

Chapter 16
Flooding and regulated structures

ESMERALDA GRAPHITE PROJECT

aarc ENVIRONMENTAL SOLUTIONS
APEM Group

GRAPHINEX

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Glossary, acronyms and abbreviations

Acronym or Abbreviation	Meaning
ACARP	Australian Coal Association Research Program
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARF	Areal Reduction Factor
AVM	Average Variability Method
BOM	Bureau of Meteorology
DEM	Digital Elevation Model
DES	Department of Environment and Science
DETSI	Department of the Environment, Science, Innovation and Tourism
DNRME	Department of Natural Resources, Mines and Energy
EIS	Environmental Impact Statement
EP Regulation	Environmental Protection Regulation 2019
GL	Gigalitre
HDPE	High-Density Polyethylene
IDC	Index of Diversion Condition
MAW	Mine-affected water
MLA	Mining Lease Application
MPP	Mineral processing plant
PDD	Pit Dewatering Dam
PMF	Probable Maximum Flood
PWD	Process Water Dam
TOR	Terms of Reference
TP	Temporal pattern
TSF	Tailings Storage Facