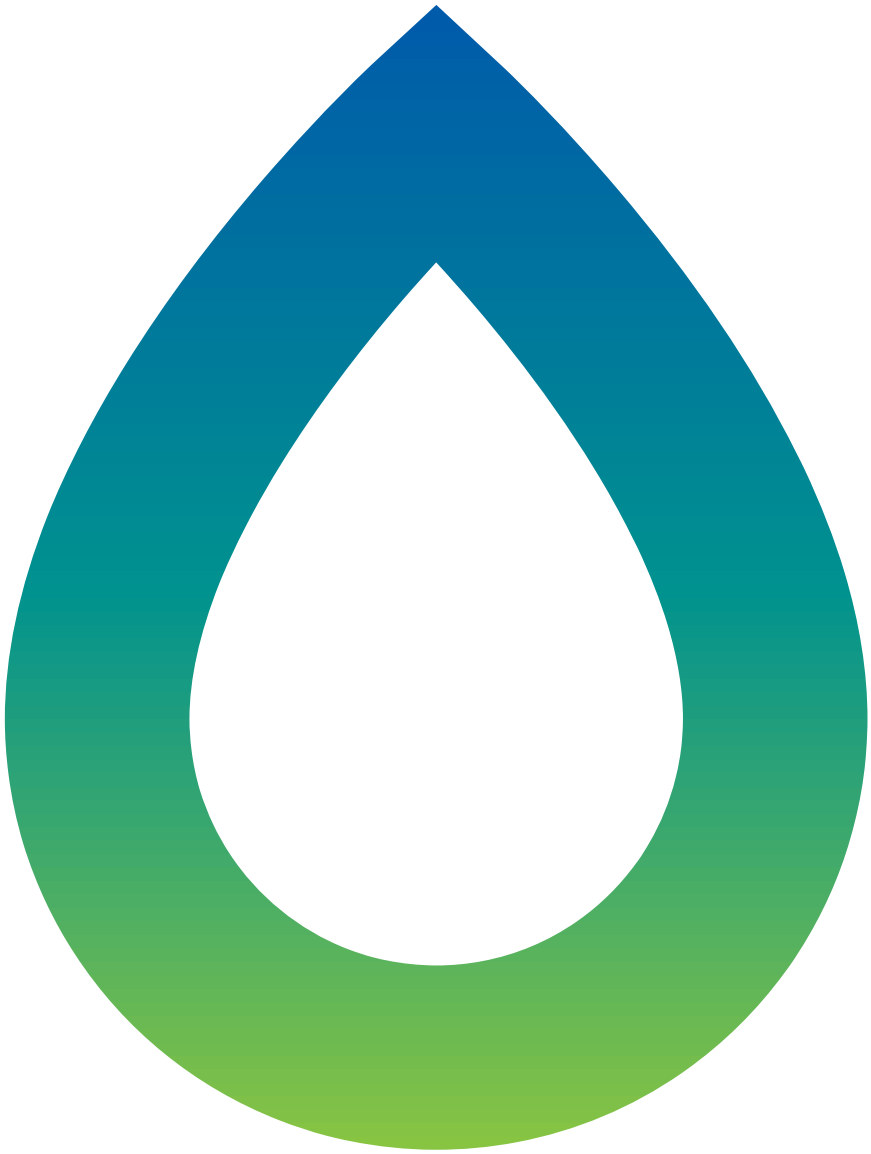
LEI LITHIUM PROJECT

Surface Water Assessment

Lei Lithium Mining Pty Ltd

25 September 2026

2255-02-C3



DETAILS

Report Title	Lei Lithium Project, Surface Water Assessment
Client	Lei Lithium Mining Pty Ltd

THIS REVISION

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1 INTRODUCTION

Lithium Plus Minerals Ltd propose to develop an underground lithium mine known as the Lei Lithium Project (the Project), located on the Cox Peninsula in the Northern Territory, approximately 30 km south of Darwin within ML(A) 33874, accessed via Fog Bay Road. The life of mine is estimated to be 7 years, with a total resource recovery of approximately 3.09 million tonnes of spodumene, as direct shipping ore from the Darwin Port to overseas.

Key surface features include the development of a temporary box cut to construct a cut-and-cover tunnel, temporary surface waste dumps, run of mine pad, crushing and screening areas, and water storages, including a raw water dam, mine water dams and sediment dams.

WRM has completed a preliminary surface water assessment to:

- Identify the environmental values and beneficial uses of the surface water environment;
- Develop preliminary site-specific guidelines values (SSGVs) for the receiving environment based on locally derived values, standard reference guidelines and policies;
- Identify site constraints due to flooding;
- Provide a preliminary indication of the site water balance, including water volumes required for operations; and
- Respond to public submissions on the referral application relevant to surface water management (Appendix A).

An overview of the methodology and results of the preliminary surface water assessment are provided in the following sections.

1.1 SITE CONFIGURATION AND SCHEDULE

Key stages across the Life of Mine (LOM) are outlined in Table 1.1**Error! Reference source not found.**.

Table 1.1 Key site and water infrastructure completion dates

Phase	Key infrastructure	Estimated completion (project months)	Project month period	Project Year
Phase 1 (Construction Phase)	Construction of infrastructure, Cut and cover tunnel and decline.	12[a]	1 – 12	1
Phase 2 (Operational Phase)	Underground, mining and ore transport to Port.	68	13 – 80	2 – 7
Closure and rehabilitation	Backfilling, removal of infrastructure and revegetation.	6	81 – 86	7
Post-closure	Monitoring of the mine site until rehabilitation completion criteria are achieved and the site is relinquished.	Ongoing		

Note:
a - raw water and sediment dams will be prioritised in the construction schedule and used to supply construction water.

2 ENVIRONMENTAL SETTING

2.1 GENERAL

This section of the surface water assessment describes the regional and local drainage characteristics in the vicinity of Lei Lithium. Environmental values as defined by the ANZG (2018) guidelines and NT government regulations of these waterways are also described.

2.2 ENVIRONMENTAL VALUES

2.2.1 Land use and surface water use

The project area is largely undeveloped vacant crown land with some disturbance including the sealed Fog Bay Road, unsealed access tracks, mineral exploration activities as well as historic mining pits and dams (Frater, 2005).

There are no national parks, conservation areas or any residences, farms or industry within the catchment areas upstream or immediately downstream of the mine.

2.2.2 Biodiversity values and beneficial uses

Waterways in the project area are largely intact and are considered under ANZG (2018) protection level classification as 'slightly disturbed'. They are not considered an example of rare, highly diverse, or significant habitat in the region.

The project area also lies within:

- the Bynoe Harbour Region declaration of surface water beneficial uses under the NT Water Act;
- The Darwin Rural Adelaide River Water Control District gazetted in June 2024; and
- The Fog Bay Area gazetted in 1998 and 1999.

The beneficial values associated with the above areas include:

- **Darwin Rural Adelaide River Water Control District**: Agriculture, aquaculture, public water supply, cultural, industry, rural stock and domestic, mining activity and petroleum activity.
- **Fog Bay Area**: Ecosystem protection and recreation water quality aesthetics.

As part of the ecological assessment undertaken for the Project (EcOz, 2024a), three significant vegetation types of relevance were identified in the vicinity of the Project area and within key waterways. These include:

- **Riparian Vegetation:**
  - Riparian vegetation is classified as any native vegetation within, and immediately surrounding, a water way, and is not restricted to a distinct vegetation community immediately adjacent to waterways.
  - Riparian vegetation that is distinct from the surrounding vegetation often has additional values, which include supporting unique biodiversity and providing refuge habitat and habitat corridors.
  - Riparian vegetation edges the river and creek lines that cross the Project area, specifically the Charlotte River and its tributaries.
- **Mangroves:**
  - Mangroves are located along sheltered coastlines, growing in tidal areas frequently inundated by salt water.

- Mangroves contain many unique and highly specialised animals and plants, including many species restricted to these environments.
- A mangrove community occurs adjacent to the disturbance footprint within the landward zone, where tidal inundation is irregular and infrequent.

- **Old-growth forest:**
  - Hollow-bearing trees occur in a wide range of vegetation, however, they are more likely to occur within older Eucalyptus forest and woodlands with a lower fire frequency. As the development of tree hollows is associated with the age of vegetation, a forest with many tree hollows is referred to as an old-growth forest.
  - Some hollow-bearing trees were noted between the Charlotte River and the western side of the Project area. However, densities observed did not quality for as old-growth forest.

2.2.3 Groundwater environmental and social values

Groundwater environmental and social values been assessed by CloudGMS (2026a) and characterised by Eco Logical (2026a). Key aspects are summarised below:

- The project area is underlain by the Burrell Creek Formation (BCF) groundwater system. The aquifer is described as fractured and weathered rocks. There is limited use of this aquifer for domestic, stock, or agricultural water supply. The closest registered bore currently in use to provide domestic water supply is located approximately 1.9 km south of Lei Lithium.
- The aquifer beneath the Lei Lithium mine site and surrounding areas is a poor groundwater resource.
- Within the 2 km from the Project area, there is a moderate potential aquatic Groundwater Dependent Ecosystem (GDE) identified as the Charlotte River. At its closest point, the Charlotte River channel intersects the southwestern corner of the Project area.
- Terrestrial GDEs of moderate potential is seen across majority of the Project area and the area of disturbance; the ecosystem type is identified as Eucalypt Woodland. There is a low potential terrestrial GDE identified in the south-western corner of the disturbance area and Project area. The ecosystem type is identified as drainage open woodland; this species is also seen within the northern section of the 2 km site radius.
- Mangroves are mapped along the river up to the western boundary of ML33874. While groundwater flows from the aquifer to the river may supply nutrients to aquatic vegetation it is unlikely that the mangroves would be considered groundwater dependent.

2.3 DRAINAGE CHARACTERISTICS

The location of the Project is shown Figure 2.1. The Project is within the Charlotte River catchment which drains to Bynoe Harbour.

The catchment of the Charlotte River to Fog Bay Road, shown in Figure 2.1, is 59 km^2. The Charlotte River channel flows along the southwest corner of the mining lease.

The mining lease area is drained by several minor tributaries of the Charlotte River that drain southwest directly to the Charlotte River channel, or northwest towards unnamed tributary of the Charlotte River. Local drainage on the site is characterised by low ridges with flat, poorly-defined drainage paths.

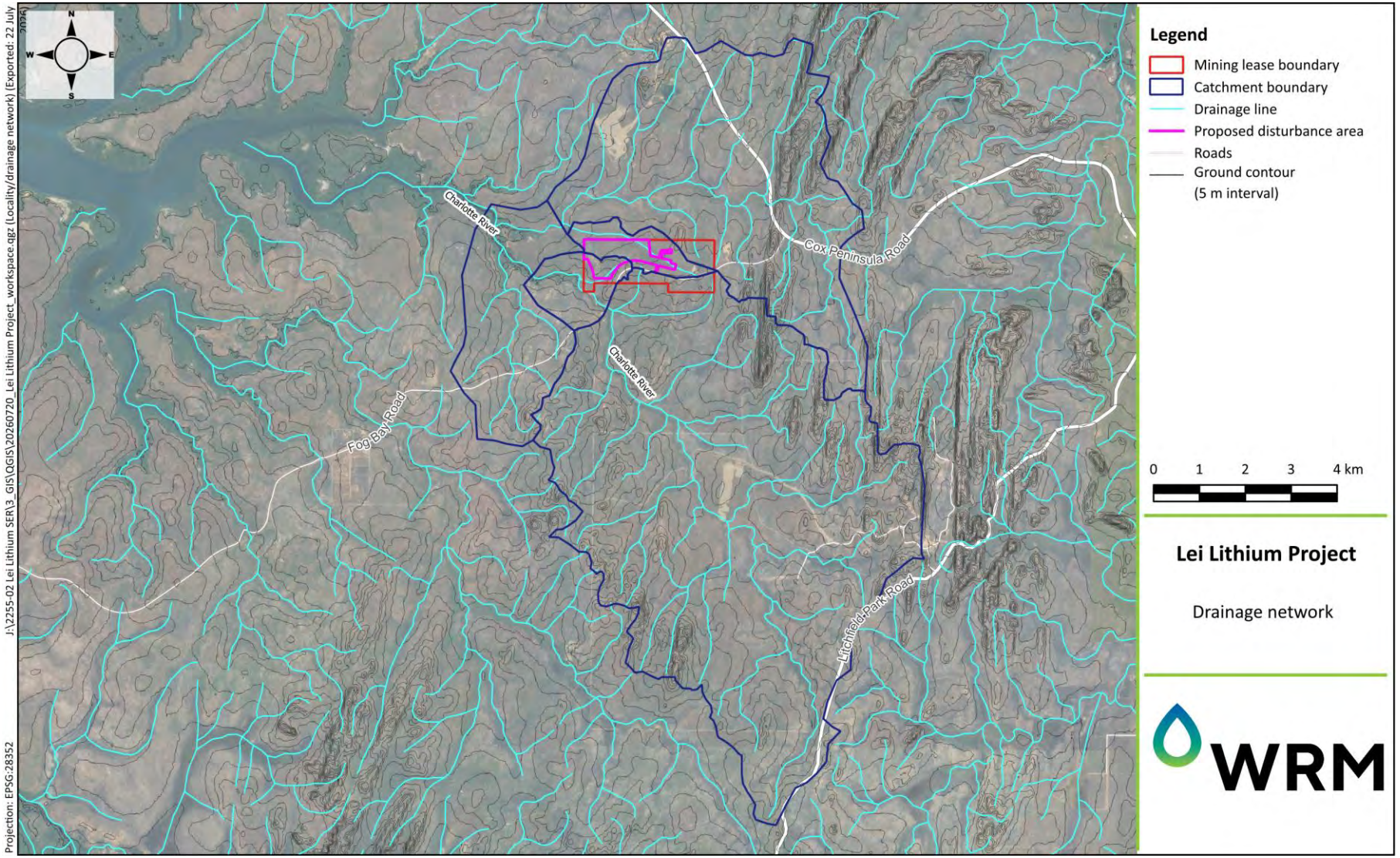


Figure 2.1 Locality and drainage network

3 WATER QUALITY ANALYSIS

3.1 OVERVIEW

Water quality monitoring has been undertaken for the project for the period between January 2023 to December 2025. Figure 3.1 shows the locations of existing surface water monitoring and groundwater monitoring stations.

The water quality monitoring stations were categorised into five key categories:

- Downstream reaches of the Charlotte River (SW5):
  - Characterises the lower reaches of the Charlotte River catchment, which exhibits brackish/estuarial stream characteristics in the vicinity of the Project site, indicating waters being fairly saline compared to local freshwater ephemeral streams.
- Upstream reaches of the Charlotte River (SW3 & New Upstream):
  - Characterises the upper reaches of the Charlotte River catchment, which generally exhibits more freshwater characteristics compared to the lower reaches (at SW5).
- Local site streams (SW1, SW2 and SW4):
  - Characterises the local overland flow catchment on site, which is likely to represent the local drainage on site.
- The unnamed northern tributary of the Charlotte River (New 1 and New 2):
  - Characterises the catchment to the north, which includes an existing mine site (BP33 underground) upstream of the existing monitoring locations.
- Groundwater bores:
  - Characterises the water quality in the groundwater aquifers.

The water quality monitoring data provides a characterisation of background surface water quality and were used to develop initial SSGV's for detecting and assessing potential impacts once mining commences. Water quality concentrations recorded below the limit of reporting (LOR) were assumed to be half of the LOR value. The 20th percentile, median and 80th percentile was calculated for each of the water quality parameters of interest. The water quality statistics were also compared against existing water quality guidelines, which include:

- Darwin Harbour Water Quality Objectives (DHWQO) for nutrients and other physical parameters (NTG, 2010); and
- ANZECC and ANZG water quality guidelines for heavy metal toxicants for the 95%ile level of species protection (ANZG, 2018).

Appendix C provides a detailed analysis of recorded base line surface water quality data at each of the monitoring sites. The following section provides a summary of the analysis given in Appendix C.

3.2 SURFACE WATER QUALITY ANALYSIS

3.2.1 Charlotte River

Table 3.1 summarises the key water quality parameters for the Charlotte River (at SW5). Table 3.2 summarises the proposed SSTV parameters for the Charlotte River at SW5, SW3 and New Upstream. The derivation of the site-specific guideline values is provided in Section 3.4. The Charlotte River monitoring locations transition from sea water at SW5 to freshwater at New Upstream with sea water influence during very high tides. The background water quality data for the Charlotte River show:

- The Charlotte River is generally elevated compared to the default guideline values for the following parameters:
  - Nutrients:
    - Ammonia, Total Nitrogen, Total Phosphorus,
  - Dissolved metals that are part of the marine water and freshwater quality guidelines:
    - Aluminium and Chromium (note that for Chromium this was attributed to the limit of reporting concentration being higher than the default guideline value).
- For other dissolved metals, there are elevated traces of:
  - Boron and Strontium, which are elements which are naturally found in marine water; and
  - Lithium, which may be due to the lithium deposit in this area.
- All dissolved metal levels analysed in Table 3.1 with exception of aluminium were below or within the ANZG (2018) 95% limit of protection for marine species.
- At SW5:
  - The pH for the catchment is generally slightly acidic to neutral, which correlates to the acidity of fresh rainwater in tropical regions.
  - Electrical conductivity, Salinity, Alkalinity, Sulfate and Chloride levels are elevated compared to other monitoring stations in the site catchment. This indicates that the monitoring locations in the Charlotte River are influenced by sea water with intermittent fresh to brackish flows during runoff events.
  - Dissolved major cations which include Calcium, Magnesium, Sodium and Potassium are generally highly associated with salt water.
- At SW3:
  - Electrical conductivity, Salinity, Alkalinity, Sulfate and Chloride levels are generally lower in comparison to the downstream reaches of the Charlotte River (SW5). For water quality samples above the median, the electrical conductivity generally indicates brackish waters. Water quality samples below the median generally indicates freshwater.
  - The water quality at SW03 tends to vary between freshwater and brackish waters depending on when the sample has been undertaken. This indicates waters at SW3 transition between fresh water and brackish water depending on tide.
- At New Upstream:
  - Electrical conductivity, salinity, alkalinity, sulfate and chloride levels are significantly lower in comparison to the downstream reaches of the Charlotte River (SW5 and in SW3 to an extent). Water quality samples at the New Upstream monitoring location generally exhibit surface water quality results closer to freshwater ecosystems.
  - The water quality at New Upstream generally indicate freshwater and has little influence from the tidal characteristics of the Charlotte River and may be treated as a freshwater stream.

3.2.2 Local Creeks

Table 3.2 summarises the proposed SSTV parameters for the Charlotte River at SW1, SW2 and SW4. The local creeks monitoring locations are generally freshwater for most of the samples, with some sea water influence during very high tides. The background water quality data for the Local Creeks show:

- The water quality generally exhibits freshwater characteristics, however, can be influence by seawater during periods of high tide.
- The pH range is slightly more acidic compared to the Charlotte River locations.

- Ammonia is slightly higher when compared against the 80th percentile.
- Nutrients (both Total Nitrogen and Total Phosphorus) are slightly lower when compared to the Charlotte River catchment.
- Elevated dissolved metals include:
  - Barium, Manganese and Iron.
  - The remaining dissolved metals are either similar or lower than the Charlotte River catchment.
- At SW1:
  - The electrical conductivity at SW1 is significantly lower across the 20th - 80th percentile range (between 30.1 µS/cm and 260.5 µS/cm) when compared to the Charlotte River locations. The salinity range indicates that SW1 is generally freshwater.
  - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are significantly lower compared to SW5 and can generally be classified as freshwater.
- At SW2:
  - The electrical conductivity at SW2 is significantly lower across the 20th - 80th percentile range (between 55.9 µS/cm and 18,180 µS/cm) when compared to the Charlotte River locations. The salinity range indicates that SW2 transitions between freshwater and brackish/sea water depending on the tide level.
  - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are generally elevated towards the upper end (80% percentile) of the water quality samples undertaken, and on par with freshwater for lower end (20th to 50th percentile).
- At SW4:
  - The electrical conductivity at SW4 is significantly lower across the 20th - 80th percentile range (between 62 µS/cm and 474 µS/cm) when compared against the downstream stations (SW5 and SW3). The salinity range indicates that SW4 is generally freshwater.
  - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are significantly lower compared to SW5 and can generally be classified as freshwater.

3.2.3 Unnamed northern tributary

Table 3.2 summarises the proposed SSTV parameters for the Charlotte River at New 1 and New 2. The Unnamed Northern Tributary monitoring locations transition from seawater at New 1 to freshwater at New 2 with sea water influence during very high tides. The background water quality data for the Unnamed Northern Tributary show:

- The downstream location (New 1) generally transitions between freshwater and brackish water depending on the tide, however is generally more brackish than fresh. The upstream location (New 2) is generally fresh water.
- The pH range is slightly more acidic compared to the Charlotte River locations.
- Elevated dissolved metals include:
  - Barium, Manganese and Iron.
  - The remaining dissolved metals are either similar or lower than the Charlotte River catchment.
- At New 1:
  - The electrical conductivity at New 1 is generally lower across the 20th percentile (647 µS/cm) and generally similar for the 50th to 80th percentile range (23,838 µS/cm and 55,648 µS/cm) when compared against the downstream Charlotte River station (SW5). The salinity range indicates that New 1 transitions between freshwater and brackish/sea water depending on the tide level (albeit more brackish water than freshwater).

- Nutrients (both Total Nitrogen and Total Phosphorus) are generally very similar compared to the downstream Charlotte River monitoring location.

- At New 2:
  - The electrical conductivity at New 2 is significantly lower across the 20th - 80th percentile range (between 27.8 µS/cm and 868.8 µS/cm) when compared to the Charlotte River locations. The salinity range indicates that New 2 is generally freshwater.
  - Nutrients (both Total Nitrogen and Total Phosphorus) are generally very similar compared to the downstream Charlotte River monitoring location.

3.3 GROUNDWATER QUALITY ANALYSIS

Table 3.3 summarises the key water quality parameters from groundwater monitoring bores. Table C.9 summaries the groundwater quality parameters for the full range of toxicants. The background groundwater quality data for collected during the monitoring period shows:

- Compared to the background surface water quality monitoring in the Section 3.2, the toxicants which are elevated include:
  - Nutrients:
    - Nitrogen and Phosphorus.
  - Dissolved metals:
    - Arsenic, Barium, Iron and Lithium.
- The groundwater quality samples show the electrical conductivity/salinity levels are generally lower than the baseline water quality in the Charlotte River seawater and the local creek freshwater during natural rainfall runoff event. In addition, the parameters associated with major cations are generally much lower. The groundwater quality sampling undertaken indicate that there is limited potential of interaction between the sea waters identified in the Charlotte River and the groundwater aquifers (and are essentially separate systems). Electrical conductivity and major cations should continue to be monitored to detect if there is any interaction between the surface sea water and the groundwater aquifer.
- It is planned to include monitoring around the elevated toxicants found in groundwater in comparison to the background surface water quality. The key contaminants are included in the site-specific guideline values in Table 3.4.

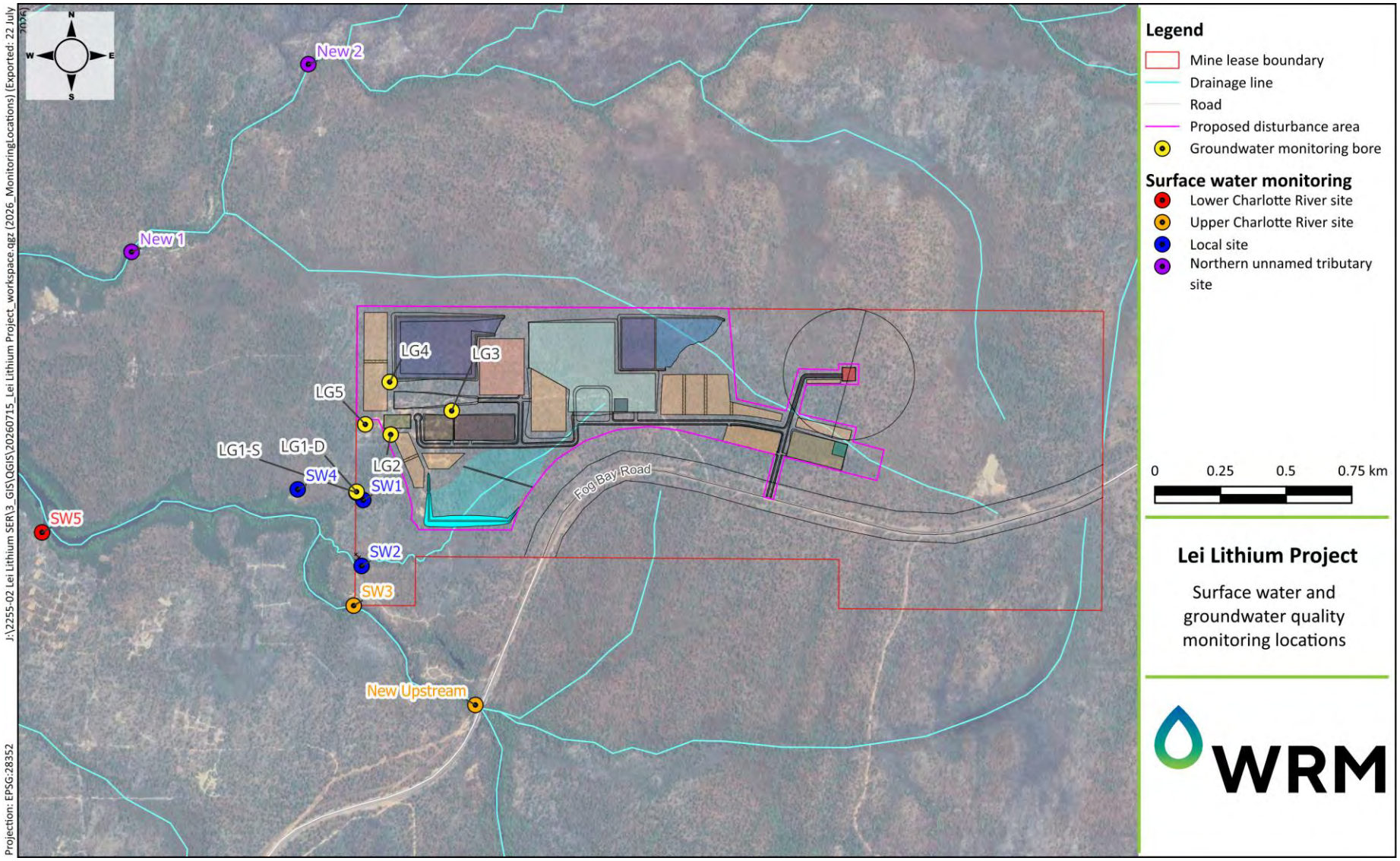


Figure 3.1 **Existing surface and groundwater monitoring locations**

Table 3.1 Site background surface water quality assessment (Charlotte River at SW5)– dissolved metals and hydrocarbons

Parameter	Units	Freshwater default guidelines values	Marine water default guideline values	No. of data points	20th percentile	Median	80th percentile	Discussion
Physical parameters [b]								
Electrical conductivity	µS/cm	200	NA	25	15,502	40,029	52,115	Elevated traces compared to freshwater rivers and streams, however no indicator for marine water environment. Water quality samples at SW5 indicates that the water is generally very saline, indicating the brackish water, where marine water quality objectives may be more appropriate.
pH	-	6.0 – 7.5	6.0 – 8.5	25	6.86	7.10	7.35	Within the limitations of the default guideline values.
Dissolved Oxygen	%	80 - 100	50 - 100	25	69.3	83.8	90.6	Within the limitations of the default guideline values.
Turbidity	NTU	20	NA	25	1.71	5.19	8.72	Within the limitations of the default guideline values.
Total suspended solids (mg/L)	mg/L	5	10	20	2.50	7.0	24.2	Slightly elevated traces above the 80%ile compared to the DHWQO values.
Nutrients [b]								
Ammonia	mg/L	NA	0.020	25	0.052	0.13	0.20	Elevated traces in surface water monitoring locations compared to the marine guideline values.
Nitrite and Nitrate (NO_X)	mg/L	0.008	0.020	25	0.005	0.005	0.005[a]	Within the limitations of the DHWQO marine guideline values and generally below the LOR.
Total Nitrogen	mg/L	0.23	0.3	25	0.2	0.4	0.5	Generally elevated above the DHWQO marine guidelines values.
Total Phosphorus	mg/L	0.01	0.03	25	0.01	0.025	0.054	Generally elevated above the DHWQO marine guidelines value.
Filterable Reactive Phosphorus	mg/L	0.005	0.010	25	0.005	0.005	0.005[a]	Within the limitations of the default guidelines values and generally below the LOR.
Chlorophyll	µg/L	2	4	23	0.5	2.0	4.6	Slightly elevated traces above the 80%ile compared to the DHWQO values.
Dissolved metals [c]								

Parameter	Units	Freshwater default guidelines values	Marine water default guideline values	No. of data points	20th percentile	Median	80th percentile	Discussion
Aluminium	mg/L	0.0550 when pH >6.5, 0.0008 when pH< 6.5	0.0370	25	0.005	0.050	0.050	Elevated above the marine water default guideline values, however below the freshwater default guideline values.
Arsenic	mg/L	0.013	NA	25	0.0005	0.005	0.005	Levels are generally below the freshwater default guidelines values, however, no indicators for marine environment.
Barium	mg/L	NA	NA	24	0.011	0.013	0.016	No indicators in freshwater or marine water environment.
Beryllium	mg/L	NA	NA	24	0.0005	0.005	0.005[a]	No indicators in freshwater or marine water environment.
Boron	mg/L	0.94	NA	24	1.56	3.63	4.65	Elevated levels of Boron which is commonly found in marine water. Suggest 80%ile, if required.
Cadmium	mg/L	0.0002	0.0055	25	0.00005	0.00005	0.0005[a]	Generally below the LOR.
Caesium	mg/L	NA	NA	2	0.0005	0.0005	0.0005[a]	Generally below the LOR.
Chromium	mg/L	0.001	0.0044	25	0.0005	0.0005	0.005[a]	Generally below the LOR.
Cobalt	mg/L	0.0014	0.0010	24	0.0005	0.005	0.005[a]	Generally below the LOR with some occasional concentrations above this.
Copper	mg/L	0.0014	0.0006	25	0.0009	0.005	0.005[a]	Generally below the LOR.
Iron	mg/L	0.28	0.54	25	0.025	0.050	0.050	Within the limitations of guidelines values.
Lead	mg/L	0.0034	0.0044	25	0.0005	0.005	0.005[a]	Generally below the LOR.
Lithium	mg/L	NA	NA	25	0.0524	0.139	0.164	No indicators in freshwater or marine water environment. However, some elevated traces in the environment.
Mercury	mg/L	0.0006	0.0004	25	0.00005	0.00005	0.00005[a]	Generally below the LOR.
Nickel	mg/L	0.011	0.0059	25	0.0005	0.005	0.005[a]	Generally below the LOR.
Selenium	mg/L	0.011	NA	25	0.005	0.005	0.05[a]	Generally below the LOR.
Silver	mg/L	0.00005	0.0014	2	0.0005	0.0005	0.0005[a]	Generally below the LOR.

Parameter	Units	Freshwater default guidelines values	Marine water default guideline values	No. of data points	20th percentile	Median	80th percentile	Discussion
Strontium	mg/L	NA	NA	2	1.984	2.245	2.506	No indicators in freshwater or marine water environment. However, some elevated traces in the environment.
Thorium	mg/L	NA	NA	2	0.0005	0.0005	0.0005[a]	Generally below the LOR.
Tin	mg/L	NA	NA	2	0.0005	0.0005	0.0005[a]	Generally below the LOR.
Titanium	mg/L	NA	NA	1	0.005	0.005	0.005[a]	Generally below the LOR.
Uranium	mg/L	0.0005	0.1	2	0.0006	0.00075	0.0009	Generally below the LOR.
Vanadium	mg/L	0.006	0.1	24	0.005	0.05	0.05[a]	Generally below the LOR.
Zinc	mg/L	0.008	0.008	25	0.0025	0.025	0.025[a]	Generally below the LOR.
Hydrocarbons[c]								
TRH C6-C10	mg/L	NA	NA	25	0.0100	0.0100	0.0100[a]	Generally below the LOR.
>C10-C16	mg/L	NA	NA	25	0.0500	0.0500	0.0500[a]	Generally below the LOR.
>C16-C34	mg/L	NA	NA	25	0.0500	0.0500	0.0500[a]	Generally below the LOR.
>C34-C40	mg/L	NA	NA	25	0.0500	0.0500	0.0500[a]	Generally below the LOR.
Benzene	mg/L	0.95	0.7	25	0.0005	0.0005	0.0005[a]	Generally below the LOR.
Toluene	mg/L	0.18	0.18	25	0.0010	0.0010	0.0010[a]	Generally below the LOR.
Ethylbenzene	mg/L	0.08	0.08	25	0.0010	0.0010	0.0010[a]	Generally below the LOR.
Meta & para xylene	mg/L	0.075	0.075	25	0.0010	0.0010	0.0010[a]	Generally below the LOR.
Ortho-xylene	mg/L	0.350	NA	25	0.0010	0.0010	0.0010[a]	Generally below the LOR.
Naphthalene	mg/L	0.016	0.07	25	0.0025	0.0025	0.0025[a]	Generally below the LOR.

Note:
a – Limit of Reporting.
b – Darwin Harbour Water Quality Objectives (NT, 2010)
c – Australian and New Zealand Water Quality Guideline Values (ANZG, 2018)

Table 3.2 Proposed surface water trigger values compared to 80%ile water quality at each monitoring location

Parameter	Trigger	Units	SW5	SW3	New Upstream	SW1	SW2	SW4	New 1	New 2
Field parameters										
pH	6.0 – 8.5	-	6.86 – 7.35	6.15 – 7.19	6.06 – 7.80	5.83 – 6.07	5.87 – 6.41	5.95 – 7.04	6.16 – 7.15	6.07 – 6.70
EC		µS/cm	15,502 – 52,115	56.6 – 44,010	40.5 - 521	30.08 – 260.52	55.94 – 18,181	62 - 474	647.4 – 55,648	27.84 – 868.84
Dissolved Oxygen	50 - 100	%	69.3 – 90.6	63.3 – 92.7	58.7 – 82.5	61.3 – 86.6	61.6 – 90.5	54.6 – 85.3	79.1 – 92.5	62.3 – 81.9
Total Suspended Solids	24.2	mg/L	24.2	28	7.2	2.5	8.2	7.6	13	5
Nutrients										
Ammonia	198	µg/L	198	190	80	230	188	202	158	108
Nitrite and Nitrate	20	µg/L	5	5	5	5	5	5	5	5
Total Nitrogen	500	µg/L	500	500	400	400	360	400	500	500
Total Phosphorus	54	µg/L	54	50	50	20	48	40	56	50
Dissolved metals										
Aluminium	50	µg/L	50	50	40	30	20	50	50	50
Arsenic	13	µg/L	5.0	5.0	1.0	2.0	1.0	3.8	5.0	3.8
Cobalt	1	µg/L	5.0	5.0	1.0	0.5	1.0	4.2	5.0	1.7
Copper	0.6	µg/L	5.0	5.0	1.0	0.5	0.5	4.6	5.0	2.5
Iron	540	µg/L	50	136	330	80	212	418	88	362
Lead	4.4	µg/L	5.0	5.0	0.5	0.5	0.5	3.2	5.0	0.5
Lithium	164	µg/L	162.4	5.0	70	164	70	146.6	4.8	6.0
Mercury	0.4	µg/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Nickel	5.9	µg/L	5.0	5.0	1.0	0.5	0.5	3.4	5.0	1.0
Silver	1.4	µg/L	0.5	0.5	-	0.5	0.5	0.5	-	-
Zinc	8	µg/L	25	25.0	7.0	2.5	4.6	18.6	25	6.8

Table 3.3 Groundwater quality assessment – dissolved metals and hydrocarbons

Parameter	Units	Freshwater default guidelines values	Marine water default guideline values	No. of data points	20th percentile	Median	80th percentile	Discussion
Physical parameters[b]								
Electrical conductivity	µS/cm	200	NA	49	137.5	226.6	402.4	Lower than surface water quality background data.
pH	-	6.0 – 7.5	6.0 – 8.5	49	6.19	6.68	7.20	Similar to surface water quality.
Dissolved Oxygen	%	80 - 100	50 - 100	49	0.40	1.13	2.60	Significantly lower than surface water quality.
Turbidity	NTU	20	NA	49	1.93	10.48	114.52	Elevated compared to the baseline surface water quality.
Total suspended solids	mg/L	5	10	49	124.2	172	214	Elevated compared to baseline surface water quality.
Nutrients[b]								
Ammonia	mg/L	NA	0.020	-	-	-	-	No samples.
Nitrite and Nitrate (NO_X)	mg/L	0.008	0.020	49	0.005	0.01	0.04	Slightly elevated compared to baseline surface water quality.
Total Nitrogen	mg/L	0.23	0.30	52	0.10	0.30	0.58	Slightly elevated above the baseline surface water quality.
Total Phosphorus	mg/L	0.01	0.03	52	0.172	0.25	0.458	Significantly elevated above the baseline surface water quality.
Filterable Reactive Phosphorus	mg/L	0.005	0.010	52	0.102	0.195	0.366	Significantly elevated above the baseline surface water quality.
Chlorophyll	mg/L	0.002	0.004	-	-	-	-	No samples.
Dissolved metals[c]								
Aluminium	mg/L	0.0550 when pH >6.5, 0.0008 when pH< 6.5	0.0370	52	0.005	0.005	0.005 [a]	Generally below baseline surface water quality.
Arsenic	mg/L	0.013	NA	52	0.012	0.0305	0.1146	Significantly elevated above the baseline surface water quality.

Parameter	Units	Freshwater default guidelines values	Marine water default guideline values	No. of data points	20th percentile	Median	80th percentile	Discussion
Barium	mg/L	NA	NA	52	0.0322	0.0465	0.0668	Slightly elevated above the baseline surface water quality.
Beryllium	mg/L	NA	NA	52	0.0005	0.0005	0.0005 [a]	Same as baseline surface water quality.
Boron	mg/L	0.94	NA	52	0.025	0.025	0.025 [a]	Generally below baseline surface water quality.
Cadmium	mg/L	0.0002	0.0055	52	0.00005	0.00005	0.00005 [a]	Same as baseline surface water quality.
Caesium	mg/L	NA	NA	-	-	-	-	No samples.
Chromium	mg/L	0.001	0.0044	52	0.0005	0.0005	0.0005 [a]	Same as baseline surface water quality.
Cobalt	mg/L	0.0014	0.0010	52	0.0005	0.0005	0.0005 [a]	Same as baseline surface water quality.
Copper	mg/L	0.0014	0.0006	52	0.0005	0.0005	0.0009	Same as baseline surface water quality.
Iron	mg/L	0.28	0.54	52	0.025	0.285	1.326	Significantly elevated above the baseline surface water quality.
Lead	mg/L	0.0034	0.0044	52	0.0005	0.0005	0.0005 [a]	Same as baseline surface water quality.
Lithium	mg/L	NA	NA	49	0.0786	0.10	0.1426	Slightly elevated compared to baseline surface water quality.
Mercury	mg/L	0.0006	0.0004	52	0.00005	0.00005	0.00005 [a]	Same as baseline surface water quality.
Nickel	mg/L	0.011	0.0059	52	0.0005	0.0005	0.0020	Same as baseline surface water quality.
Selenium	mg/L	0.011	NA	52	0.005	0.005	0.005 [a]	Same as baseline surface water quality.
Silver	mg/L	0.00005	0.0014	-	-	-	-	No samples.
Strontium	mg/L	NA	NA	-	-	-	-	No samples.
Thorium	mg/L	NA	NA	-	-	-	-	No samples.
Tin	mg/L	NA	NA	-	-	-	-	No samples.
Titanium	mg/L	NA	NA	-	-	-	-	No samples.
Uranium	mg/L	0.0005	0.1	-	-	-	-	No samples.
Vanadium	mg/L	0.006	0.1	52	0.005	0.005	0.005 [a]	Same as baseline surface water quality.

Parameter	Units	Freshwater default guidelines values	Marine water default guideline values	No. of data points	20th percentile	Median	80th percentile	Discussion
Zinc	mg/L	0.008	0.008	52	0.0025	0.00375	0.0192	Same as baseline surface water quality.
Hydrocarbons								Same as baseline surface water quality.
TRH C6-C10	mg/L	NA	NA	52	0.0100	0.0100	0.0100 [a]	Same as baseline surface water quality.
>C10-C16	mg/L	NA	NA	52	0.0500	0.0500	0.0500 [a]	Same as baseline surface water quality.
>C16-C34	mg/L	NA	NA	52	0.0500	0.0500	0.0500 [a]	Same as baseline surface water quality.
>C34-C40	mg/L	NA	NA	52	0.0500	0.0500	0.0500 [a]	Same as baseline surface water quality.
Benzene	mg/L	0.95	0.7	52	0.0005	0.0005	0.0005 [a]	Same as baseline surface water quality.
Toluene	mg/L	0.18	0.18	52	0.0010	0.0010	0.0010 [a]	Same as baseline surface water quality.
Ethylbenzene	mg/L	0.08	0.08	52	0.0010	0.0010	0.0010 [a]	Same as baseline surface water quality.
Meta & para xylene	mg/L	0.075	0.075	52	0.0010	0.0010	0.0010 [a]	Same as baseline surface water quality.
Ortho-xylene	mg/L	0.350	NA	52	0.0010	0.0010	0.0010 [a]	Same as baseline surface water quality.
Naphthalene	mg/L	0.016	0.07	52	0.0025	0.0025	0.0025 [a]	Same as baseline surface water quality.

Note:
a – Limit of Reporting
b – Darwin Harbour Water Quality Objectives (NT, 2010)
c – Australian and New Zealand Water Quality Guideline Values (ANZG, 2018)

3.4 SITE SPECIFIC GUIDELINE VALUES

The proposed surface water trigger values at SW5 are shown in Table 3.4. Given that water at SW5 is mainly sea water quality for more than 80% of baseline samples, the marine water guideline values in ANZG (2018) have been adopted for the proposed trigger values. The proposed parameters have been selected based on ANZG (2018), the Darwin Harbour Water Quality Objectives and elevated analytes in surface water at SW5 and groundwater monitoring. The proposed trigger values have been determined based on the lowest guideline value or the elevated 80th percentile value at SW5. The proposed downstream monitoring location is at SW5.

Table 3.4 Proposed surface water trigger values at monitoring location

Parameter	Abbrev.	Units	Analysis	Trigger value
Physical parameters				
pH	pH	pH	In situ.	6.0 – 8.5[a]
Dissolved Oxygen	DO	%		50% - 100%[a]
Total Suspended Solids	TSS	mg/L		24.2[b]
Nutrients				
Ammonia	NH_3	µg/L	Lab	198[b]
Total Nitrogen	TN	µg/L		500[b]
Total Phosphorus	TP	µg/L		54[b]
Dissolved metals				
Aluminium	Al	µg/L	Filtered (0.45 µm)	50[b]
Arsenic	As	µg/L		13[c]
Cobalt	Co	µg/L		1[d]
Copper	Cu	µg/L		0.6[d]
Iron	Fe	µg/L		540[a]
Lead	Pb	µg/L		4.4[d]
Lithium	Li	µg/L		430[e]
Mercury	Hg	µg/L		0.4[a]
Nickel	Ni	µg/L		5.9[d]
Zinc	Zn	µg/L		8[d]

Notes:
a: Darwin Harbour Water Quality Objectives for upper estuary ecosystems.
b: 80th percentile of background data for surface water quality in the Charlotte River.
c: ANZG (2018) 95% species protection for freshwater ecosystems.
d: ANZG (2019) 95% species protection for marine water ecosystems.
e: Waste Discharge Licences 248-03 and WDL 253-01 granted in accordance with section 74 of the Water Act 1992 (NT)

4 FLOOD ASSESSMENT

4.1 OVERVIEW

The TUFLOW two-dimensional flood model was used to undertake a preliminary assessment of flood inundation of the mine lease area for existing (pre-mining) conditions. The flood model was run for the 10%, 1%, and 0.1% Annual Exceedance Probability (AEP) as well as the Probable Maximum Precipitation (PMP) flood events for current climate conditions. The hydraulic model was also run for the 1% AEP future climate conditions.

The model included a short reach of the Charlotte River channel, as well as the local overland flow paths through the mining lease.

4.2 MODEL CONFIGURATION

Local stormwater runoff was simulated using the direct-rainfall function of TUFLOW which applies rainfall directly to the surface of the modelled area, allowing the two-dimensional model to determine flow directions, depths and velocities.

4.2.1 Topographic data

The available topographical data was surveyed and provided on 4 June 2026 which covers the full extent of the hydraulic model.

4.2.2 Boundary conditions

Flows along the Charlotte River was estimated using the Regional Flood Frequency Estimation Model (RFFE) (https://rffe-2021.wmawater.com.au/) for 10% and 1% annual exceedance probability (AEP) flood events. For the extreme design events, the 1% AEP RFFE design discharges were factored up by 4 for the 0.1% AEP flood event and were factored up by 8 for the PMP event based on general knowledge of surrounding flood studies. This flow was adopted as a constant inflow rate for modelling of the Charlotte River.

Climate change factors were also applied on the direct rainfall within the ML boundary, as well as the predicted design discharges for the Charlotte River in accordance with the "Ready reckoner for flooding under climate change" guidelines (DCCEEW, 2025). The guidance explains how to account for climate change in flood risk assessments in accordance with the Australia Rainfall and Runoff (ARR v4.2), Book 1, Chapter 6 (Ball, et al., 2019). The ready reckoner can be applied to streamflows and rainfall depths, however, a proper hydrology assessment should be undertaken for the detailed design. Table 4.1 shows the adopted ready reckoner climate change parameters adopted for the Charlotte River Catchment.

Two climate change scenarios were modelled for this assessment:

- **Current climate**: which represents the shift in climate from the ARR baseline period (1961 – 1990) to current/near-term conditions (2021 – 2040); and
- **Future climate**: which represents the shift in climate for medium-term conditions (2041 - 2060), which is approximately the timing of the mine closure.

Table 4.2 shows the adopted peak discharges for the Charlotte River. Table 4.3 shows the adopted rainfall depths for local stormwater runoff.

A constant tailwater level of 4.0 mAHD, which was based on the High Astronomical Tide (HAT) level was applied in the Charlotte River. The adopted tailwater level was sourced from the "High Resolution Storm Tide and Climate Change Impacts Study – 2010" (SEA, 2010) report. Areas outside of the extent of the tailwater level were estimated based on topographic slope.

Table 4.1 Adopted ready reckoner climate change parameters

Parameter	Current climate	Future climate
Climate scenario or degrees of warming	SSP2-4.5	SSP2-4.5
Time horizon	Current and near-term (2021-2040)	Medium-term (2041-2060)
Projection uncertainty	Median	Median
Degrees of warming (relative to 1961 – 1990: approximate ARR baseline period)	1.2	1.7
IFD rate of change	Central (median)	Central (median)

Table 4.2 Adopted Charlotte River peak discharge

Flood event	RFFE peak discharge (m^3/s)	Current climate peak discharge (m^3/s)	Future climate peak discharge (m^3/s)
10% AEP	110	127	135
1% AEP	246	280	296
0.1% AEP[a]	982	1,121	1,184
PMP[b]	1,965	2,240	2,368

Note:
a,b: Extreme events were multiplied by a factor of 4 and 8 of the predicted RFFE 1% AEP design discharge for the 0.1% AEP and the PMP events respectively.

4.2.3 Rainfall and losses

Table 4.3 shows adopted design rainfall depths for the modelled design events. The design rainfall depths have been uplifted to current climate conditions (SSP2-4.5 2030) and future climate change for the 1% CC AEP event (SSP2-4.5 2050).

Table 4.4 shows the adopted initial losses for a range of design events. The following is of note:

- A zero initial loss was adopted for the 0.1% AEP and PMP design flood events.
- A consistent 5.3 mm/hr continuing loss was adopted for all current climate design events.
- A consistent 5.4 mm/hr continuing loss was adopted for all future climate design events.

Table 4.3 Adopted design rainfall depths

Storm duration (min)	Rainfall depths (mm)				
	10%	1%	0.1%	PMP	1% CC
30	65.9	85.0	133.6	260.2	91.2
45	79.5	102.4	159.7	378.4	109.8
60	89.5	115.4	179.8	484.9	123.8
90	102.2	133.0	207.7	567.6	141.8
120	111.2	146.7	228.8	641.6	155.9
180	123.5	169.2	264.1	777.4	178.9
270	138.0	194.5	306.5	851.0	204.8

Storm duration (min)	Rainfall depths (mm)				
	10%	1%	0.1%	PMP	1% CC
360	148.3	216.9	341.6	966.3	227.6

Table 4.4 Adopted initial losses

Storm duration (min)	Initial loss (mm)				
	10%	1%	0.1%	PMP	1% CC
30	18.2	18.7	0	0	18.9
45	27.2	28.0	0	0	28.3
60	36.3	37.3	0	0	37.8
90	36.9	35.7	0	0	36.1
120	36.9	37.2	0	0	37.7
180	36.7	30.4	0	0	30.7
270	36.4	18.9	0	0	19.2
360	36.0	7.5	0	0	7.6

4.3 FLOOD RESULTS

The modelled flood extent and depth for the 1% AEP current climate conditions is shown in Figure 4.1. The modelled flood extent and depth for the 10% AEP, 0.1% AEP and PMP events under current climate conditions and 1% AEP for future climate conditions are shown in Appendix B. The model results show that flooding in the Charlotte River has minimal impact within the mine lease area. Shallow inundation occurs in low-lying areas within the mining lease, and there would be a low risk of inundation of box cut for events up to and including the 0.1% AEP for current climate conditions. For the PMP event, there may be shallow depths of less than 0.1 m.

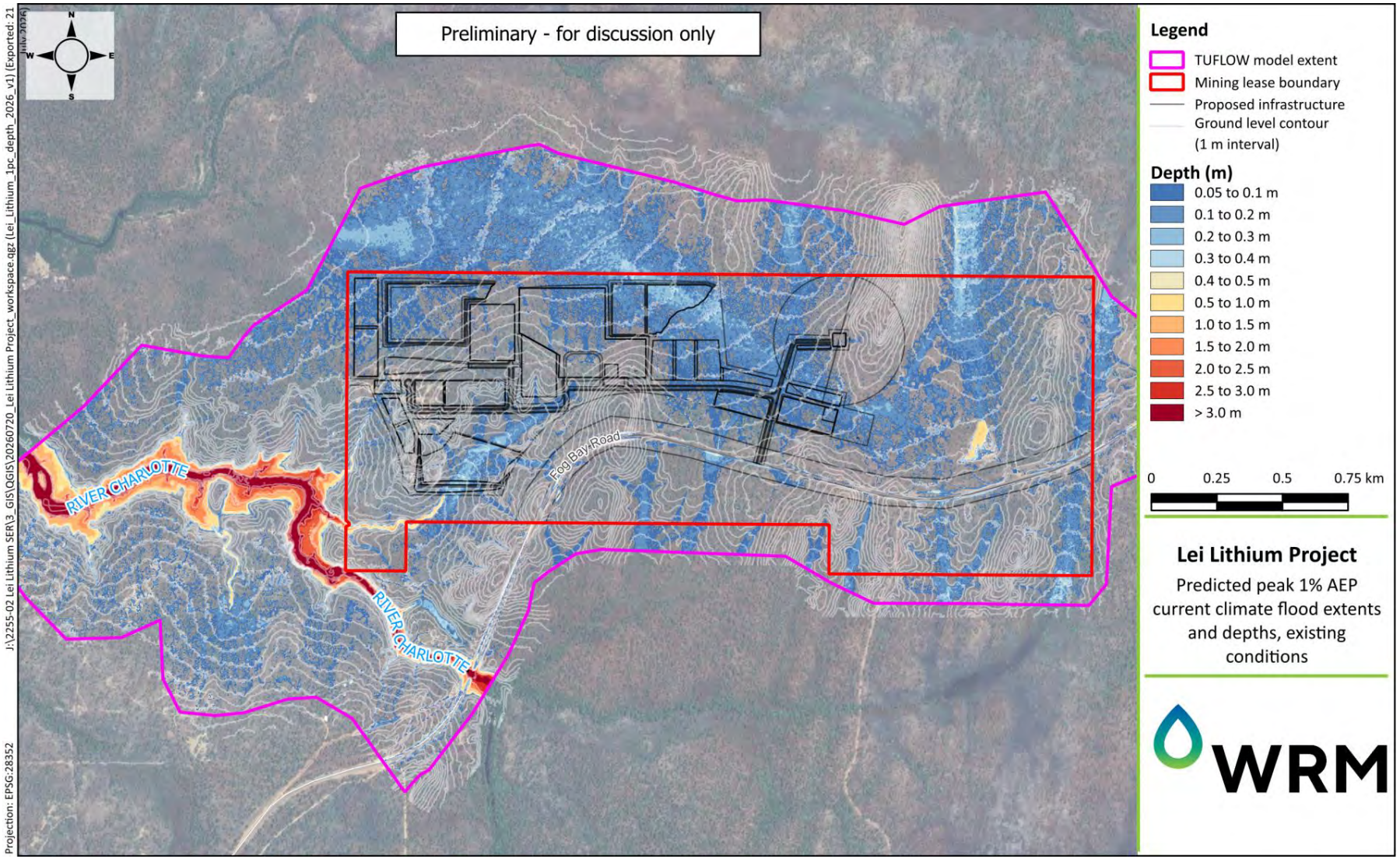


Figure 4.1 **Preliminary TUFLOW model existing conditions flood extent and depths, 1% AEP current climate**

5 PROPOSED SITE LAYOUT

The proposed site layout is shown in Figure 5.1. Key components of surface water management infrastructure are:

- A Raw Water Dam (RWD) to collect local stormwater runoff from the eastern portion of the lease area.
- Mine Water Dam 1 (MWD1) which collects runoff from the Waste Rock Dump, ROM pad, ore handling areas and the workshop area.
- Mine Water Dam 2 (MWD2), a turkey's nest which is planned to be excised from the existing Raw Water Dam. MWD2 is to be operated as an additional cell to MWD1 to manage excess mine-affected water (which includes runoff from the waste rock dump and the crushing and ore stockpile areas.
- Sedimentation Dam (SD) which collects runoff from disturbed areas in the southwestern portion of the lease area.

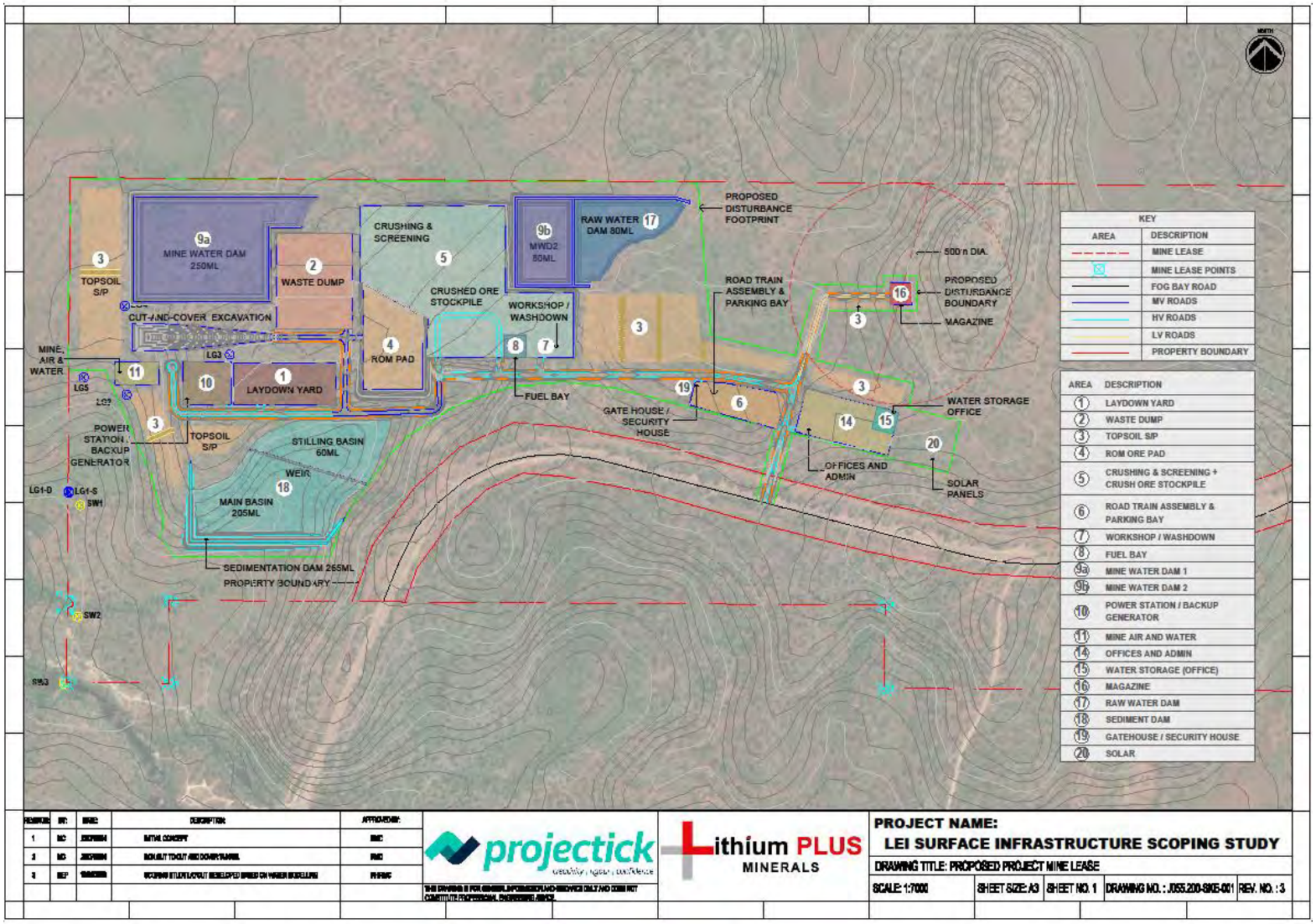


Figure 5.1 Proposed site layout

6 PRELIMINARY WATER BALANCE ASSESSMENT

6.1 OVERVIEW

A preliminary water balance assessment of the site and the Charlotte River was undertaken using the GoldSim software to model the site water management system (WMS) and the Charlotte River catchment to identify discharge requirements.

Long-term daily rainfall and evaporation data for the area was extracted from the SILO DataDrill service (https://www.longpaddock.qld.gov.au/silo/) (DESI, 2024). The site water balance was simulated using multiple climate sequences extracted from the historical climate data to assess the performance of the site water management system under the full range of historical climatic conditions.

6.2 CHARLOTTE RIVER CATCHMENT

This section describes the potential dilution that can be achieved during mine water releases in the Charlotte River catchment to the planned downstream surface water quality location at SW5. The Charlotte River catchment is located immediately south of Lei Lithium and has a catchment area of approximately 61.4 km^2 to SW5 (not including the local mine site catchments). The water quality at the monitoring location is generally brackish water due to the tidal influence of the Timor Sea. The water quality assessment in Section 3 and Appendix C shows that the water quality is frequently more saline compared to the upper monitoring stations.

There is potential to discharge mine-affected water from the site to the Charlotte River, provided that the mine-affected water quality can achieve sufficient dilution at the monitoring location. This assessment assesses the predicted salinities and discharge volumes discharged from the site.

6.2.1 Controlled release strategy

Controlled releases will be undertaken from MWD1 into Charlotte River, via local drainage line south of MWD1. Controlled releases from MWD1 would be undertaken when there is flow in the Charlotte River. It is assumed that up to a maximum of 500 L/s (through a siphon) would be used to undertake releases into the Charlotte River. The discharge rate would vary based on the required discharge ratio to achieve compliance at the downstream monitoring location.

For this assessment it has been assumed that controlled releases are to be undertake during flow. Given that the Charlotte River is tidal, discharges may occur all year round. A mixing assessment would be required to confirm the rules for discharge. However, this may impact the sizing requirements for MWD1.

6.2.1.1 Dilution limitations

The actual allowable controlled release rate for this assessment was determined based on the dilution factors required to meet the site-specific guideline values at the planned compliance point on the Charlotte River (SW5). The flow volumes at SW5 were estimated using the water balance. Contributing flows to the compliance point include:

- Runoff from the 61.4 km^2 catchment area for the Charlotte River; and
- Overflows from SD.

The dilution requirements were based on the modelled arsenic concentration and aluminium concentrations in MWD1. MWD1 would primarily receive groundwater dewatering inflows from the underground, catchment runoff from the Waste Rock Dump and ore stockpile areas. There would also be some dilution from runoff inflows and evapo-concentration in water dams.

Section 6.5.4 describes the predicted release volumes from the MWD1, catchment runoff volumes in the Charlotte River, and sediment basin releases for a range of different climatic conditions.

6.3 SITE WATER MANAGEMENT SYSTEM

Figure 6.1 shows approximate catchment areas draining to the proposed site storages. Summary details of proposed storages and catchment land use area are provided in Table 6.1 and Table 6.2.

It is planned to convert the RWD into a multiple cell dam during Year 4 and is planned to be operational from Project Year 5 onwards. One cell will be converted into mine water dam (MWD2), and the existing RWD would have a reduced capacity (80 ML).

Table 6.1 Site storages

Dam	Catchment area (ha)	Dam surface area (ha)	Maximum capacity (ML)	Maximum operating volume (ML)
Year 1 - 4				
MWD1	29.8	7.5	250	Project Year 2 Q3 = 175; Project Year 2 Q4 = 25.
RWD	82.6	5.7	160	-
SD	36.5	8.7	265	-
Year 5 onwards				
MWD1	29.8	7.5	250	Project Year 2 Q3 = 175; Project Year 2 Q4 = 25.
MWD2	3.7	2.6	80	70.4
RWD	78.9	2.9	80	-
SD	36.5	8.7	265	-

Table 6.2 Estimated catchment and land-use areas (ha)

Storage	Catchment area (ha)				
	Natural	Hardstand	Waste rock dumps	Cleared	Total
Year 1 - 4					
MWD1	2.12	23.99	3.73	0	**29.85**
MWD2	0	0	0	0	**0**
SD	19.92	15.99	0	0.60	**36.51**
RWD	63.18	13.71	0	5.67	**82.55**
Total	**85.22**	**53.69**	**3.73**	**6.27**	**148.91**
Year 5 - 7					
MWD1	2.12	23.99	3.73	0	**29.85**
MWD2	0	3.66	0	0	**3.66**
SD	19.92	15.99	0	0.60	**36.51**

Storage	Catchment area (ha)				
	Natural	Hardstand	Waste rock dumps	Cleared	Total
RWD	63.17	10.05	0	5.67	**78.89**
Total	**85.21**	**53.69**	**3.73**	**6.27**	**148.91**

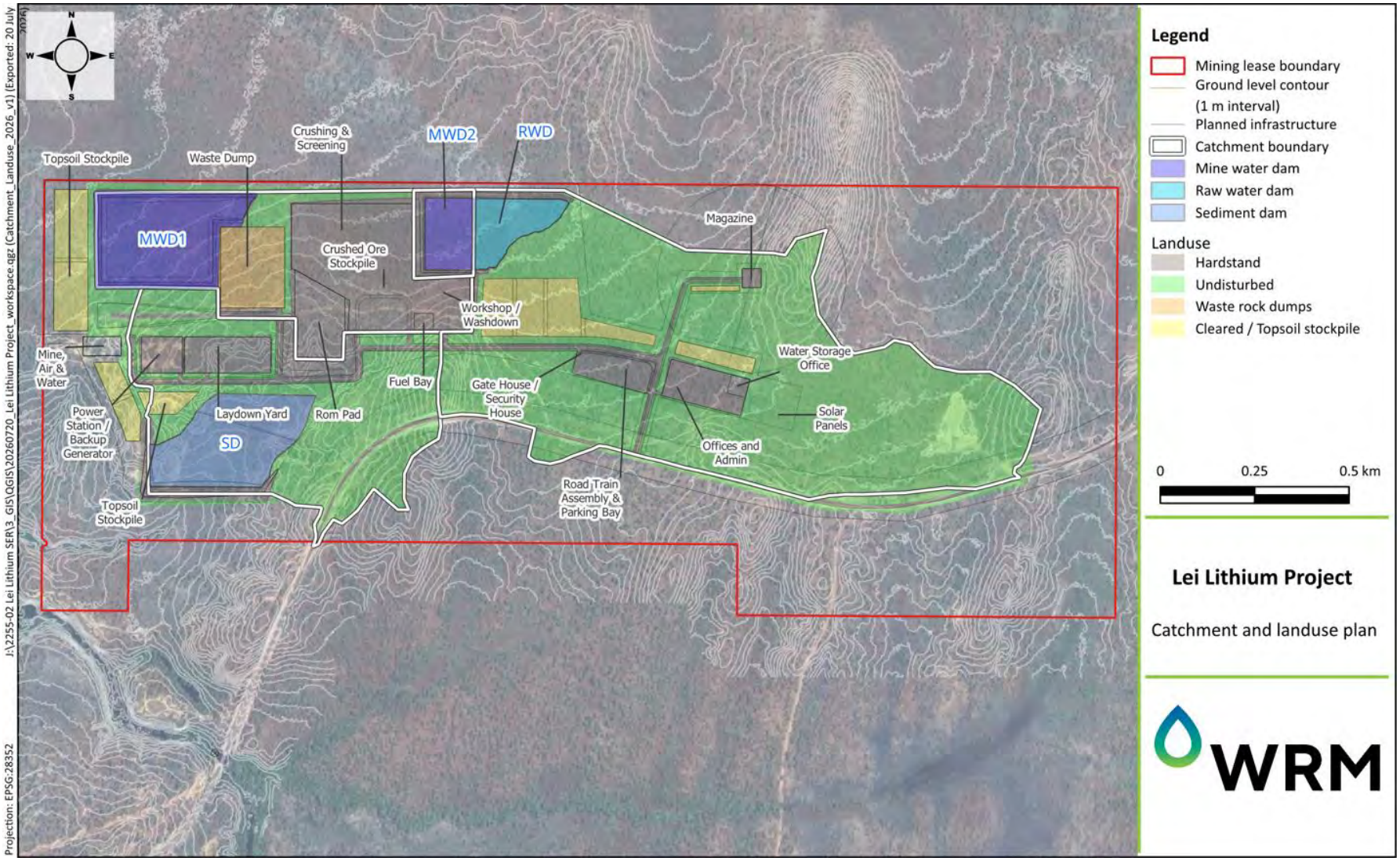


Figure 6.1 Catchment and landuse plan

Figure 6.2 shows the schematic of the water management system. System operating rules are summarised as follows:

- All dams collect surface runoff from their contributing catchments and lose water through evaporation.
- The underground operation receives groundwater inflows and would be dewatered to MWD1.
- Construction water demands are supplied from the SD as the primary source, with backup supply from RWD if SD is empty.
- Surface water demands are supplied from the SD as the primary source, with the RWD used as a secondary source when the SD is unable to meet demands.
- Underground water demands are taken from MWD1, with water returned from underground operations being directed back to MWD1. Approximately 71.9% to 39.8% of the underground demand would be loss from the system (depending on the climate). Losses from the underground are associated with air vent losses and moisture lost to the surrounding ore/material body. The remainder of the water pumped into the underground would be dewatered back to MWD1.
- From Year 2 onwards, SD is dewatered to MWD1 at a rate 4 ML/d when MWD1 falls below 1 ML to improve water security.
- From Year 5 (when MWD2 is online), MWD2 is dewatered to MWD1 at a rate 4 ML/d when MWD2 contains water above its minimum operating volume and MWD1 falls below 60% capacity.
- From Year 5 onwards (when MWD2 is online), MWD1 is dewatered to MWD2 at a rate of 4 ML/day when MWD1 exceeds its maximum operating volume and MWD2 is below its maximum operating volume.

Controlled release from MWD1 to Charlotte River occur when MWD1 volume exceeds maximum operating volume and during a flow event in the Charlotte River.

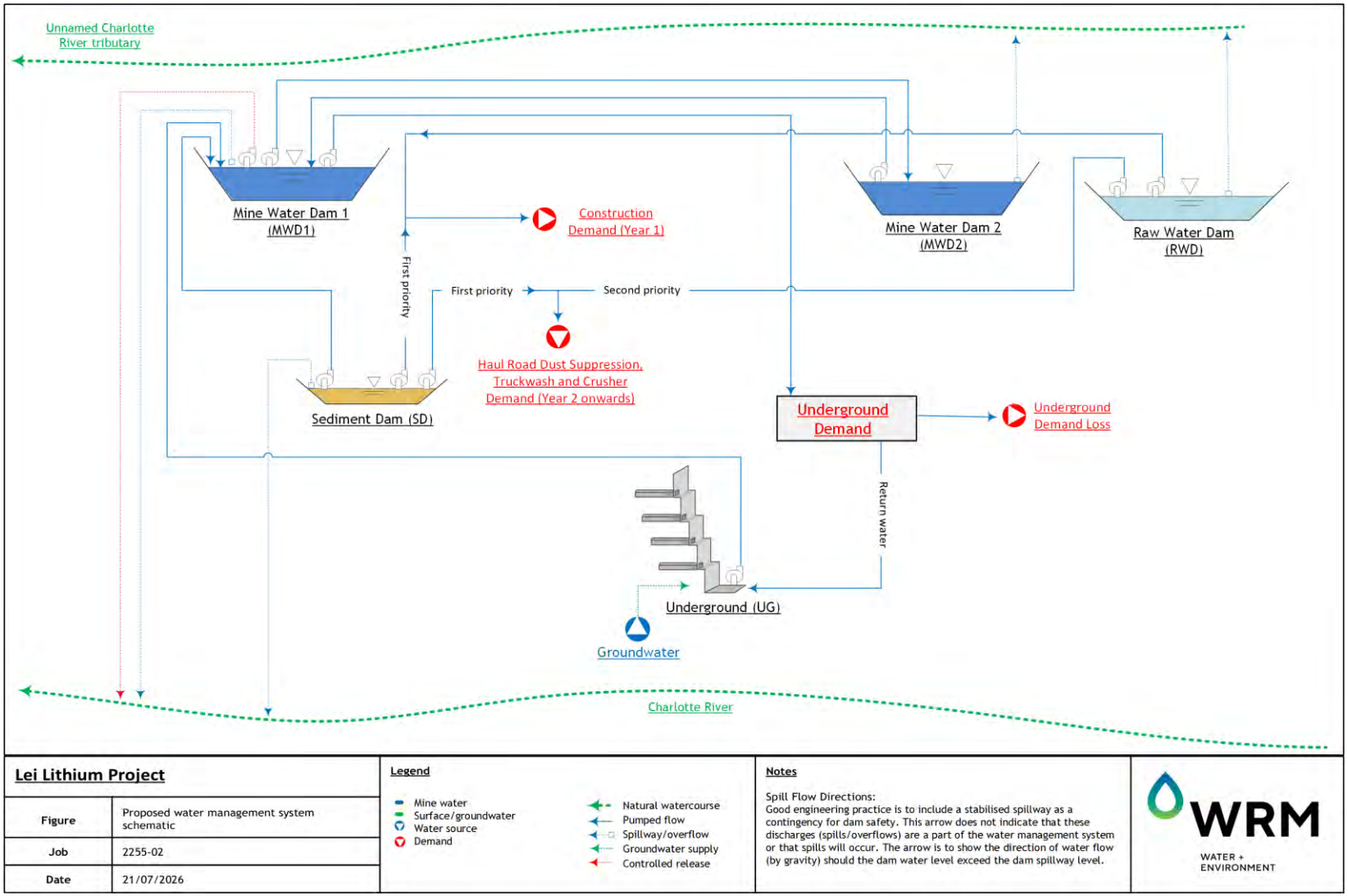


Figure 6.2 Water management system schematic

6.4 WATER SOURCES AND DEMANDS

Table 6.3 shows a summary of water demands and sources for the Project.

Table 6.4 provides a summary of groundwater inflows to underground operations, provided in the groundwater report (CloudGMS, 2026a).

Surface runoff volume is calculated using the Australian Water Balance Model (AWBM) runoff model, based on the adopted parameters in Table 6.5.

Table 6.3 Water sources and demands

Source/ Demand	Description	Duration	Volume
Source			
Runoff	Direct rainfall & catchment runoff	Life of project	Varies
Groundwater inflow	Groundwater inflow to underground and cut & cover tunnel	Life of project	Varies
Demand			
Construction demand	Construction Yr 1 only from SD and RWD (197 ML) and 103 ML required to be sourced externally	Year 1 (Construction Phase)	300 ML
Crusher (Dust suppression demand)	Surface demand from SD and RWD	Year 2 onwards (Operational Phase)	30 ML/a
Truck washdown demand	Surface demand from SD and RWD	Year 2 onwards (Operational Phase)	10 ML/a
Mine and access roads demand (Dust suppression demand)	Surface demand from SD and RWD	Year 2 onwards (Operational Phase)	45 ML/a
Underground water demand	Underground water usage from mine affected water	Year 2 onwards (Operational Phase)	221 ML/a[a]
Underground water return[b]	Underground water usage returned to the surface (varies on climate).	Year 2 onwards (Operational Phase)	62.1 ML/a to 135.25 ML/a
Underground water loss[b]	Underground water usage lost in the underground (through in-situ moisture and air vent losses).	Year 2 onwards (Operational Phase)	158.9 ML/a to 85.75 ML/a

Notes:
a – Represents the total underground water demand required for operations
b – Water used for underground demands is recirculated back into the Water Management System after losses through in-situ moisture to the surrounding material and air vents have occurred. The air vent losses are generally based on climatic conditions due to the difference in temperature between the surface and the underground mind.

Table 6.4 Adopted annual groundwater inflows

Phase	Project date	Project Year	Underground inflows[a] (ML/month)	Cut and cover inflows (ML/month)	Total GW inflows (ML/month)
Construction Phase	Apr 2027	0.00	0.00	7.83	7.83
	Jul 2027	0.25	0.00	7.83	7.83
	Oct 2027	0.50	0.35	7.83	8.18
	Jan 2027	0.75	0.35	7.83	8.18
Operational Phase	Apr 2028	1.00	0.36	17.18	17.53
	Jul 2028	1.25	5.90	4.67	10.57
	Oct 2028	1.50	11.84	3.01	14.85
	Jan 2029	1.75	15.44	6.45	21.89
	Apr 2029	2.00	17.90	5.47	23.38
	Jul 2029	2.25	18.45	3.08	21.53
	Oct 2029	2.50	24.61	3.03	27.64
	Jan 2030	2.75	25.31	6.68	31.99
	Apr 2030	3.00	26.21	4.93	31.15
	Jul 2030	3.25	27.48	3.08	30.56
	Oct 2030	3.50	28.83	2.47	31.30
	Jan 2031	3.75	30.25	5.53	35.78
	Apr 2031	4.00	30.57	5.68	36.25
	Jul 2031	4.25	31.34	3.31	34.65
	Oct 2031	4.50	32.20	2.76	34.95
	Jan 2032	4.75	33.19	7.28	40.47
	Apr 2032	5.00	33.42	6.56	39.98
	Jul 2032	5.25	33.62	3.50	37.12
	Oct 2032	5.50	30.48	2.39	32.86
	Jan 2033	5.75	38.27	6.87	45.14
	Apr 2033	6.00	34.70	6.07	40.77
	Jul 2033	6.25	34.45	3.37	37.82
	Oct 2033	6.50	33.32	4.94	38.26
	Jan 2034	6.75	33.32	4.94	38.26
Closure	Apr 2034	7.00	33.32	4.94	38.26
	July 2034	7.25	33.32	4.94	38.26

Note a: Combined groundwater inflow to the underground stopes and decline.

Table 6.5 **Adopted AWBM parameters**

Parameter	Undisturbed	Hardstand	Waste Rock Dump	Cleared
C1 (mm)	50	2	50	6
C2 (mm)	100	10	150	25
C3 (mm)	200	30	200	100
A1	0.1	0.33	0.133	0.133
A2	0.2	0.33	0.433	0.433
A3	0.7	0.33	0.433	0.433
BFI	0	0	0	0
Kbase	0	0	0	0
Ksurf	0	0	0	0

6.5 WATER BALANCE RESULTS

6.5.1 Average annual water balance

Summary results of the annual water balance assessment for average climatic conditions over the LOM are shown in Table 6.6. The model results show:

- For the Construction Phase (Year 1):
  - The average annual inflow to the WMS of about 1,110 ML/a, comprising stormwater runoff, direct rainfall on dams and groundwater inflows.
  - The site dams overflows include:
    - Mine-affected water: No overflows are predicted.
    - Sediment water: 14 ML/a is predicted for average climatic conditions; and
    - Raw water: 293 ML/a is predicted for average climatic conditions.
  - To prevent uncontrolled overflows, MWD1 requires controlled releases of approximately 26 ML/a under average climate conditions.
  - A construction water shortfall is predicted in Year 1, amounting to 103 ML/a under average climate conditions.
- For the Operational Phase (Year 2 – 7):
  - The average annual inflow to the WMS ranges between 1,354 ML/a to 1,643 ML/a, comprising stormwater runoff, direct rainfall on dams, groundwater inflows and return water from underground demands.
  - The site dams overflows include:
    - Mine-affected water: No overflows are predicted.
    - Sediment water: between 43 ML/a to 56 ML/a is predicted for average climatic conditions; and
    - Raw water: between 396 ML/a to 491 ML/a is predicted for average climatic conditions.
  - To prevent uncontrolled overflows for a 1% AEP, MWD1 requires controlled releases of between 298 ML/a to 472 ML/a under average climate conditions.
  - All operational surface water demands are satisfied by captured site runoff, direct rainfall and groundwater inflows under average climate conditions.

Table 6.6 Site water balance average annual summary

Category	Parameter	Construction Phase	Operational Phase					
		Year 1 (ML)	Year 2 (ML)	Year 3 (ML)	Year 4 (ML)	Year 5 (ML)	Year 6 (ML)	Year 7 (ML)
Inflows	Groundwater inflow	96	194	313	386	440	465	465
	Rainfall runoff	817	793	791	791	798	795	799
	Direct rainfall on dams	194	276	282	287	285	286	287
	Return water from Underground[a]	0	92	92	92	92	92	92
	Total	**1,108**	**1,354**	**1,478**	**1,556**	**1,615**	**1,636**	**1,643**
Outflows	Evaporation	119	376	387	396	392	394	395
	Mine water dam overflows	0	0	0	0	0	0	0
	Sediment dam overflows	14	43	49	52	54	55	56
	Raw water dam overflows	293	396	401	403	491	411	414
	Underground demand	0	221	221	221	221	221	221
	Construction demand	197	0	0	0	0	0	0
	Surface water demand[b]	0	85	85	85	85	85	85
	Controlled release	26	298	320	392	439	466	472
	Total	**649**	**1,418**	**1,463**	**1,549**	**1,684**	**1,632**	**1,644**
Site water balance		**458**	**-64**	**15**	**7**	**-69**	**5**	**-1**
Shortfall	Shortfall in demands which are required to be sourced externally.	103	0	0	0	0	0	0

Note:
a: Represents the portion of the underground demand that returns back to the water management system.
b: Includes crusher demands, truck washdown demands and dust suppression on mine & access roads.

6.5.2 Total water storage inventory

Figure 6.3 shows the total storage inventory over the life of mine. The results show:

- The lower inventory levels observed during the Construction Phase (Year 1) are primarily attributed to construction water demands, which result in increased drawdown from the available water storages.
- Once construction activities are completed and the Operational Phase (Year 2) commences, storage recovery occurs, with inventory levels showing a sustained increasing trend. Therefore, the initial low inventory represents a short-term construction phase impact and does not indicate an ongoing storage limitation.
- From Project Year 5, it was assumed that water would be discharged from the RWD to construct MWD2, which lowers the volume of water on site.
- There would generally be sufficient water in the Operational Phase (Year 2 onwards) to supply site operational demands.
- Under the median climate conditions (50%ile), the maximum water inventory is predicted to occur in Project Year 2, with storage reaching approximately 508 ML. After reaching this peak, inventory levels gradually decrease throughout the mine life, reaching approximately 370 ML by the end of the LOM.

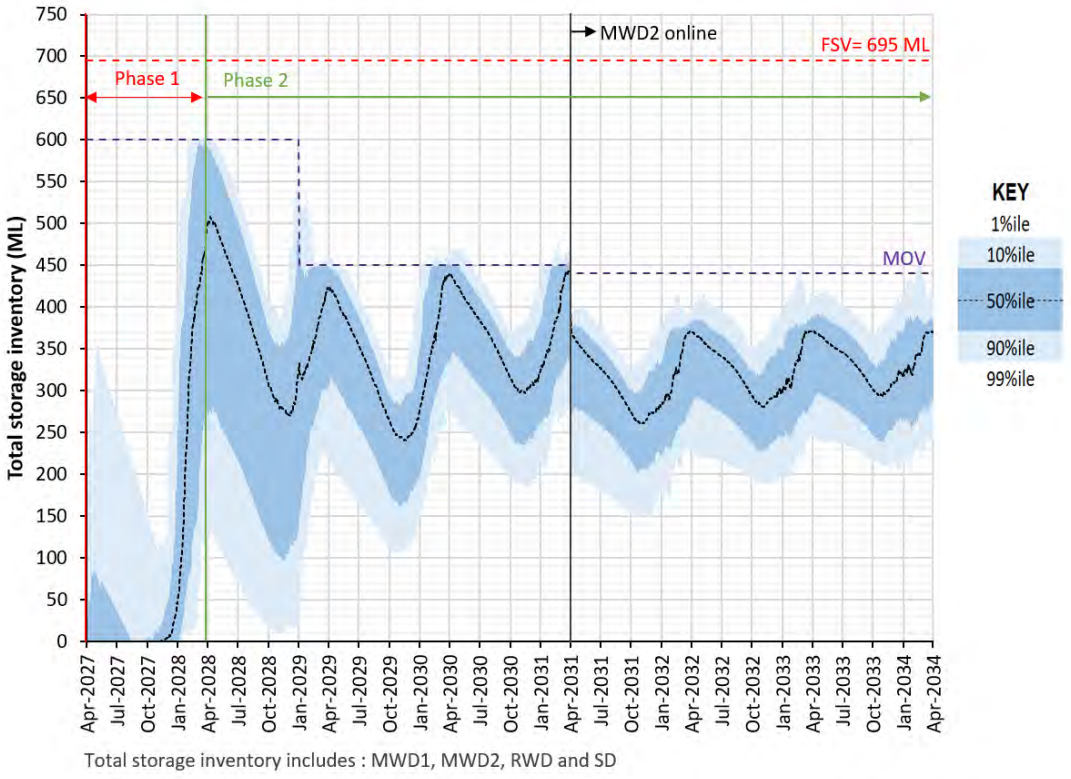


Figure 6.3 Total storage inventory

6.5.3 Mine water inventory

Figure 6.4 shows the mine water dam inventory over the life of mine. The results show:

- As construction activities are completed, the inventory recovers and reaches a maximum of approximately 185 ML by the end of the Construction Phase (Year 1) for wetter climatic conditions.
- Following the commencement of underground (UG) water demands, the inventory initially declines. However, as the predicted groundwater into mine steadily increases from mine progression, there is a gradual recovery in mine water inventory levels. To provide additional storage capacity for and minimise the risk of uncontrolled discharges from dewatering of the underground, the maximum operating volume (MOV) is reduced from 175 ML to 25 ML by 2029.
- Following this operational change, inventory levels continue to exhibit a sustained increasing trend during the dry season where discharges are limited. The lower volume allows the site to manage the predicted groundwater inflows during the dry season limiting the risk of uncontrolled spills from the site (from groundwater in the underground mine).
- The addition of MWD2 at the beginning of Project Year 5 allows the site to manage more groundwater inflows during the dry season, where groundwater inflows are predicted to be at its peak.
- The maximum mine water inventory predicted over the mine life is approximately 323 ML for very wet climatic conditions (1%ile), occurring in Project Year 7.

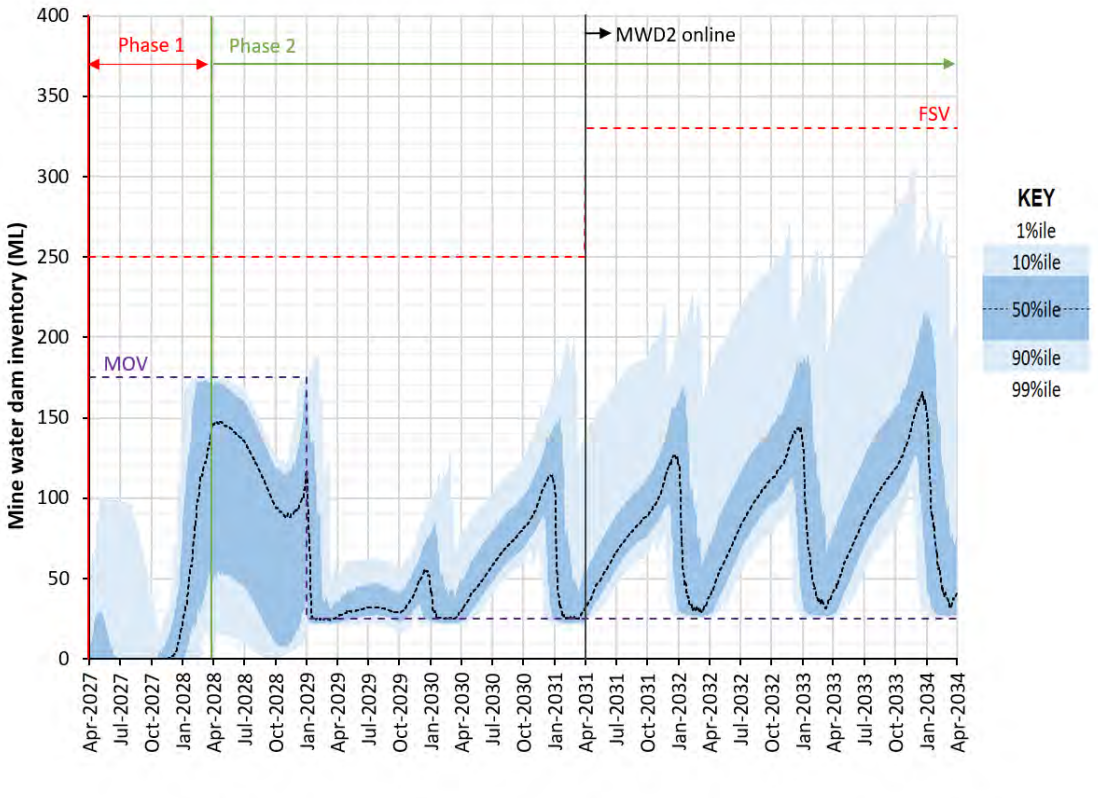


Figure 6.4 Mine water inventory

6.5.4 Controlled release volumes

Figure 6.5 shows the predicted range of quarterly controlled releases from MWD1. Table 6.7 to Table 6.9 show the MWD1 discharge volumes relative to flows in the Charlotte River at SW5, for dry

(10%ile), median (50%ile) and wet (90%ile) climatic conditions, respectively. These results show that, to meet the SSGVs at SW5:

- For dry (10%ile) climatic conditions, controlled releases would be undertaken by Jan 2029. Quarterly discharges from MWD1 comprise only 1.8% - 3.3% of the total flows at the downstream location when controlled releases are undertaken.
- For median (50%ile) climatic conditions, controlled releases would be undertaken by Jan 2029. Quarterly discharges from MWD1 comprise only 1.0% - 5.5% of the total flows at the downstream location when controlled releases are undertaken.
- For wet (90%ile) climatic conditions, controlled releases would be undertaken by Jan 2028. MWD1 comprise only 0.2% - 2.3% of the total flows at the downstream location when controlled releases are undertaken.

Figure 6.5 shows the predicted range of quarterly controlled releases from MWD1 to the Charlotte River.

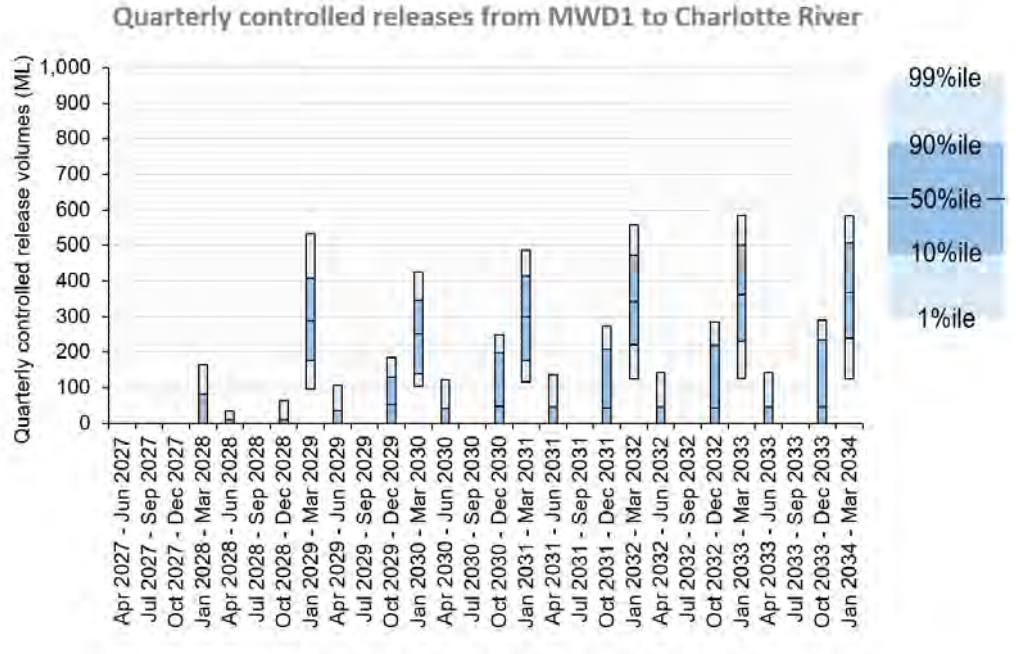


Figure 6.5 Quarterly controlled releases from MWD to the Charlotte River

Table 6.7 Modelled discharges from MWD1 for dry rainfall years (10%ile) relative to flow volumes in Charlotte River at SW5 (incl. MWD1 releases)

Project quarter	MWD1 discharge volume (ML)	SD spill volume (ML)	Charlotte River runoff volume at SW5 (ML)	% streamflow comprising MWD1 discharge
April 2027	0	0	0	0.0%
July 2027	0	0	0	0.0%
October 2027	0	0	0	0.0%
January 2028	0	0	9,498	0.0%
Year 1	**0**	**0**	**9,498**	**0.0%**
April 2028	0	0	0	0.0%
July 2028	0	0	0	0.0%
October 2028	0	0	0	0.0%
January 2029	177	0	9,503	1.8%
Year 2	**177**	**0**	**9,503**	**1.8%**
April 2029	0	0	0	0.0%
July 2029	0	0	0	0.0%
October 2029	0	0	0	0.0%
January 2030	205	0	9,502	2.1%
Year 3	**205**	**0**	**9,502**	**2.1%**
April 2030	0	0	0	0.0%
July 2030	0	0	0	0.0%
October 2030	0	0	0	0.0%
January 2031	278	0	9,502	2.8%
Year 4	**278**	**0**	**9,502**	**2.8%**
April 2031	0	0	0	0.0%
July 2031	0	0	0	0.0%
October 2031	0	0	0	0.0%
January 2032	301	0	9,498	3.1%
Year 5	**301**	**0**	**9,498**	**3.1%**
April 2032	0	0	0	0.0%
July 2032	0	0	0	0.0%
October 2032	0	0	0	0.0%
January 2033	324	0	9,498	3.3%
Year 6	**324**	**0**	**9,498**	**3.3%**
April 2033	0	0	0	0.0%
July 2033	0	0	0	0.0%

Project quarter	MWD1 discharge volume (ML)	SD spill volume (ML)	Charlotte River runoff volume at SW5 (ML)	% streamflow comprising MWD1 discharge
October 2033	0	0	0	0.0%
January 2034	324	0	9,497	3.3%
Year 7	**324**	**0**	**9,497**	**3.3%**

Table 6.8 Modelled discharges from MWD1 for median rainfall years (50%ile) relative to flow volumes in Charlotte River at SW5 (incl. MWD1 releases)

Project quarter	Discharge volume (ML)	Sediment dam spills (ML)	Charlotte River runoff volume at SW5 (ML)	% streamflow comprising MWD1 discharge
April 2027	0	0	0	0.0%
July 2027	0	0	0	0.0%
October 2027	0	0	1,043	0.0%
January 2028	0	0	29,597	0.0%
Year 1	**0**	**0**	**30,640**	**0.0%**
April 2028	0	0	0	0.0%
July 2028	0	0	0	0.0%
October 2028	0	0	1,043	0.0%
January 2029	292	0	29,962	1.0%
Year 2	**292**	**0**	**31,005**	**0.9%**
April 2029	0	0	0	0.0%
July 2029	0	0	0	0.0%
October 2029	59	0	1,042	5.4%
January 2030	320	1	30,597	1.0%
Year 3	**379**	**1**	**31,639**	**1.2%**
April 2030	0	0	0	0.0%
July 2030	0	0	0	0.0%
October 2030	61	0	1,054	5.4%
January 2031	391	10	30,594	1.3%
Year 4	**452**	**10**	**31,648**	**1.4%**
April 2031	0	0	0	0.0%
July 2031	0	0	0	0.0%
October 2031	56	0	1054	5.1%
January 2032	446	15	31,411	1.4%
Year 5	**502**	**15**	**32,465**	**1.6%**
April 2032	0	0	0	0.0%

Project quarter	Discharge volume (ML)	Sediment dam spills (ML)	Charlotte River runoff volume at SW5 (ML)	% streamflow comprising MWD1 discharge
July 2032	0	0	0	0.0%
October 2032	60	0	1042	5.4%
January 2033	473	15	31,376	1.5%
Year 6	**533**	**15**	**32,418**	**1.7%**
April 2033	0	0	0	0.0%
July 2033	0	0	0	0.0%
October 2033	61	0	1,042	5.5%
January 2034	479	15	31,376	1.5%
Year 7	**541**	**15**	**32,418**	**1.7%**

Table 6.9 Modelled discharges from MWD1 fore wet rainfall years (90%ile) relative to flow volumes in Charlotte River at SW5 (incl. MWD1 releases)

Project quarter	Discharge volume (ML)	Sediment dam spills (ML)	Charlotte River runoff volume at SW5 (ML)	% streamflow comprising MWD1 discharge
April 2027	0	0	3,509	0.0%
July 2027	0	0	3,509	0.0%
October 2027	0	0	11,026	0.0%
January 2028	82	46	52,640	0.2%
Year 1	**82**	**46**	**70,684**	**0.2%**
April 2028	9	0	3,507	0.2%
July 2028	9	0	3,507	0.2%
October 2028	23	0	11,090	0.2%
January 2029	431	145	52,652	0.8%
Year 2	**472**	**145**	**70,756**	**0.9%**
April 2029	36	5	3,448	1.0%
July 2029	36	0	3,448	1.0%
October 2029	145	0	10,667	1.3%
January 2030	429	152	52,653	0.8%
Year 3	**645**	**157**	**70,215**	**1.1%**
April 2030	41	5	3,201	1.3%
July 2030	41	0	3,201	1.3%
October 2030	213	0	10,155	2.1%
January 2031	507	155	52,653	1.0%
Year 4	**803**	**160**	**69,211**	**1.4%**

Project quarter	Discharge volume (ML)	Sediment dam spills (ML)	Charlotte River runoff volume at SW5 (ML)	% streamflow comprising MWD1 discharge
April 2031	46	5	3,201	1.4%
July 2031	46	0	3,201	1.4%
October 2031	224	0	9,416	2.3%
January 2032	575	156	52,651	1.1%
Year 5	**891**	**162**	**68,470**	**1.5%**
April 2032	46	5	3,203	1.4%
July 2032	46	0	3,203	1.4%
October 2032	241	0	10,342	2.3%
January 2033	604	156	52,653	1.1%
Year 6	**937**	**162**	**69,401**	**1.6%**
April 2033	46	5	3,448	1.3%
July 2033	46	0	3,448	1.3%
October 2033	252	0	10,663	2.3%
January 2034	610	158	53,504	1.1%
Year 7	**954**	**163**	**71,062**	**1.5%**

6.5.5 Supply risk

Figure 6.6 shows the predicted annual supply risk over the simulation period. The results show:

- External water supply would generally be required for Construction Phase (Year 1), where water is required for the initial development of the box cut and mine water infrastructure, and in the Operational Phase (Year 2 only) for very dry climatic conditions.
- The predicted additional volumes required to meet site demands for very dry climatic conditions (99%ile), include:
  - Site construction demands: up to 146 ML; and
  - Operational demands: up to 6 ML.
- To meet site demands in the first year, the following measures will be investigated:
  - Construction of temporary water handling infrastructure in the wet season to supply;
  - External water supply; and/or
  - Water extraction from groundwater bores, subject to applying for and being granted a groundwater extraction licence.
- For the remainder of the LOM, there would be sufficient water storage on site to meet all site operational demands.

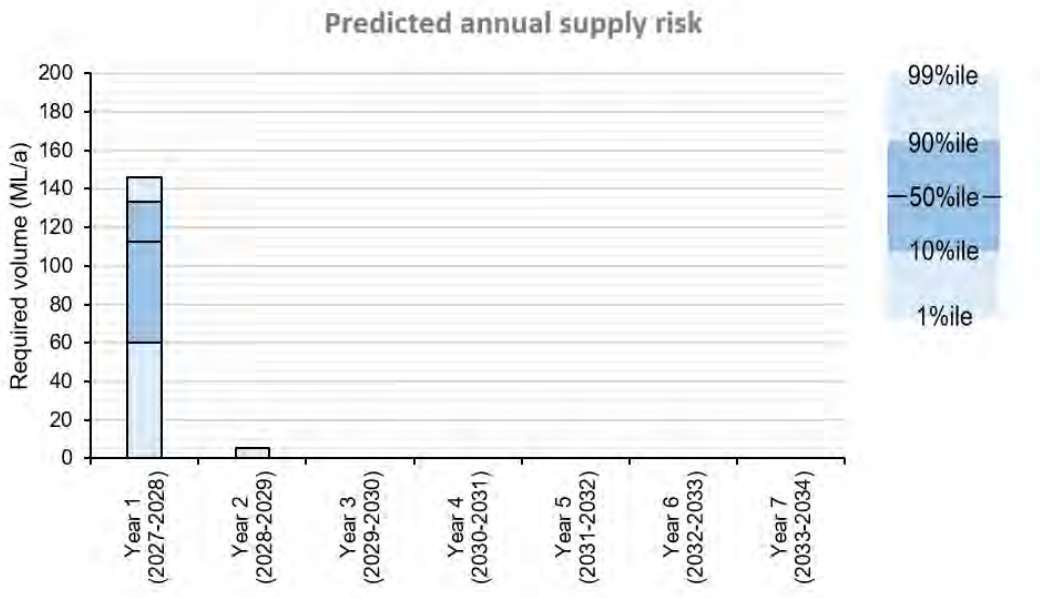


Figure 6.6 Predicted annual supply risk volumes over the life of mine

7 CONCLUSIONS

The results of the preliminary surface water assessment for the Lei Lithium Project show:

- Flooding in the Charlotte River has minimal impact within the mine lease area. Shallow inundation occurs in low-lying areas within the mining lease. Flood modelling has been updated to include the 10% AEP, 0.1% AEP and a PMP event for current climate, and a 1% AEP event for future climate.
- Based on the controlled releases assessment undertaken, discharges from the MWD1 to the receiving environment generally range between:
  - Dry rainfall years (10%ile): 1.8% to 3.3% of the predicted Charlotte River runoff volume;
  - Median rainfall years (50%ile): 1.0% to 5.5% of the predicted Charlotte River runoff volume; and
  - Wet rainfall years (90%ile): 0.2% to 2.3% of the predicted Charlotte River runoff volume.
- The proposed water management infrastructure is generally capable of supplying site demands under average climatic conditions during the Operational Phase based on collection of stormwater runoff from within the mining lease area. There is a chance for very dry climatic conditions that external water would be required to supplement water demands in Year 2.
- For the Construction Phase, water would generally be required to be sourced externally to meet site construction demands. Options to supplement water demands in the dry season should be considered such as:
  - A Surface Water Extraction Licence from existing nearby water storages and/or waterways;
  - Sourcing water from neighbouring mine sites;
  - Investigation into using mine-affected water to supplement other operational demand requirements (provided it meets any specific guideline requirements);
  - Consider groundwater extraction and bores; and/or
  - Yield additional water from catchment runoff from within the mine lease.

8 REFERENCES

ANZECC, 2000a	'*Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy Paper No 4',* Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000
ANZG, 2018	'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', Australian and New Zealand Governments and Australian state and territory governments, 2018
Ball, et al., 2019	Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (eds), 2019, '*Australian Rainfall and Runoff: A Guide to Flood Estimation'*, v4.2, Commonwealth of Australia (Geoscience Australia).
CloudGMS, 2026a	'Lei Lithium Project Groundwater Model Addendum Report', prepared for Lithium Plus Minerals Ltd, CloudGMS, 2026
DCCEEW, 2025	'Ready reckoner for flooding under climate change', Department of Climate Change, Energy, the Environment and Water, Canberra, February 2025. CC by 4.0.
Department of Environment, Science and Innovation (DESI), 2024	'*SILO Data Drill*', State of Queensland, viewed at http://www.longpaddock.qld.gov.au/silo/.
EcoLogical, 2026a	'Lei Lithium Groundwater Impact Assessment and Model Report', Prepared for EcOz', Eco Logical Australia, June 2026
EcOz, 2024a	'Ecological Assessment of EL31091 – Lithium Plus', report 222752-112, EcOz,, August 2024
Frater, 2005	*"Tin-tantalum pegmatite mineralisation of the Northern Territory, Northern Territory Geological Survey, Report 16"*, Northern Territory Government, 2005
NTG, 2010	'Water Quality Objectives for the Darwin Harbour Region – Background Document), Northern Territory Government, February 2010
SEA, 2010	'High Resolution Storm Tide and Climate Change Impacts Study', prepared for Northern Territory Department of Lands and Planning, Systems Engineering Australia (SEA), July 2010.

APPENDIX A RESPONSE TO SER COMMENTS

Environmental Factor	Topic	Summary of issues / recommendations raised in submission / Stakeholder	Response
Hydrological processes	Mine design – flood risk	**DLPE – Mining Division** It is recommended the Proponent apply Probable Maximum Precipitation (PMP) and include an updated flood model assessment to provide an indication of "worst-case" scenario and the likely flood water management structures required, their size and location.	Section 4 (Flooding) extends the preliminary flood assessment to the 10% AEP, 1% AEP, 0.1% AEP and the PMP.
	Mine design - Boxcut	**DLPE – Mining Division** • The mine design is in the conceptual stage until geotechnical assessments are undertaken to determine the best approach and will impact the quantity of water requirements for construction and operations. • Greater clarity is required to understand the project water supply and demand, particularly during the first year of operation where dust and its management will be a key risk.	Mine water infrastructure (mine dams on site) has been sized to have a risk of uncontrolled overflow of less than a 1% AEP and a risk of running out of water supply for operations of less than 1% AEP. Outcomes of the predicted supply risk on site is described in Section 6.5.5. Based on an average rainfall year the modelling predicts there will be a water supply shortfall of 103ML during the construction phase. To reduce this risk, construction the raw water and sedimentation dams will be prioritized, using water captured in temporary dams on overland flow paths. These temporary dams will be removed once the permanent dams are built. It may be necessary to import external water and/or extract groundwater, subject to a Groundwater Extraction Licence under the Water Act. For the operations would generally have sufficient water capacity to meet all site water demands.
	Surface water flows	**ECNT** • ECNT are concerned that all drainage lines from the project area flow into the Charlotte River.	All drainage lines from the project area flow into the Charlotte River. Mine water dams will manage groundwater from the underground and catchment runoff from the waste rock dump and ore stockpile areas. A sediment dam will manage sediment water generated from catchment runoff on the southern side of the site.
	Supplementary water use options	**ECNT** • A wide range of additional options to supplement water use are mentioned in the referral report, albeit with little detail, including surface water extraction, groundwater extraction, and harvesting of additional water from catchment run off. If these options are indeed being considered then they each need to be fully assessed for their impact on their respective areas, with appropriate studies undertaken to determine relevant impacts.	Water demands for the Project will be met primarily through water captured and recycled within the site water management system. Rainfall runoff from the mine lease is collected in the Raw Water Dam, Sediment Dam and Mine Water Dams, while groundwater entering the underground mine is recovered through dewatering and stored in the mine water dams. These water sources are reused to supply operational requirements, including dust suppression, truck washdown and underground mining activities. The water balance assessment indicates that captured surface runoff and recovered mine water are generally

Environmental Factor	Topic	Summary of issues / recommendations raised in submission / Stakeholder	Response
		• The Project's potential reliance on groundwater necessitates a greater degree of assessment compared to previously operating mines that relied on dam water.	sufficient to meet operational water demands throughout the mine life under average climatic conditions. A site water balance assessment is provided in Section 6. As stated above, based on an average rainfall year the modelling predicts there will be a water supply shortfall of 103ML during the construction phase. To reduce this risk, construction the raw water and sedimentation dams will be prioritized, using water captured in temporary dams on overland flow paths. These temporary dams will be removed once the permanent dams are built. It may be necessary to import external water and/or extract groundwater, subject to a Groundwater Extraction Licence under the Water Act.
	Preliminary flood assessment	**ECNT** • ECNT are concerned the preliminary flood assessment scenario of 1% annual exceedance probability is not adequate in comparison to the flood modelling prepared for the BP33 SER. Modelling for BP33 included 50%, 2%, 1%, 0.1% annual exceedance probability rates.	Section 4 (Flooding) extends the preliminary flood assessment to the 10% AEP, 1% AEP, 0.1% AEP and the PMP.
	Preliminary flood assessment	**ECNT** • It is also unclear if the modelling considers the context of climate change and sea level rise, including increased likelihood of extreme weather events.	Section 4 (Flooding) describes the uplift applied the rainfall depths and the Charlotte River predicted discharges. A sensitivity has also been undertaken for a future climate change for the 1% AEP flood event to SSP2-4.5 2050.
Inland water environmental quality	Development of site-specific guideline values	**ECNT** • The uncertainties that existing regarding the potential impact on hydrological processes, should be assessed as part of an EIS. • ECNT mention the collection of baseline data to inform site-specific guideline values should be undertaken and included in the next stage of the environmental assessment process.	Section 3 includes a water quality analysis of existing surface water and groundwater monitoring locations. Site specific guideline values have been developed based on the baseline data and relevant water quality guidelines such as ANZG (2018), Darwin Harbour Water Quality Objectives and key toxicants found in groundwater monitoring that show an increase when compared to the surface water.
	Surface water quality - Monitoring trigger levels	**DLPE – Flora and Fauna Division** • The Flora and Fauna Division notes that the referral report (Table 5-16) states that dilution factors will meet the trigger values, this is considered a low bar and dilution below the trigger values is preferred.	Water would be diluted to meet trigger values which are based on the water quality objectives and the baseline water quality. The suggested site-specific trigger values which are based on the baseline water quality are based on the 80th percentile, which ensures that the dilution achieved is generally below the baseline values. In addition, water quality monitoring will continue to be monitored in the vicinity of the site to ensure the environment is not being impacted.

Environmental Factor	Topic	Summary of issues / recommendations raised in submission / Stakeholder	Response

	Water management	**DLPE – Mining Division**
		• The referral identified the use of Darwin Harbour Water Quality Objectives (DHWQO) priority water quality indicators, with baseline for nitrogen in groundwater underneath the site exceeding these values naturally. DLPE recommend should waste discharge, in accordance with DHWQO not be achievable or not supported given the sensitive Charlotte River receptor, alternative water management strategies or a combination of strategies need to be developed (e.g. irrigation to land and waste discharge) to demonstrate appropriate management of water inventory.
			Water quality will be regularly monitored in accordance with the water quality monitoring programs in the WMP. This will provide early detection of any elevated contaminants from mining. TARPs will be implemented to identify any ongoing issues with regards to water quality on site and an investigation will be undertaken to identify the appropriate water treatment measure, if any elevated contaminants are identified.
			Alternative strategies may be required to be investigated, which include the following measures:
			• Water treatment measures to mitigate any high traces of toxicants in groundwater, which may include:
			  ○ Carbon filters for Iron;
			  ○ Phoslock for Total Phosphorus;
			  ○ Coagulating and Flocculating agents
			  ○ Reverse Osmosis treatment
			  ○ Resin filtration
			• Additional storage dams to manage excess water on site.
			• Evaporation fans to reduce the available water on site.

APPENDIX B PRELIMINARY FLOOD MAPS

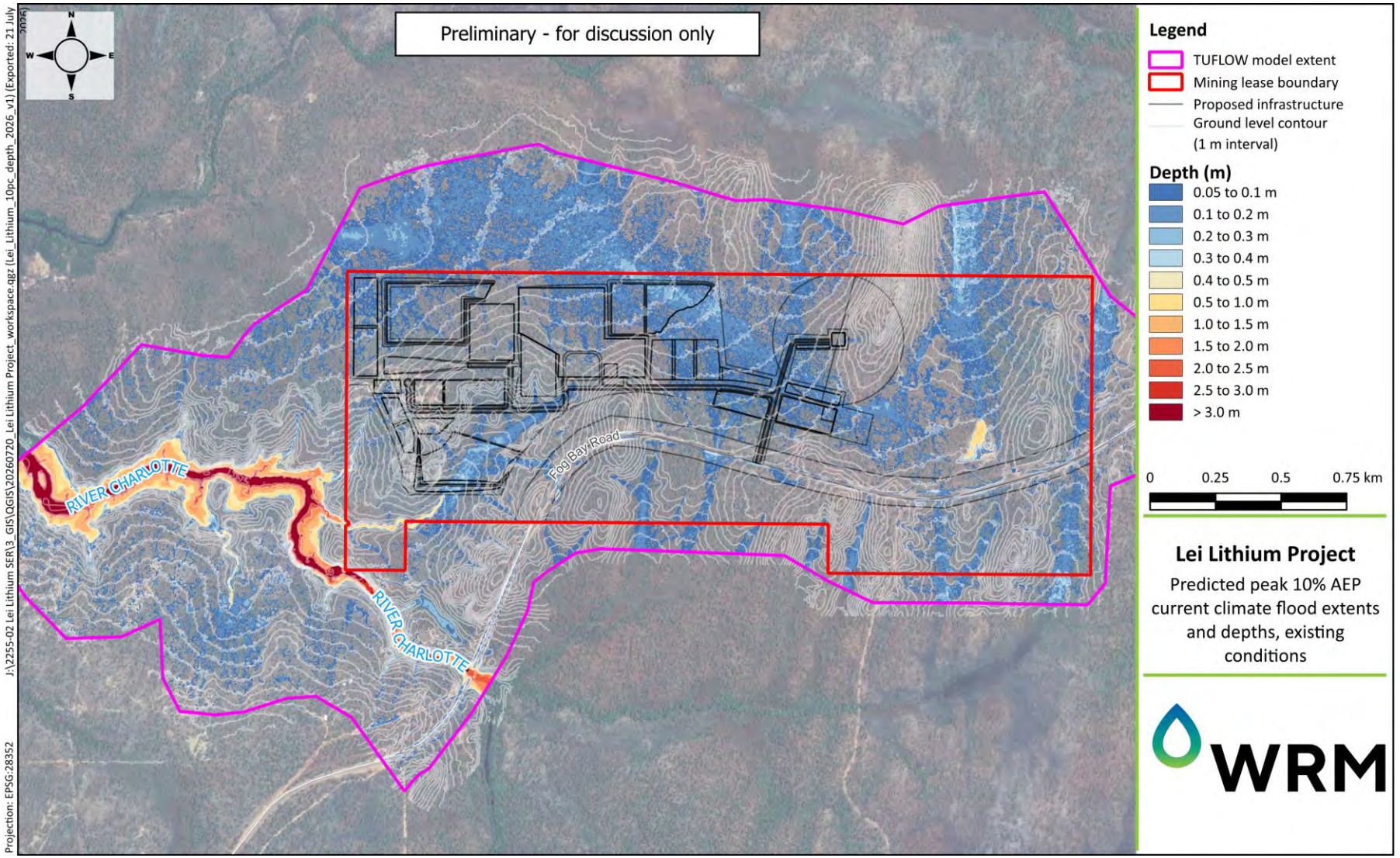


Figure B.1 Preliminary TUFLOW model existing conditions flood extent and depths, 10% AEP current climate

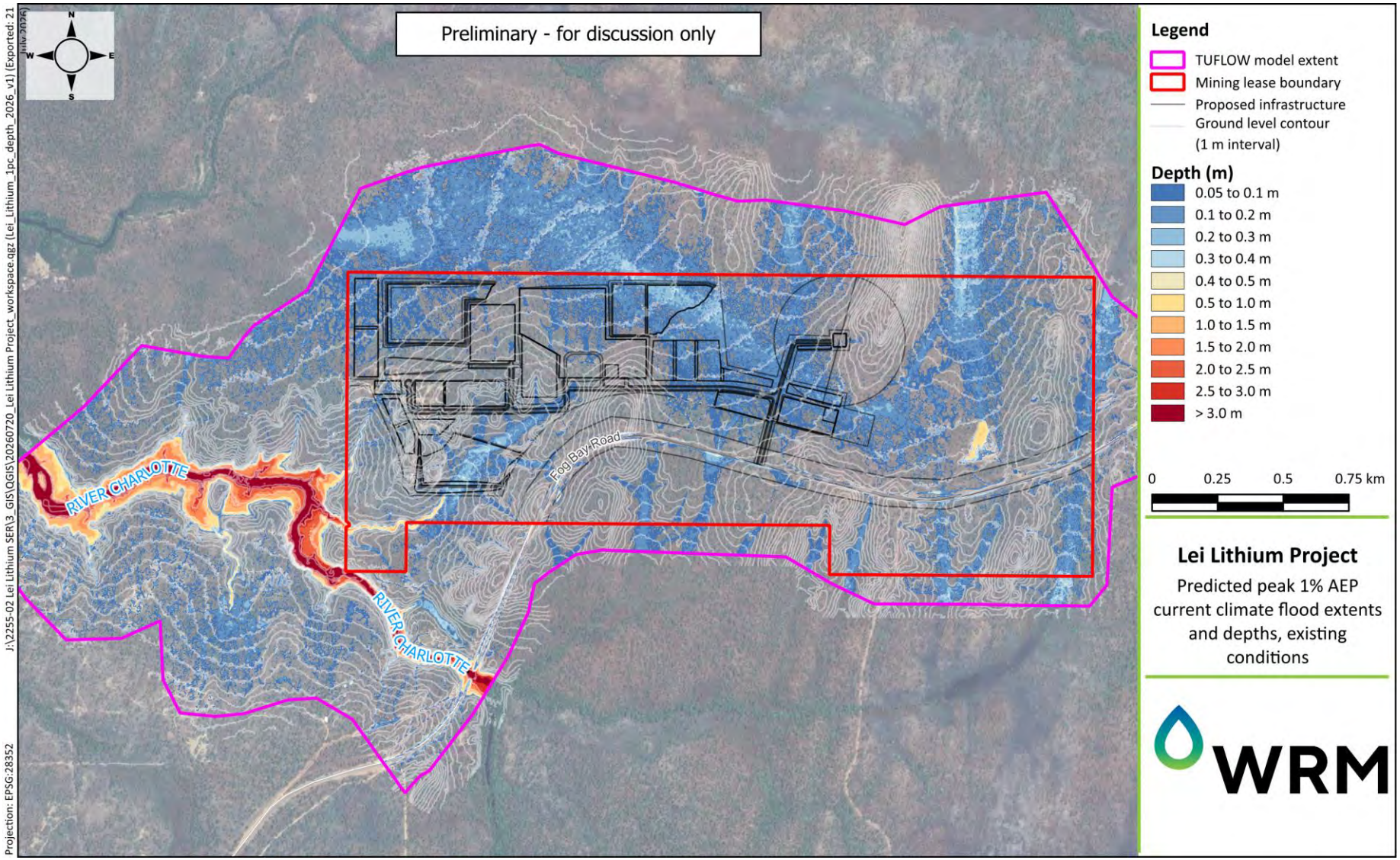


Figure B.2 Preliminary TUFLOW model existing conditions flood extent and depths, 1% AEP current climate

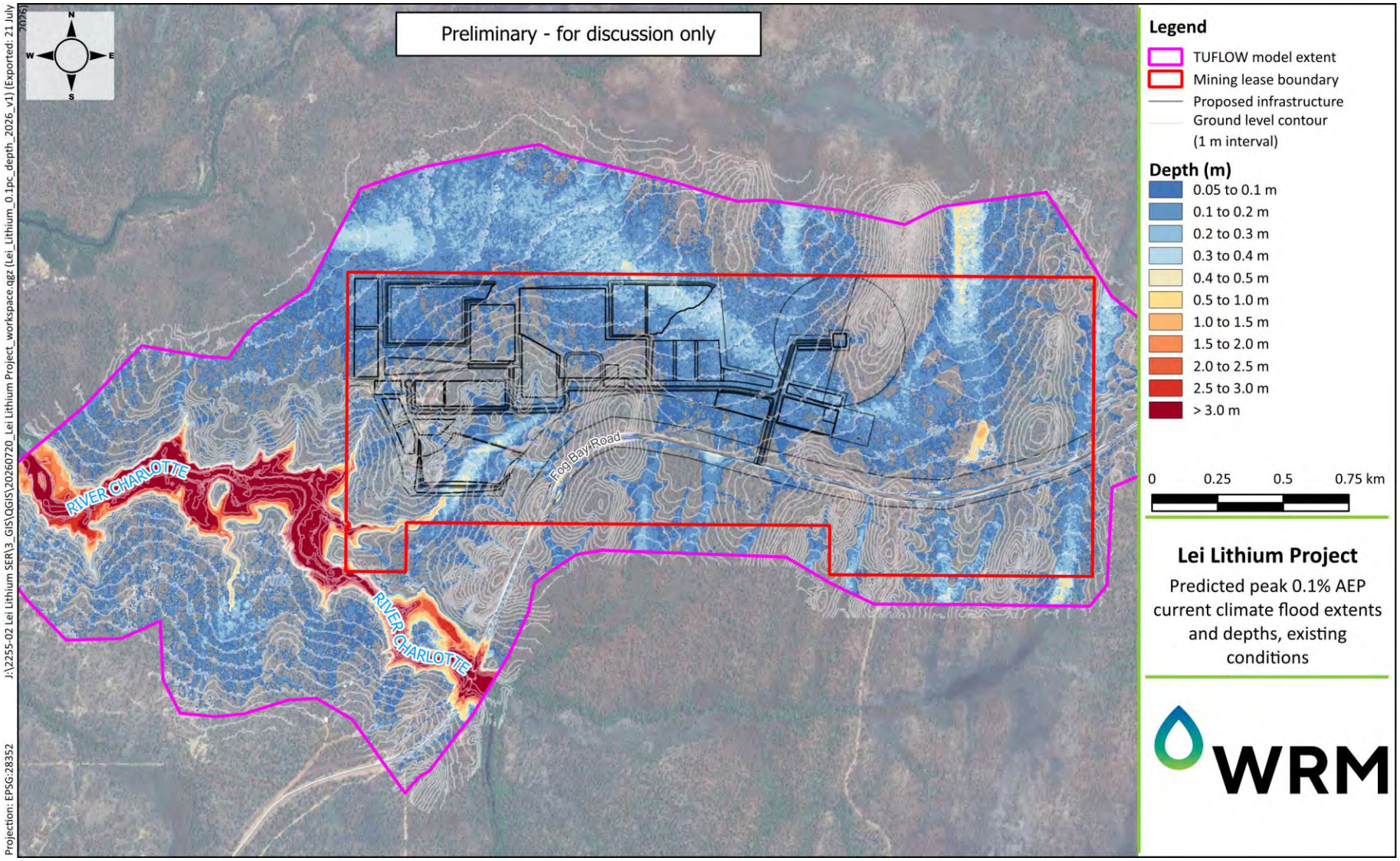


Figure B.3 Preliminary TUFLOW model existing conditions flood extent and depths, 0.1% AEP current climate

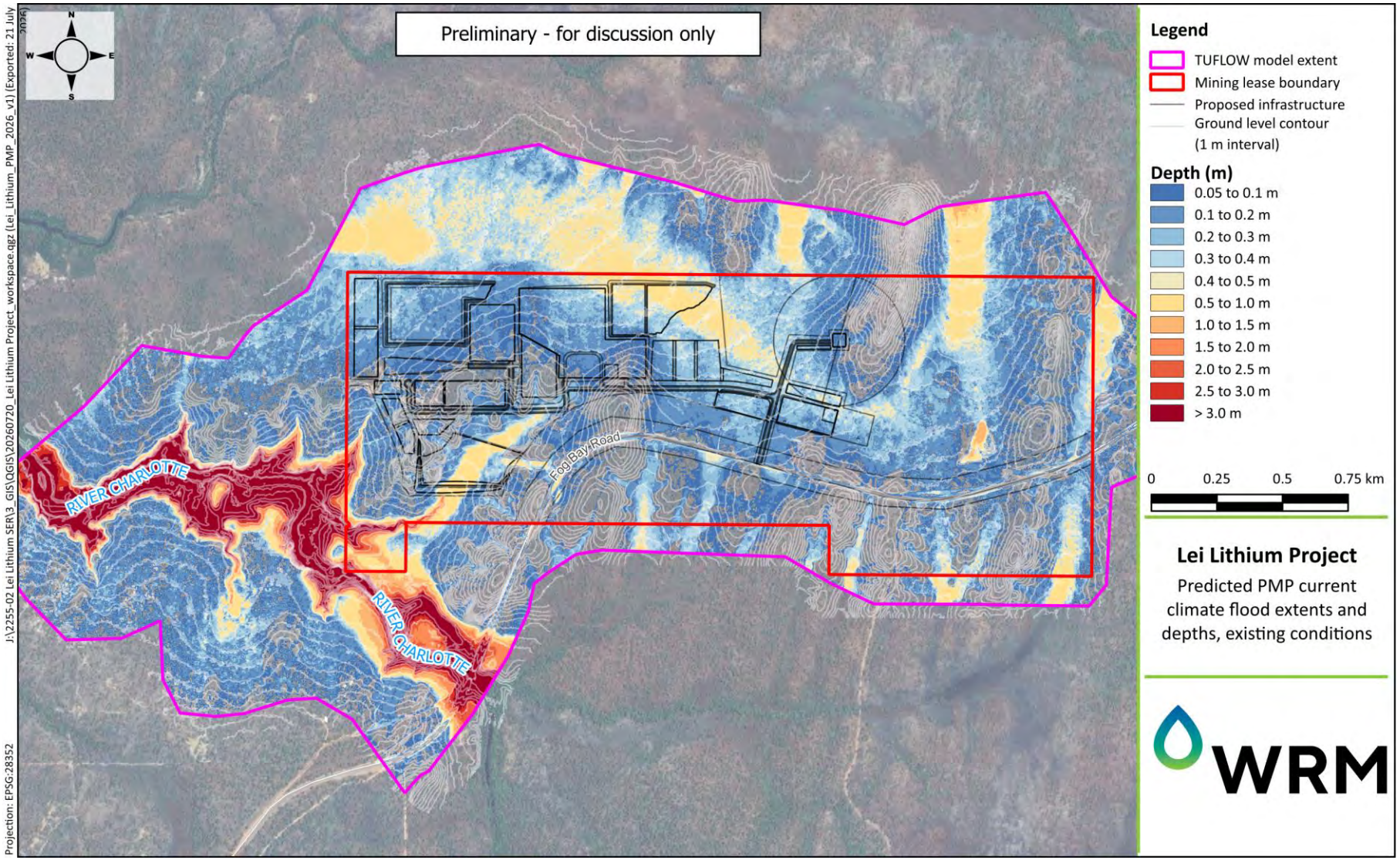


Figure B.4 Preliminary TUFLOW model existing conditions flood extent and depths, PMP current climate

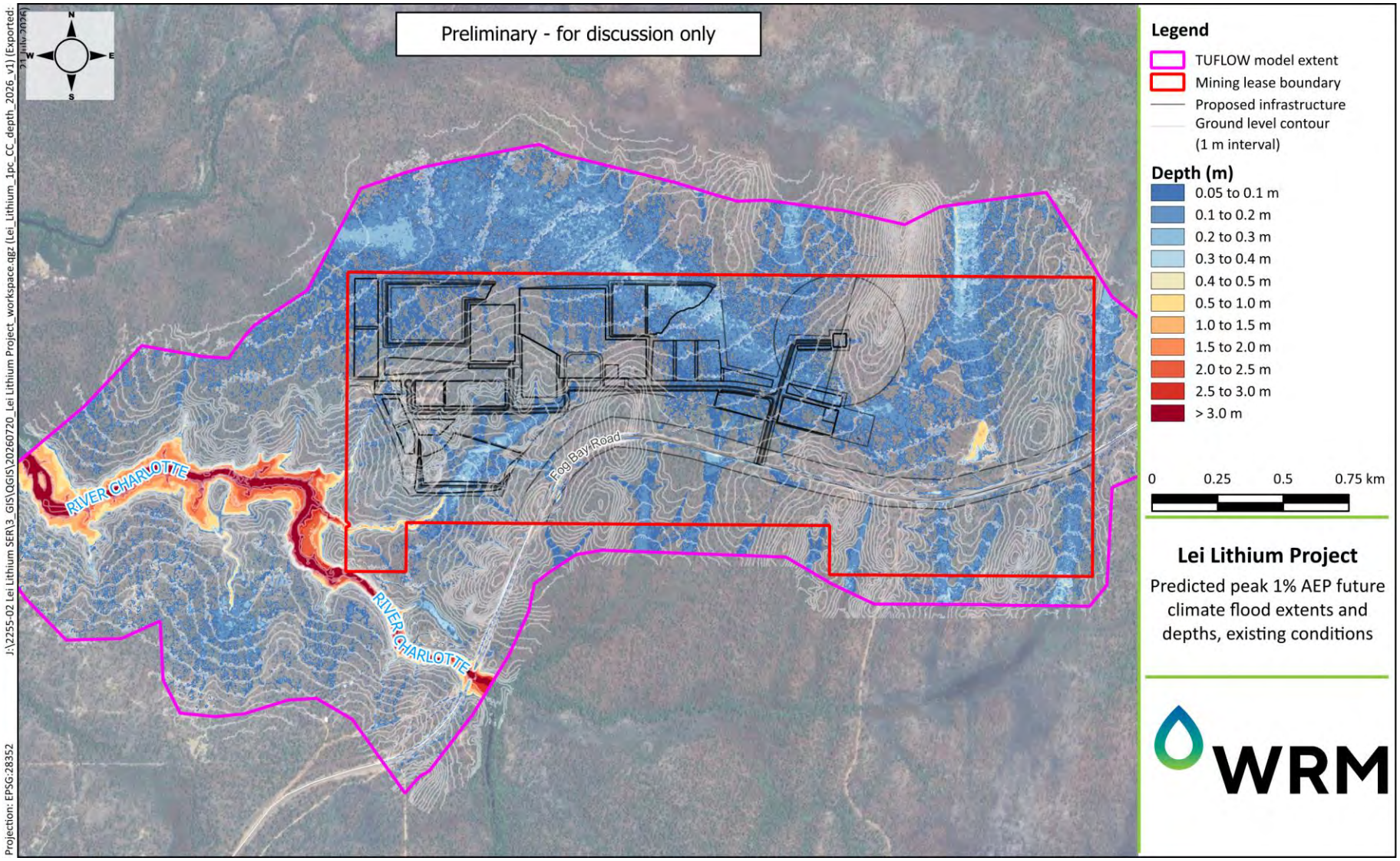


Figure B.5 Preliminary TUFLOW model existing conditions flood extent and depths, 1% AEP future climate

APPENDIX C DISCUSSION ON WATER QUALITY

C.1 OVERVIEW

Baseline surface water quality monitoring has been undertaken in the vicinity of the Lei Lithium site. The surface water monitoring stations has been categorised into four main categories:

- The downstream reaches of the Charlotte River (SW5):
  - Characterises the lower reaches of the Charlotte River at the proposed downstream monitoring location, which exhibits brackish/estuarial stream characteristics, indicating waters being saline compared to local freshwater ephemeral streams.
- The upstream reaches of the Charlotte River (SW3 and New Upstream):
  - Characterises the upper reaches of the Charlotte River which are generally exhibit more freshwater characteristics compared to the downstream reaches at SW5. The water quality further downstream (SW3) is more frequently influenced by sea waters compared to the upstream monitoring location (New Upstream) and transition between freshwater and brackish water during periods of high tide.
- Local site streams (SW1, SW2 and SW4):
  - Characterises the local overland flow catchment on site, which is likely to represent the local drainage on site. The water quality generally exhibits freshwater characteristics, however, can be influence by seawater during periods of high tide.
- The unnamed northern tributary of the Charlotte River (New 1 and New 2):
  - Characterises the catchment to the north, which includes an existing mine site (BP33 underground) upstream of the existing monitoring locations. The downstream location (New 1) generally transitions between freshwater and brackish water depending on the tide, however is generally more brackish than fresh. The upstream location (New 2) is generally fresh water.

This assessment describes the water quality characteristics of the local and northern unnamed tributary. The results show:

- Downstream reaches of Charlotte River:
  - At SW5:
    - The electrical conductivity at SW5 located in the downstream reaches of the Charlotte River, is generally very saline across the 20th - 80th percentile range (between 15,502 µS/cm to 52,115 µS/cm).
    - The pH range is generally neutral (6.86 pH to 7.35 pH for the 20th to 80th percentile).
    - Nutrients are generally high in Total Nitrogen (between 0.2 mg/L and 0.5 mg/L for the 20th to 80th percentile) and slightly elevated for Total Phosphorus (between 0.01 mg/L to 0.054 mg/L for the 20th to 80th percentile).
    - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are generally elevated above the LOR.
    - Other naturally elevated metals include:
      - Lithium, which may be attributed to the Lithium ore deposit in the area; and
      - Manganese.
- Upstream reaches of Charlotte River:
  - At SW3:

- The electrical conductivity at SW3 is generally lower across the 20th - 80th percentile range (between 56.6 µS/cm and 44,010 µS/cm) when compared against the downstream reaches at SW5. The salinity range indicates that SW3 transitions between freshwater and brackish/sea water depending on the tide level.
- The pH range is slightly more acidic compared to the downstream reaches at SW5 (6.15 pH to 7.19 pH for the 20th to 80th percentile).
- Nutrients (both Total Nitrogen and Total Phosphorus) are generally the same as SW5.
- Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are generally elevated towards the upper end (50th to 80% percentile) of the water quality samples undertaken, and on par with freshwater for lower end (20th percentile).
- Elevated dissolved metals above the SW5 samples, include:
  - Barium, Manganese and Iron.
- The remaining dissolved metals are either similar or lower than the downstream reaches of the Charlotte River.

- At New Upstream:
  - The electrical conductivity at New upstream is significantly lower across the 20th - 80th percentile range (between 40.5 µS/cm and 521 µS/cm) when compared against the downstream stations (SW5 and SW3). The salinity range indicates that New Upstream is generally freshwater.
  - The pH range is slightly more acidic compared to the downstream reaches at SW5 (6.06 pH to 7.80 pH for the 20th to 80th percentile).
  - Nutrients (both Total Nitrogen and Total Phosphorus) are slightly lower compared to the SW5 location.
  - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are significantly lower compared to SW5 and can generally be classified as freshwater.
  - Elevated dissolved metals include:
    - Barium, Manganese and Iron.
    - The remaining dissolved metals are either similar or lower than the downstream reaches of the Charlotte River.

- Local site streams:
  - At SW1:
    - The electrical conductivity at SW1 is significantly lower across the 20th - 80th percentile range (between 30.1 µS/cm and 260.5 µS/cm) when compared to the Charlotte River locations. The salinity range indicates that SW1 is generally freshwater.
    - The pH range is slightly more acidic compared to the Charlotte River locations (5.87 pH to 6.41 pH for the 20th to 80th percentile).
    - Nutrients (both Total Nitrogen and Total Phosphorus) are slightly lower when compared to the Charlotte River locations.
    - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are significantly lower compared to SW5 and can generally be classified as freshwater.
    - Elevated dissolved metals include:
      - Barium, Manganese and Iron.
      - The remaining dissolved metals are either similar or lower than the Charlotte River catchment.

- At SW2:
  - The electrical conductivity at SW2 is significantly lower across the 20th - 80th percentile range (between 55.9 µS/cm and 18,180 µS/cm) when compared to the Charlotte River locations. The salinity range indicates that SW2 transitions between freshwater and brackish/sea water depending on the tide level.
  - The pH range is slightly more acidic compared to the Charlotte River locations (5.95 pH to 7.04 pH for the 20th to 80th percentile).
  - Nutrients (both Total Nitrogen and Total Phosphorus) are slightly lower when compared to the Charlotte River locations.
  - Ammonia is slightly higher when compared against the 80th percentile.
  - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are generally elevated towards the upper end (80% percentile) of the water quality samples undertaken, and on par with freshwater for lower end (20th to 50th percentile).
  - Elevated dissolved metals include:
    - Barium, Manganese and Iron.
    - The remaining dissolved metals are either similar or lower than the Charlotte River catchment.
- At SW4:
  - The electrical conductivity at SW4 is significantly lower across the 20th - 80th percentile range (between 62 µS/cm and 474 µS/cm) when compared against the downstream stations (SW5 and SW3). The salinity range indicates that SW4 is generally freshwater.
  - The pH range is slightly more acidic compared to the Charlotte River locations (5.83 pH to 6.07 pH for the 20th to 80th percentile).
  - Nutrients (both Total Nitrogen and Total Phosphorus) are slightly lower when compared to the Charlotte River catchment.
  - Ammonia is slightly higher when compared against the 80th percentile.
  - Parameters associated with marine waters (Anions and Cations, Boron, Strontium, and Barium) are significantly lower compared to SW5 and can generally be classified as freshwater.
  - Elevated dissolved metals include:
    - Iron.
    - The remaining dissolved metals are either similar or lower than the Charlotte River catchment.

- Unnamed northern tributary:
  - At New 1:
    - The electrical conductivity at New 1 is generally lower across the 20th percentile (647 µS/cm) and generally similar for the 50th to 80th percentile range (23,838 µS/cm and 55,648 µS/cm) when compared against the downstream Charlotte River station (SW5). The salinity range indicates that New 1 transitions between freshwater and brackish/sea water depending on the tide level (albeit more brackish water than freshwater).
    - The pH range is slightly more acidic compared to the Charlotte River locations (6.16 pH to 7.15 pH for the 20th to 80th percentile).
    - Nutrients (both Total Nitrogen and Total Phosphorus) are generally very similar compared to the downstream Charlotte River monitoring location.
    - Elevated dissolved metals include:

        - Barium, Manganese and Iron.
        - The remaining dissolved metals are either similar or lower than the Charlotte River catchment.
- At New 2:
    - The electrical conductivity at New 2 is significantly lower across the 20th - 80th percentile range (between 27.8 µS/cm and 868.8 µS/cm) when compared to the Charlotte River locations. The salinity range indicates that New 2 is generally freshwater.
    - The pH range is slightly more acidic compared to the Charlotte River locations (6.07 pH to 6.70 pH for the 20th to 80th percentile).
    - Nutrients (both Total Nitrogen and Total Phosphorus) are generally very similar compared to the downstream Charlotte River monitoring location.
    - Elevated dissolved metals include:
        - Barium, Manganese and Iron.
        - The remaining dissolved metals are either similar or lower than the Charlotte River catchment.

Table C.1 Site background surface water quality assessment (SW1)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		13	5.87	6.04	6.41
Temperature	°C	13	28.02	29.34	29.89
Electrical Conductivity	µS/cm	13	30.08	46.0	260.5
Total Dissolved Solids	mg/L	13	18.8	29.9	159
Salinity	ppt	13	0.01	0.02	0.124
Dissolved Oxygen	%	13	61.56	80.5	90.54
Oxidation-Reduction Potential	mV	12	165.1	206.5	222.2
Turbidity	NTU	13	3.524	5	8.262
Total Suspended Solids	mg/L	9	2.5	2.5	8.2
Nutrients					
Ammonia	mg/L	13	0.011	0.04	0.188
Nitrite	mg/L	13	0.005	0.005	0.005
Nitrate	mg/L	13	0.005	0.005	0.005
Nitrite + Nitrate (as NOx)	mg/L	13	0.005	0.005	0.005
Total Kjeldahl Nitrogen	mg/L	13	0.1	0.2	0.36
Total Nitrogen	mg/L	13	0.1	0.2	0.36
Total Phosphorus	mg/L	13	0.005	0.005	0.048
Reactive Phosphorus	mg/L	13	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	11	0.5	0.5	1
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	13	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	13	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	13	4.4	7	10
Total Alkalinity as CaC03	mg/L	13	4.4	7	10
Sulfate as S04	mg/L	13	0.5	0.5	2
Chloride	mg/L	13	3	4	4
Calcium	mg/L	13	0.5	0.5	0.5
Magnesium	mg/L	13	0.5	0.5	0.8
Sodium	mg/L	13	3	4	4
Potassium	mg/L	13	0.5	0.5	0.5
Total Anions	mg/L	13	0.194	0.23	0.34
Total Cations	mg/L	13	0.13	0.17	0.244

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	9	0.5	0.5	9.2
Dissolved metals					
Aluminium Al	mg/L	13	0.005	0.005	0.02
Antimony Sb	mg/L	1	0.0005	0.0005	0.0005
Arsenic As	mg/L	13	0.0005	0.001	0.001
Beryllium Be	mg/L	12	0.0005	0.0005	0.0005
Barium Ba	mg/L	12	0.0142	0.0175	0.02
Bismuth Bi	mg/L	1	0.0005	0.0005	0.0005
Cadmium Cd	mg/L	13	0.00005	0.00005	0.00005
Caesium	mg/L	2	0.0005	0.0005	0.0005
Chromium	mg/L	13	0.0005	0.0005	0.0005
Cobalt Co	mg/L	12	0.0005	0.0005	0.001
Copper Cu	mg/L	13	0.0005	0.0005	0.0005
Lead Pb	mg/L	13	0.0005	0.0005	0.0005
Lithium Li	mg/L	13	0.0034	0.005	0.0066
Manganese Mn	mg/L	11	0.016	0.031	0.075
Molybdenum Mo	mg/L	1	0.0005	0.0005	0.0005
Nickel Ni	mg/L	13	0.0005	0.0005	0.0005
Rubidium Rb	mg/L	1	0.002	0.002	0.002
Selenium Se (Total)	mg/L	12	0.005	0.005	0.005
Silver Ag	mg/L	2	0.0005	0.0005	0.0005
Strontium	mg/L	2	0.003	0.003	0.003
Thorium	mg/L	2	0.0005	0.0005	0.0005
Tin	mg/L	2	0.0005	0.0005	0.0005
Titanium	mg/L	1	0.005	0.005	0.005
Uranium U	mg/L	2	0.0005	0.0005	0.0005
Vanadium V	mg/L	12	0.005	0.005	0.005
Zinc Zn	mg/L	13	0.0025	0.0025	0.0046
Boron	mg/L	12	0.025	0.025	0.025
Iron Fe	mg/L	13	0.078	0.14	0.212
Mercury	mg/L	13	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	13	10	10	10
C10 - C14 Fraction	µg/L	13	25	25	25
C15 - C28 Fraction	µg/L	13	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	13	25	25	25
C10 - C36 Fraction (sum)	µg/L	13	25	25	25
C6 - C10 Fraction	mg/L	13	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	13	10	10	10
>C10 - C16 Fraction	mg/L	13	50	50	50
>C16 - C34 Fraction	mg/L	13	50	50	50
>C34 - C40 Fraction	mg/L	13	50	50	50
>C10 - C40 Fraction (sum)	mg/L	13	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	13	50	50	50
Benzene	µg/L	13	0.5	0.5	0.5
Toluene	µg/L	13	1	1	1
Ethylbenzene	µg/L	13	1	1	1
meta-Xylene	µg/L	13	1	1	1
para-Xylene	µg/L	13	1	1	1
ortho-Xylene	µg/L	13	1	1	1
Total Xylenes	µg/L	13	1	1	1
Sum of BTEX	µg/L	13	0.5	0.5	0.5
Naphthalene	µg/L	13	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	13	98.34	104	109.2
Toluene-D8	%	13	93.4	99.8	104.4
4-Bromofluorobenzene	%	13	99.56	108	119.6

Table C.2 Site background surface water quality assessment (SW2)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		23	5.952	6.5	7.038
Temperature	°C	23	25.44	28.6	29.54
Electrical Conductivity	µS/cm	23	55.94	686	18180.8
Total Dissolved Solids	mg/L	23	36.34	446	11820.4
Salinity	ppt	23	0.03	0.33	10.808
Dissolved Oxygen	%	23	54.56	75	85.34
Oxidation-Reduction Potential	mV	22	143.62	187.05	220.18
Turbidity	NTU	23	2.036	4.27	5.134
Total Suspended Solids	mg/L	18	2.5	2.5	7.6
Nutrients					
Ammonia	mg/L	23	0.007	0.06	0.202
Nitrite	mg/L	23	0.005	0.005	0.005
Nitrate	mg/L	23	0.005	0.005	0.005
Nitrite + Nitrate (as NOx)	mg/L	23	0.005	0.005	0.005
Total Kjeldahl Nitrogen	mg/L	23	0.2	0.25	0.4
Total Nitrogen	mg/L	23	0.2	0.3	0.4
Total Phosphorus	mg/L	23	0.005	0.01	0.04
Reactive Phosphorus	mg/L	23	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	20	0.5	0.5	2
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	23	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	23	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	23	6	9	54.4
Total Alkalinity as CaC03	mg/L	23	6	9	54.4
Sulfate as S04	mg/L	23	0.7	5	1120
Chloride	mg/L	23	15.6	46	7528
Calcium	mg/L	23	0.5	2	166
Magnesium	mg/L	23	1	4	485
Sodium	mg/L	23	8.8	29	3664
Potassium	mg/L	23	0.5	1	135.8
Total Anions	mg/L	23	0.626	1.58	236.64
Total Cations	mg/L	23	0.482	1.72	211

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	17	4.8	49	4956
Dissolved metals					
Aluminium Al	mg/L	22	0.005	0.015	0.05
Antimony Sb	mg/L	1	0.0005	0.0005	0.0005
Arsenic As	mg/L	23	0.0005	0.0005	0.0038
Beryllium Be	mg/L	22	0.0005	0.0005	0.0041
Barium Ba	mg/L	22	0.016	0.025	0.0328
Bismuth Bi	mg/L	1	0.0005	0.0005	0.0005
Cadmium Cd	mg/L	23	0.00005	0.00005	0.00032
Caesium	mg/L	3	0.0005	0.0005	0.0005
Chromium	mg/L	23	0.0005	0.0005	0.0032
Cobalt Co	mg/L	22	0.0005	0.0005	0.0042
Copper Cu	mg/L	23	0.0005	0.0005	0.0046
Lead Pb	mg/L	23	0.0005	0.0005	0.0032
Lithium Li	mg/L	22	0.003	0.0045	0.07
Manganese Mn	mg/L	20	0.0134	0.0285	0.0588
Molybdenum Mo	mg/L	1	0.0005	0.0005	0.0005
Nickel Ni	mg/L	23	0.0005	0.0005	0.0034
Rubidium Rb	mg/L	1	0.002	0.002	0.002
Selenium Se (Total)	mg/L	22	0.005	0.005	0.017
Silver Ag	mg/L	3	0.0005	0.0005	0.0005
Strontium	mg/L	3	0.0074	0.011	0.017
Thorium	mg/L	3	0.0005	0.0005	0.0005
Tin	mg/L	3	0.0005	0.0005	0.0005
Titanium	mg/L	2	0.005	0.005	0.005
Uranium U	mg/L	3	0.0005	0.0005	0.0005
Vanadium V	mg/L	22	0.005	0.005	0.041
Zinc Zn	mg/L	23	0.0025	0.0025	0.0186
Boron	mg/L	22	0.025	0.025	1.606
Iron Fe	mg/L	22	0.062	0.135	0.418
Mercury	mg/L	23	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	23	10	10	10
C10 - C14 Fraction	µg/L	23	25	25	25
C15 - C28 Fraction	µg/L	23	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	23	25	25	25
C10 - C36 Fraction (sum)	µg/L	23	25	25	25
C6 - C10 Fraction	mg/L	23	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	23	10	10	10
>C10 - C16 Fraction	mg/L	23	50	50	50
>C16 - C34 Fraction	mg/L	23	50	50	50
>C34 - C40 Fraction	mg/L	23	50	50	50
>C10 - C40 Fraction (sum)	mg/L	23	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	23	50	50	50
Benzene	µg/L	23	0.5	0.5	0.5
Toluene	µg/L	23	1	1	1
Ethylbenzene	µg/L	23	1	1	1
meta-Xylene	µg/L	23	1	1	1
para-Xylene	µg/L	22	1	1	1
ortho-Xylene	µg/L	23	1	1	1
Total Xylenes	µg/L	23	1	1	1
Sum of BTEX	µg/L	23	0.5	0.5	0.5
Naphthalene	µg/L	23	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	23	97.46	108	115.6
Toluene-D8	%	23	91.78	101	109
4-Bromofluorobenzene	%	23	95.92	105	114.6

Table C.3 Site background surface water quality assessment (SW3)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		31	6.15	6.78	7.19
Temperature	°C	31	26.6	29	30.9
Electrical Conductivity	µS/cm	31	56.6	9512	44010
Total Dissolved Solids	mg/L	31	37	6181.5	26760
Salinity	ppt	31	0.02	5.29	28.43
Dissolved Oxygen	%	31	63.3	86.9	92.7
Oxidation-Reduction Potential	mV	30	162.6	209	240.46
Turbidity	NTU	31	3.21	5.54	10.98
Total Suspended Solids	mg/L	26	2.5	8	28
Nutrients					
Ammonia	mg/L	31	0.02	0.09	0.19
Nitrite	mg/L	31	0.005	0.005	0.005
Nitrate	mg/L	31	0.005	0.005	0.005
Nitrite + Nitrate (as NOx)	mg/L	31	0.005	0.005	0.005
Total Kjeldahl Nitrogen	mg/L	31	0.2	0.4	0.5
Total Nitrogen	mg/L	31	0.2	0.4	0.5
Total Phosphorus	mg/L	31	0.005	0.03	0.05
Reactive Phosphorus	mg/L	31	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	28	0.5	0.5	3.6
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	31	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	31	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	31	6	26	107
Total Alkalinity as CaC03	mg/L	31	6	26	107
Sulfate as S04	mg/L	31	4	366	2380
Chloride	mg/L	31	31	2510	15600
Calcium	mg/L	31	0.5	56	402
Magnesium	mg/L	31	2	170	1140
Sodium	mg/L	31	17	1410	9500
Potassium	mg/L	31	0.5	48	345
Total Anions	mg/L	31	1.04	78.9	489
Total Cations	mg/L	31	0.9	79.4	537

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	26	4.82	2009	5820
Dissolved metals					
Aluminium Al	mg/L	30	0.005	0.04	0.05
Antimony Sb	mg/L	1	0.0005	0.0005	0.0005
Arsenic As	mg/L	31	0.0005	0.001	0.005
Beryllium Be	mg/L	30	0.0005	0.0005	0.005
Barium Ba	mg/L	30	0.0116	0.018	0.0222
Bismuth Bi	mg/L	1	0.0005	0.0005	0.0005
Cadmium Cd	mg/L	31	0.00005	0.00005	0.0005
Caesium	mg/L	3	0.0005	0.0005	0.0005
Chromium	mg/L	31	0.0005	0.0005	0.005
Cobalt Co	mg/L	30	0.0005	0.0005	0.005
Copper Cu	mg/L	31	0.0005	0.001	0.005
Lead Pb	mg/L	31	0.0005	0.0005	0.005
Lithium Li	mg/L	30	0.002	0.031	0.1466
Manganese Mn	mg/L	28	0.0078	0.039	0.0676
Molybdenum Mo	mg/L	1	0.0005	0.0005	0.0005
Nickel Ni	mg/L	31	0.0005	0.001	0.005
Rubidium Rb	mg/L	1	0.002	0.002	0.002
Selenium Se (Total)	mg/L	30	0.005	0.005	0.05
Silver Ag	mg/L	3	0.0005	0.0005	0.0005
Strontium	mg/L	3	0.0074	0.011	0.2312
Thorium	mg/L	3	0.0005	0.0005	0.0005
Tin	mg/L	3	0.0005	0.0005	0.0005
Titanium	mg/L	2	0.005	0.005	0.005
Uranium U	mg/L	3	0.0005	0.0005	0.0005
Vanadium V	mg/L	30	0.005	0.005	0.05
Zinc Zn	mg/L	31	0.0025	0.0025	0.025
Boron	mg/L	30	0.025	0.69	4.068
Iron Fe	mg/L	30	0.05	0.055	0.136
Mercury	mg/L	31	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	31	10	10	10
C10 - C14 Fraction	µg/L	31	25	25	25
C15 - C28 Fraction	µg/L	31	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	31	25	25	25
C10 - C36 Fraction (sum)	µg/L	31	25	25	25
C6 - C10 Fraction	mg/L	31	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	31	10	10	10
>C10 - C16 Fraction	mg/L	31	50	50	50
>C16 - C34 Fraction	mg/L	31	50	50	50
>C34 - C40 Fraction	mg/L	31	50	50	50
>C10 - C40 Fraction (sum)	mg/L	31	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	31	50	50	50
Benzene	µg/L	31	0.5	0.5	0.5
Toluene	µg/L	31	1	1	1
Ethylbenzene	µg/L	31	1	1	1
meta-Xylene	µg/L	31	1	1	1
para-Xylene	µg/L	30	1	1	1
ortho-Xylene	µg/L	31	1	1	1
Total Xylenes	µg/L	31	1	1	1
Sum of BTEX	µg/L	31	0.5	0.5	0.5
Naphthalene	µg/L	31	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	31	98.1	105	112
Toluene-D8	%	31	93.8	99.5	112
4-Bromofluorobenzene	%	31	94.2	109	122

Table C.4 Site background surface water quality assessment (SW4)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		11	5.83	5.93	6.07
Temperature	°C	11	27.8	28.7	29.2
Electrical Conductivity	µS/cm	11	62	158.9	474
Total Dissolved Solids	mg/L	11	40	103	318.5
Salinity	ppt	11	0.03	0.07	0.24
Dissolved Oxygen	%	11	61.25	83.4	86.6
Oxidation-Reduction Potential	mV	10	161.42	221.8	241
Turbidity	NTU	11	1.21	2.69	5
Total Suspended Solids	mg/L	8	2.5	2.5	2.5
Nutrients					
Ammonia	mg/L	11	0.02	0.03	0.23
Nitrite	mg/L	11	0.005	0.005	0.005
Nitrate	mg/L	11	0.005	0.005	0.005
Nitrite + Nitrate (as NOx)	mg/L	11	0.005	0.005	0.005
Total Kjeldahl Nitrogen	mg/L	11	0.1	0.2	0.4
Total Nitrogen	mg/L	11	0.1	0.2	0.4
Total Phosphorus	mg/L	11	0.005	0.01	0.02
Reactive Phosphorus	mg/L	11	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	9	0.5	0.5	0.5
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	11	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	11	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	11	4	6	13
Total Alkalinity as CaC03	mg/L	11	4	6	13
Sulfate as S04	mg/L	11	2	4	7
Chloride	mg/L	11	12	31	51
Calcium	mg/L	11	0.5	0.5	1
Magnesium	mg/L	11	0.5	2	4
Sodium	mg/L	11	8	22	31
Potassium	mg/L	11	0.5	0.5	2
Total Anions	mg/L	11	0.56	1.06	1.66
Total Cations	mg/L	11	0.35	1.12	1.78

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	8	8	8	25.6
Dissolved metals					
Aluminium Al	mg/L	11	0.005	0.02	0.03
Antimony Sb	mg/L	0	-	-	-
Arsenic As	mg/L	11	0.0005	0.001	0.002
Beryllium Be	mg/L	10	0.0005	0.0005	0.0005
Barium Ba	mg/L	10	0.005	0.0075	0.009
Bismuth Bi	mg/L	0	-	-	-
Cadmium Cd	mg/L	11	0.00005	0.00005	0.00005
Caesium	mg/L	1	0.0005	0.0005	0.0005
Chromium	mg/L	11	0.0005	0.0005	0.0005
Cobalt Co	mg/L	10	0.0005	0.0005	0.0005
Copper Cu	mg/L	11	0.0005	0.0005	0.0005
Lead Pb	mg/L	11	0.0005	0.0005	0.0005
Lithium Li	mg/L	11	0.003	0.004	0.005
Manganese Mn	mg/L	9	0.005	0.007	0.0102
Molybdenum Mo	mg/L	0	-	-	-
Nickel Ni	mg/L	11	0.0005	0.0005	0.0005
Rubidium Rb	mg/L	0	-	-	-
Selenium Se (Total)	mg/L	10	0.005	0.005	0.005
Silver Ag	mg/L	1	0.0005	0.0005	0.0005
Strontium	mg/L	1	0.011	0.011	0.011
Thorium	mg/L	1	0.0005	0.0005	0.0005
Tin	mg/L	1	0.0005	0.0005	0.0005
Titanium	mg/L	1	0.005	0.005	0.005
Uranium U	mg/L	1	0.0005	0.0005	0.0005
Vanadium V	mg/L	10	0.005	0.005	0.005
Zinc Zn	mg/L	11	0.0025	0.0025	0.0025
Boron	mg/L	10	0.025	0.025	0.025
Iron Fe	mg/L	11	0.025	0.05	0.08
Mercury	mg/L	11	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	11	10	10	10
C10 - C14 Fraction	µg/L	11	25	25	25
C15 - C28 Fraction	µg/L	11	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	11	25	25	25
C10 - C36 Fraction (sum)	µg/L	11	25	25	25
C6 - C10 Fraction	mg/L	11	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	11	10	10	10
>C10 - C16 Fraction	mg/L	11	50	50	50
>C16 - C34 Fraction	mg/L	11	50	50	50
>C34 - C40 Fraction	mg/L	11	50	50	50
>C10 - C40 Fraction (sum)	mg/L	11	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	11	50	50	50
Benzene	µg/L	11	0.5	0.5	0.5
Toluene	µg/L	11	1	1	1
Ethylbenzene	µg/L	11	1	1	1
meta-Xylene	µg/L	11	1	1	1
para-Xylene	µg/L	11	1	1	1
ortho-Xylene	µg/L	11	1	1	1
Total Xylenes	µg/L	11	1	1	1
Sum of BTEX	µg/L	11	0.5	0.5	0.5
Naphthalene	µg/L	11	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	11	93.1	107	115
Toluene-D8	%	11	91.8	97.8	104
4-Bromofluorobenzene	%	11	95.4	109	123

Table C.5 Site background surface water quality assessment (SW5)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		25	6.862	7.1	7.346
Temperature	°C	25	26.56	29.5	31.36
Electrical Conductivity	µS/cm	25	15502	40029	52115.2
Total Dissolved Solids	mg/L	25	10562.6	26046	32679.2
Salinity	ppt	25	11.242	25.48	34.01
Dissolved Oxygen	%	25	69.28	83.8	90.56
Oxidation-Reduction Potential	mV	24	214.74	232.85	284.58
Turbidity	NTU	25	1.714	5.19	8.716
Total Suspended Solids	mg/L	20	2.5	7	24.2
Nutrients					
Ammonia	mg/L	25	0.052	0.13	0.198
Nitrite	mg/L	25	0.005	0.005	0.005
Nitrate	mg/L	25	0.005	0.005	0.006
Nitrite + Nitrate (as NOx)	mg/L	25	0.005	0.005	0.006
Total Kjeldahl Nitrogen	mg/L	25	0.2	0.4	0.5
Total Nitrogen	mg/L	25	0.2	0.4	0.5
Total Phosphorus	mg/L	25	0.01	0.025	0.054
Reactive Phosphorus	mg/L	25	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	23	0.5	2	4.6
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	25	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	25	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	25	53.8	115	129.4
Total Alkalinity as CaC03	mg/L	25	53.8	115	129.4
Sulfate as S04	mg/L	25	868	2450	2880
Chloride	mg/L	25	6664	15100	19060
Calcium	mg/L	25	144.8	393	461.4
Magnesium	mg/L	25	435.8	1140	1330
Sodium	mg/L	25	3660	9370	10820
Potassium	mg/L	25	137.6	337	403.2
Total Anions	mg/L	25	207	479	602.4
Total Cations	mg/L	25	205.2	527	611.4

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	21	2210	6010	6570
Dissolved metals					
Aluminium Al	mg/L	25	0.005	0.05	0.05
Antimony Sb	mg/L	1	0.0005	0.0005	0.0005
Arsenic As	mg/L	25	0.0005	0.005	0.005
Beryllium Be	mg/L	24	0.0005	0.005	0.005
Barium Ba	mg/L	24	0.011	0.013	0.016
Bismuth Bi	mg/L	1	0.0005	0.0005	0.0005
Cadmium Cd	mg/L	25	0.00005	0.0005	0.0005
Caesium	mg/L	2	0.0005	0.0005	0.0005
Chromium	mg/L	25	0.0005	0.005	0.005
Cobalt Co	mg/L	24	0.0005	0.005	0.005
Copper Cu	mg/L	25	0.0009	0.005	0.005
Lead Pb	mg/L	25	0.0005	0.005	0.005
Lithium Li	mg/L	25	0.0524	0.139	0.164
Manganese Mn	mg/L	23	0.0164	0.026	0.0368
Molybdenum Mo	mg/L	1	0.003	0.003	0.003
Nickel Ni	mg/L	25	0.0005	0.005	0.005
Rubidium Rb	mg/L	1	0.038	0.038	0.038
Selenium Se (Total)	mg/L	25	0.005	0.05	0.05
Silver Ag	mg/L	2	0.0005	0.0005	0.0005
Strontium	mg/L	2	1.984	2.245	2.506
Thorium	mg/L	2	0.0005	0.0005	0.0005
Tin	mg/L	2	0.0005	0.0005	0.0005
Titanium	mg/L	1	0.005	0.005	0.005
Uranium U	mg/L	2	0.0006	0.00075	0.0009
Vanadium V	mg/L	24	0.005	0.05	0.05
Zinc Zn	mg/L	25	0.0025	0.025	0.025
Boron	mg/L	24	1.564	3.63	4.646
Iron Fe	mg/L	25	0.025	0.05	0.05
Mercury	mg/L	25	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	25	10	10	10
C10 - C14 Fraction	µg/L	25	25	25	25
C15 - C28 Fraction	µg/L	25	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	25	25	25	25
C10 - C36 Fraction (sum)	µg/L	25	25	25	25
C6 - C10 Fraction	mg/L	25	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	25	10	10	10
>C10 - C16 Fraction	mg/L	25	50	50	50
>C16 - C34 Fraction	mg/L	25	50	50	50
>C34 - C40 Fraction	mg/L	25	50	50	50
>C10 - C40 Fraction (sum)	mg/L	25	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	25	50	50	50
Benzene	µg/L	25	0.5	0.5	0.5
Toluene	µg/L	25	1	1	1
Ethylbenzene	µg/L	25	1	1	1
meta-Xylene	µg/L	25	1	1	1
para-Xylene	µg/L	25	1	1	1
ortho-Xylene	µg/L	25	1	1	1
Total Xylenes	µg/L	25	1	1	1
Sum of BTEX	µg/L	25	0.5	0.5	0.5
Naphthalene	µg/L	25	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	25	98.2	108	115.8
Toluene-D8	%	25	94.82	104	112.8
4-Bromofluorobenzene	%	25	93.8	110	115.6

Table C.6 Site background surface water quality assessment (New 1)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		22	6.162	6.715	7.154
Temperature	°C	22	25.82	28.9	30.18
Electrical Conductivity	µS/cm	22	647.4	23837.5	55648
Total Dissolved Solids	mg/L	22	421	15496.5	36174.8
Salinity	ppt	22	0.316	14.33	36.772
Dissolved Oxygen	%	22	79.08	88.25	92.48
Oxidation-Reduction Potential	mV	22	185.96	224.56	257.48
Turbidity	NTU	22	3.514	5.48	7.604
Total Suspended Solids	mg/L	21	2.5	6	13
Nutrients					
Ammonia	mg/L	22	0.03	0.06	0.158
Nitrite	mg/L	22	0.005	0.005	0.005
Nitrate	mg/L	22	0.005	0.005	0.005
Nitrite + Nitrate (as NOx)	mg/L	22	0.005	0.005	0.005
Total Kjeldahl Nitrogen	mg/L	22	0.2	0.3	0.5
Total Nitrogen	mg/L	22	0.2	0.3	0.5
Total Phosphorus	mg/L	22	0.006	0.03	0.056
Reactive Phosphorus	mg/L	22	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	22	0.5	0.5	3
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	22	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	22	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	22	7.2	50	117.4
Total Alkalinity as CaC03	mg/L	22	7.2	50	117.4
Sulfate as S04	mg/L	22	8.4	981.5	2796
Chloride	mg/L	22	61.4	7105	17240
Calcium	mg/L	22	1.2	166.5	410.8
Magnesium	mg/L	22	3.4	457	1276
Sodium	mg/L	22	37.8	3815	10318
Potassium	mg/L	22	2	134.5	390
Total Anions	mg/L	22	1.934	222	547.2
Total Cations	mg/L	22	1.998	215	586.6

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	20	13.6	1415	6504
Dissolved metals					
Aluminium Al	mg/L	22	0.006	0.045	0.05
Antimony Sb	mg/L	0	-	-	-
Arsenic As	mg/L	22	0.0005	0.001	0.005
Beryllium Be	mg/L	22	0.0005	0.0005	0.005
Barium Ba	mg/L	22	0.0122	0.0175	0.0218
Bismuth Bi	mg/L	0	-	-	-
Cadmium Cd	mg/L	22	0.00005	0.00005	0.0005
Caesium	mg/L	0	-	-	-
Chromium	mg/L	22	0.0005	0.0005	0.005
Cobalt Co	mg/L	22	0.0005	0.00075	0.005
Copper Cu	mg/L	22	0.0005	0.004	0.005
Lead Pb	mg/L	22	0.0005	0.0005	0.005
Lithium Li	mg/L	22	0.0032	0.058	0.1624
Manganese Mn	mg/L	22	0.0086	0.0355	0.0556
Molybdenum Mo	mg/L	0	-	-	-
Nickel Ni	mg/L	22	0.0005	0.003	0.005
Rubidium Rb	mg/L	0	-	-	-
Selenium Se (Total)	mg/L	22	0.005	0.005	0.05
Silver Ag	mg/L	0	-	-	-
Strontium	mg/L	0	-	-	-
Thorium	mg/L	0	-	-	-
Tin	mg/L	0	-	-	-
Titanium	mg/L	0	-	-	-
Uranium U	mg/L	0	-	-	-
Vanadium V	mg/L	22	0.005	0.005	0.05
Zinc Zn	mg/L	22	0.0025	0.006	0.025
Boron	mg/L	22	0.025	1.595	4.62
Iron Fe	mg/L	22	0.05	0.05	0.088
Mercury	mg/L	22	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	22	10	10	10
C10 - C14 Fraction	µg/L	22	25	25	25
C15 - C28 Fraction	µg/L	22	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	22	25	25	25
C10 - C36 Fraction (sum)	µg/L	22	25	25	25
C6 - C10 Fraction	mg/L	22	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	22	10	10	10
>C10 - C16 Fraction	mg/L	22	50	50	50
>C16 - C34 Fraction	mg/L	22	50	50	50
>C34 - C40 Fraction	mg/L	22	50	50	50
>C10 - C40 Fraction (sum)	mg/L	22	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	22	50	50	50
Benzene	µg/L	22	0.5	0.5	0.5
Toluene	µg/L	22	1	1	1
Ethylbenzene	µg/L	22	1	1	1
meta-Xylene	µg/L	22	1	1	1
para-Xylene	µg/L	22	1	1	1
ortho-Xylene	µg/L	22	1	1	1
Total Xylenes	µg/L	22	1	1	1
Sum of BTEX	µg/L	22	0.5	0.5	0.5
Naphthalene	µg/L	22	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	22	102.4	109.5	118.8
Toluene-D8	%	22	94.84	107.5	115.8
4-Bromofluorobenzene	%	22	101	112.5	122.6

Table C.7 Site background surface water quality assessment (New 2)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		17	6.074	6.3	6.7
Temperature	°C	17	23.48	27.7	28.98
Electrical Conductivity	µS/cm	17	27.84	56.7	868.84
Total Dissolved Solids	mg/L	17	18.32	37	564.6
Salinity	ppt	17	0.01	0.03	0.42
Dissolved Oxygen	%	17	62.26	74.2	81.88
Oxidation-Reduction Potential	mV	17	166.44	195.9	232.66
Turbidity	NTU	17	3.216	5.1	10.022
Total Suspended Solids	mg/L	16	2.5	2.5	5
Nutrients					
Ammonia	mg/L	17	0.01	0.07	0.108
Nitrite	mg/L	17	0.005	0.005	0.005
Nitrate	mg/L	17	0.005	0.005	0.005
Nitrite + Nitrate (as NOx)	mg/L	17	0.005	0.005	0.005
Total Kjeldahl Nitrogen	mg/L	17	0.2	0.3	0.5
Total Nitrogen	mg/L	17	0.2	0.3	0.5
Total Phosphorus	mg/L	17	0.005	0.01	0.05
Reactive Phosphorus	mg/L	17	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	17	0.5	0.5	1.8
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	17	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	17	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	17	4.2	8	13.2
Total Alkalinity as CaC03	mg/L	17	4.2	8	13.2
Sulfate as S04	mg/L	17	0.5	0.5	5.2
Chloride	mg/L	17	4	7	55.2
Calcium	mg/L	17	0.5	0.5	1.8
Magnesium	mg/L	17	0.5	1	4.4
Sodium	mg/L	17	3	5	29.6
Potassium	mg/L	17	0.5	0.5	1.7
Total Anions	mg/L	17	0.19	0.34	1.816
Total Cations	mg/L	17	0.13	0.22	1.77

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	16	0.5	2.25	26
Dissolved metals					
Aluminium Al	mg/L	17	0.005	0.02	0.05
Antimony Sb	mg/L	0	-	-	-
Arsenic As	mg/L	17	0.0005	0.002	0.0038
Beryllium Be	mg/L	17	0.0005	0.0005	0.0005
Barium Ba	mg/L	17	0.0114	0.022	0.0348
Bismuth Bi	mg/L	0	-	-	-
Cadmium Cd	mg/L	17	0.00005	0.00005	0.00005
Caesium	mg/L	0	-	-	-
Chromium	mg/L	17	0.0005	0.0005	0.0005
Cobalt Co	mg/L	17	0.0005	0.0005	0.0017
Copper Cu	mg/L	17	0.0005	0.0005	0.0025
Lead Pb	mg/L	17	0.0005	0.0005	0.0005
Lithium Li	mg/L	17	0.002	0.003	0.0048
Manganese Mn	mg/L	17	0.0078	0.028	0.0666
Molybdenum Mo	mg/L	0	-	-	-
Nickel Ni	mg/L	17	0.0005	0.0005	0.001
Rubidium Rb	mg/L	0	-	-	-
Selenium Se (Total)	mg/L	17	0.005	0.005	0.005
Silver Ag	mg/L	0	-	-	-
Strontium	mg/L	0	-	-	-
Thorium	mg/L	0	-	-	-
Tin	mg/L	0	-	-	-
Titanium	mg/L	0	-	-	-
Uranium U	mg/L	0	-	-	-
Vanadium V	mg/L	17	0.005	0.005	0.005
Zinc Zn	mg/L	17	0.0025	0.0025	0.0068
Boron	mg/L	17	0.025	0.025	0.068
Iron Fe	mg/L	17	0.136	0.21	0.362
Mercury	mg/L	17	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	17	10	10	10
C10 - C14 Fraction	µg/L	17	25	25	25
C15 - C28 Fraction	µg/L	17	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	17	25	25	25
C10 - C36 Fraction (sum)	µg/L	17	25	25	25
C6 - C10 Fraction	mg/L	17	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	17	10	10	10
>C10 - C16 Fraction	mg/L	17	50	50	50
>C16 - C34 Fraction	mg/L	17	50	50	50
>C34 - C40 Fraction	mg/L	17	50	50	50
>C10 - C40 Fraction (sum)	mg/L	17	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	17	50	50	50
Benzene	µg/L	17	0.5	0.5	0.5
Toluene	µg/L	17	1	1	1
Ethylbenzene	µg/L	17	1	1	1
meta-Xylene	µg/L	17	1	1	1
para-Xylene	µg/L	16	1	1	1
ortho-Xylene	µg/L	17	1	1	1
Total Xylenes	µg/L	17	1	1	1
Sum of BTEX	µg/L	17	0.5	0.5	0.5
Naphthalene	µg/L	17	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	17	101.4	107	115.8
Toluene-D8	%	17	92.58	102	115.6
4-Bromofluorobenzene	%	17	100.04	107	119

Table C.8 Site background surface water quality assessment (New Upstream)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		26	6.06	6.85	7.8
Temperature	°C	26	24.6	27.65	29.1
Electrical Conductivity	µS/cm	26	40.5	104.1	521
Total Dissolved Solids	mg/L	26	26.65	68	339
Salinity	ppt	26	0.02	0.07	0.22
Dissolved Oxygen	%	26	58.7	73.8	82.5
Oxidation-Reduction Potential	mV	26	115.3	186.05	233.1
Turbidity	NTU	26	2.19	5.06	11.3
Total Suspended Solids	mg/L	25	2.5	2.5	7.2
Nutrients					
Ammonia	mg/L	26	0.01	0.04	0.08
Nitrite	mg/L	26	0.005	0.005	0.005
Nitrate	mg/L	26	0.005	0.005	0.005
Nitrite + Nitrate (as NOx)	mg/L	26	0.005	0.005	0.005
Total Kjeldahl Nitrogen	mg/L	26	0.2	0.3	0.4
Total Nitrogen	mg/L	26	0.2	0.35	0.4
Total Phosphorus	mg/L	26	0.005	0.02	0.05
Reactive Phosphorus	mg/L	26	0.005	0.005	0.005
Chlorophyll a	mg/m3= µg/L	26	0.5	0.75	3
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	26	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	26	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	26	6	9	12
Total Alkalinity as CaC03	mg/L	26	6	9	12
Sulfate as S04	mg/L	26	0.5	0.5	0.5
Chloride	mg/L	26	4	5	7
Calcium	mg/L	26	0.5	0.5	1
Magnesium	mg/L	26	0.5	1	2
Sodium	mg/L	26	3	4.5	7
Potassium	mg/L	26	0.5	0.5	1
Total Anions	mg/L	26	0.23	0.34	0.4
Total Cations	mg/L	26	0.13	0.3	0.48

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	22	0.5	4	11
Dissolved metals					
Aluminium Al	mg/L	26	0.005	0.015	0.04
Antimony Sb	mg/L	0	-	-	-
Arsenic As	mg/L	26	0.0005	0.0005	0.001
Beryllium Be	mg/L	26	0.0005	0.0005	0.0005
Barium Ba	mg/L	26	0.012	0.0205	0.024
Bismuth Bi	mg/L	0	-	-	-
Cadmium Cd	mg/L	26	0.00005	0.00005	0.00005
Caesium	mg/L	0	-	-	-
Chromium	mg/L	26	0.0005	0.0005	0.0005
Cobalt Co	mg/L	26	0.0005	0.0005	0.001
Copper Cu	mg/L	26	0.0005	0.0005	0.001
Lead Pb	mg/L	26	0.0005	0.0005	0.0005
Lithium Li	mg/L	26	0.002	0.005	0.006
Manganese Mn	mg/L	26	0.01	0.035	0.08
Molybdenum Mo	mg/L	0	-	-	-
Nickel Ni	mg/L	26	0.0005	0.0005	0.001
Rubidium Rb	mg/L	0	-	-	-
Selenium Se (Total)	mg/L	26	0.005	0.005	0.005
Silver Ag	mg/L	0	-	-	-
Strontium	mg/L	0	-	-	-
Thorium	mg/L	0	-	-	-
Tin	mg/L	0	-	-	-
Titanium	mg/L	0	-	-	-
Uranium U	mg/L	0	-	-	-
Vanadium V	mg/L	26	0.005	0.005	0.005
Zinc Zn	mg/L	26	0.0025	0.0025	0.007
Boron	mg/L	26	0.025	0.025	0.08
Iron Fe	mg/L	26	0.11	0.245	0.33
Mercury	mg/L	26	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	26	10	10	10
C10 - C14 Fraction	µg/L	26	25	25	25
C15 - C28 Fraction	µg/L	26	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	26	25	25	25
C10 - C36 Fraction (sum)	µg/L	26	25	25	25
C6 - C10 Fraction	mg/L	26	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	26	10	10	10
>C10 - C16 Fraction	mg/L	26	50	50	50
>C16 - C34 Fraction	mg/L	26	50	50	50
>C34 - C40 Fraction	mg/L	26	50	50	50
>C10 - C40 Fraction (sum)	mg/L	26	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	26	50	50	50
Benzene	µg/L	26	0.5	0.5	0.5
Toluene	µg/L	26	1	1	1
Ethylbenzene	µg/L	26	1	1	1
meta-Xylene	µg/L	26	1	1	1
para-Xylene	µg/L	26	1	1	1
ortho-Xylene	µg/L	26	1	1	1
Total Xylenes	µg/L	26	1	1	1
Sum of BTEX	µg/L	26	0.5	0.5	0.5
Naphthalene	µg/L	26	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	26	92.5	104	109
Toluene-D8	%	26	91.9	100.45	112
4-Bromofluorobenzene	%	26	95.7	108	118

Table C.9 Site background groundwater quality assessment (Groundwater bores)

Parameter	Units	No. of data points	20%ile	Median	80%ile
Field parameters					
pH		49	6.188	6.68	7.2
Temperature	°C	49	29.3	30.5	31.4
Electrical Conductivity	µS/cm	49	-63.5	44	187.1
Total Dissolved Solids	mg/L	49	137.54	226.6	402.38
Salinity	ppt	49	89.42	146	261.4
Dissolved Oxygen	%	49	0.06	0.11	0.188
Oxidation-Reduction Potential	mV	49	4.04	11.3	26
Turbidity	NTU	49	1.932	10.48	114.52
Total Suspended Solids	mg/L	12	124.2	172	214
Nutrients					
Ammonia	mg/L	0	-	-	-
Nitrite	mg/L	3	0.005	0.005	0.02
Nitrate	mg/L	0	-	-	-
Nitrite + Nitrate (as NOx)	mg/L	49	0.005	0.01	0.04
Total Kjeldahl Nitrogen	mg/L	52	0.1	0.3	0.58
Total Nitrogen	mg/L	52	0.1	0.3	0.58
Total Phosphorus	mg/L	52	0.172	0.25	0.458
Reactive Phosphorus	mg/L	52	0.102	0.195	0.366
Chlorophyll a	mg/m3= µg/L	0	-	-	-
Major Anions & Cations					
Hydroxide Alkalinity as CaC03	mg/L	52	0.5	0.5	0.5
Carbonate Alkalinity as CaC03	mg/L	52	0.5	0.5	0.5
Bicarbonate Alkalinity as CaC03	mg/L	52	60.2	93.5	125.6
Total Alkalinity as CaC03	mg/L	52	61	94.5	132.2
Sulfate as S04	mg/L	52	0.5	0.5	1.8
Chloride	mg/L	52	4	5	8.8
Calcium	mg/L	52	6	12	16.8
Magnesium	mg/L	52	2	4	5
Sodium	mg/L	52	12	17.5	35.8
Potassium	mg/L	52	4	5	13.4
Total Anions	mg/L	52	1.362	2.055	2.846
Total Cations	mg/L	52	1.364	2.1	2.706

Parameter	Units	No. of data points	20%ile	Median	80%ile
Total Hardness	mg/L	3	24	45	51.6
Dissolved metals					
Aluminium Al	mg/L	52	0.005	0.005	0.005
Antimony Sb	mg/L	0	-	-	-
Arsenic As	mg/L	52	0.012	0.0305	0.1146
Beryllium Be	mg/L	52	0.0005	0.0005	0.0005
Barium Ba	mg/L	52	0.0322	0.0465	0.0668
Bismuth Bi	mg/L	0	-	-	-
Cadmium Cd	mg/L	52	0.00005	0.00005	0.00005
Caesium	mg/L	0	-	-	-
Chromium	mg/L	52	0.0005	0.0005	0.0005
Cobalt Co	mg/L	52	0.0005	0.0005	0.0005
Copper Cu	mg/L	52	0.0005	0.0005	0.0009
Lead Pb	mg/L	52	0.0005	0.0005	0.0005
Lithium Li	mg/L	49	0.0786	0.1	0.1426
Manganese Mn	mg/L	52	0.0132	0.0835	0.1776
Molybdenum Mo	mg/L	0	-	-	-
Nickel Ni	mg/L	52	0.0005	0.0005	0.002
Rubidium Rb	mg/L	0	-	-	-
Selenium Se (Total)	mg/L	52	0.005	0.005	0.005
Silver Ag	mg/L	0	-	-	-
Strontium	mg/L	0	-	-	-
Thorium	mg/L	0	-	-	-
Tin	mg/L	0	-	-	-
Titanium	mg/L	0	-	-	-
Uranium U	mg/L	0	-	-	-
Vanadium V	mg/L	52	0.005	0.005	0.005
Zinc Zn	mg/L	52	0.0025	0.00375	0.0192
Boron	mg/L	52	0.025	0.025	0.025
Iron Fe	mg/L	52	0.025	0.285	1.326
Mercury	mg/L	52	0.00005	0.00005	0.00005
Hydrocarbons & BTEXN					
C6 - C9 Fraction	µg/L	52	10	10	10
C10 - C14 Fraction	µg/L	52	25	25	25
C15 - C28 Fraction	µg/L	52	50	50	50

Parameter	Units	No. of data points	20%ile	Median	80%ile
C29 - C36 Fraction	µg/L	52	25	25	25
C10 - C36 Fraction (sum)	µg/L	52	25	25	25
C6 - C10 Fraction	mg/L	52	10	10	10
C6 - C10 Fraction minus BTEX (F1)	mg/L	52	10	10	10
>C10 - C16 Fraction	mg/L	52	50	50	50
>C16 - C34 Fraction	mg/L	52	50	50	50
>C34 - C40 Fraction	mg/L	52	50	50	50
>C10 - C40 Fraction (sum)	mg/L	52	50	50	50
>C10 - C16 Fraction minus Naphtalene (F2)	mg/L	52	50	50	50
Benzene	µg/L	52	0.5	0.5	0.5
Toluene	µg/L	52	1	1	1
Ethylbenzene	µg/L	52	1	1	1
meta-Xylene	µg/L	52	1	1	1
para-Xylene	µg/L	52	1	1	1
ortho-Xylene	µg/L	52	1	1	1
Total Xylenes	µg/L	52	1	1	1
Sum of BTEX	µg/L	52	0.5	0.5	0.5
Naphthalene	µg/L	52	2.5	2.5	2.5
1.2-Dichloroethane-D4	%	52	90.54	97.45	104.8
Toluene-D8	%	52	93.64	101	111
4-Bromofluorobenzene	%	52	100.24	112.5	120.8

APPENDIX D WATER MONITORING TARPS

Table D.1 Operational surface water quality TARP

Level	Triggers	Action	Response
Level 1	No exceedances in surface water quality within the adopted trigger values for all parameters at the downstream monitoring point.	• No action required • Continue routine monitoring in accordance with the monitoring program.	• No response required.
Level 2	Exceedance in surface water quality parameter trigger values for one monitoring event	• Review laboratory quality assurance/quality control results • Request a review if a suspected laboratory error is identified. • Commence an investigation to determine potential cause of elevated trigger value. • Investigate the potential source associated with the trigger exceedance.	• Investigate any mitigation strategy and contingency measures to mitigate any contamination sources based on the outcomes of the investigation on the potential contamination source.
Level 3	Exceedance in surface water quality parameter trigger values for two consecutive monitoring events	• Investigate potential cause of elevated trigger values. • Identify the potential source associated with the trigger exceedance. • Increase frequency of monitoring.	• Implement the relevant Level 2 mitigation and contingency measures. • Apply relevant water quality treatment procedures to water storages prior to release, where required.
Level 4	Exceedance in surface water quality parameter trigger values for three consecutive monitoring events; or Exceedance greater than three times the trigger value.	• Validate relevant data to confirm trigger exceedance. • Investigate potential cause of elevated trigger values. • Engage suitably qualified personnel to identify the potential source associated with the trigger exceedance. • Initiate investigation for reasons of increase water quality concentrations.	• Implement appropriate corrective actions based on the investigation outcomes. • Review current management plans and updated them if necessary. • Notification will be undertaken in accordance with the Waste Discharge Licence and approval conditions.

Table D.2 Raw water and sediment water quality TARP

Level	Triggers	Action	Response
Level 1	Raw water/Sediment water quality is within than 90% of the SSGVs	• No action required. • Continue routine monitoring in accordance with the monitoring program.	• No response required
Level 2	Raw water/Sediment water quality is between 90% and 100% of the SSGVs	• Review laboratory QA/QC and look for potential quality control issue and request a review if a suspected lab error. • Investigate management measures or treatment procedures to manage any unexpected increases in contaminant concentrations. • Investigate to determine if additional controls or management actions are necessary to achieve compliance.	• Implement appropriate management measures or treatment procedures where required to prevent exceedance of SSGVs. • Increase frequency of monitoring.
Level 3	Raw water/Sediment water quality exceeds one or more of the SSGVs	• Investigate potential sources of contaminants in the catchment (e.g., Stockpile areas, haul roads) that are contributing to poor water quality. • Investigate options to divert runoff from the source of poor water quality to a mine water storage if required. • Investigate the option of converting the sediment basin into a mine-affected water storage (and prevent uncontrolled spills into the environment) if the sources cannot be diverted or remediated. • Investigate the option of constructing an additional mine water storage and drains to capture runoff from the contaminated area.	• Implement relevant mitigation, treatment and contingency measures identified through the investigation. • Apply relevant mitigation, treatment and contingency measures in level 2 before discharging from sediment basins.
Level 4	Raw water/Sediment water quality exceeds one or more of the SSGVs by more than for three consecutive samples or more than 50% for one sample	• Confirm and validate monitoring results. • Undertake detailed investigation into the cause of ongoing exceedances. • Review effectiveness of existing controls and management measures.	• Cease discharging from sediment/raw water dams. • Apply any treatment additives to achieve compliance. • Apply appropriate controls, measures and diversion/remediation options depending on outcomes of investigations in level 3. • Review current management plans and update if necessary. • Notification will be undertaken in accordance with the Waste Discharge Licence and approval conditions.

Table D.3 Proposed mine water site storage inventory exceedances

Level	Triggers	Action	Response
Level 1	MWD Cell 1 storage volume is less than the maximum operating volume.	• No action required. •	• No response required.
Level 2	MWD Cell 1 storage volume exceeds the maximum operating volume with current or forecast heavy rainfall (>50 mm)	• Monitor storage levels in accordance with the monitoring plan. • Undertake a post-event review to confirm event was well managed with the appropriate resources in place. • Investigate any management and contingency measures to prevent uncontrolled spills or underground inundation.	• Continue environmental releases (from MWD1) where possible. • Maximise pumping capacity for dewatering of storage. • Pump from MWD1 to MWD2 (if available). • Suspend any transfers to the mine water dams, if possible.
Level 3	MWD1 and MWD2 combined storage volume exceeds 80% of the combined full storage volume, with inflows still occurring	• Review storage trends and forecast inflows. • Undertake post-event review to confirm suitability of water transfer infrastructure and operational rules. • Assess the need for modifications or upgrades to water infrastructure. • Prepare recommendations for modifications or upgrades to water transfer infrastructure.	• Continue environmental releases (including irrigation) where possible. • Apply management and contingency measures in Level 2. • Update operational rules if required. • Implement infrastructure modification or operational changes identified during the review.
Level 4	Uncontrolled discharge of mine water from MWD to the environment.	• Record start and finish times of the overflow. • Collect water quality samples of spills at dam overflow points and in receiving waterways. • Investigate structural risks of underground mine. • Initiate investigation into reasons for system failure. • Determine measures required to prevent recurrence.	• Notification will be undertaken in accordance with the Waste Discharge Licence and approval conditions. • Implement emergency measures to minimise environmental impacts. • Remediate any environmental harm where possible. • Implement corrective actions identified by the investigation to prevent recurrence.

Table D.4 Proposed site storage inventory shortfalls TARP

Level	Triggers	Action	Response
Level 1	Current total site inventory greater than 15% (105 ML) of the total storage inventory	• No action required. • Continue routine monitoring of site water inventories	• No response required.
Level 2	Current total site inventory is between 10% (70 ML) to 15% (105 ML) of the total storage inventory.	• Monitor site storage levels and forecast water demands. • Undertake a post-event review to confirm event was well managed with the appropriate resources in place. • Investigate any management and contingency measures to prevent deficiencies in site inventory or make-up demands.	• Maximise use of sediment water for mine site demands prior to raw water use. • Implement any additional operational measures identified during the review to reduce the risk of supply deficiencies
Level 3	Current total site inventory is between 5% (35 ML) to 10% (70 ML) of the total storage inventory.	• Investigate the feasibility of increasing the storage size of current site storages (to increase the amount of water stored on site towards the end of the wet season). • Investigate the feasibility of constructing an additional water storage. • Investigate procedures which decreases the site water demands. • Investigate the feasibility of trucking water externally from other sites. • Undertake a post-event review to confirm suitability of water transfer infrastructure and operational rules. • Prepare recommendations for infrastructure modifications or upgrades to water transfer infrastructure.	• Conserve water use for non-essential operations. • Update operational rules where required. • Implement infrastructure modifications or operational changes identified during the review. • Arrange external water supplies if necessary to maintain operational requirements.
Level 4	Current total site inventory is less than 5% (35 ML) of the total storage inventory.	• Confirm water balance projections and assess the cause of the supply shortfall. • Evaluate all available water supply and demand reduction measures. • Initiate a detailed review of site water management requirements.	• Truck water from approved external source to meet operational demands. • Implement any water management strategy in level 3 • Restrict non-critical water use until storage inventories recover. • Implement emergency water management measures to maintain critical operations.



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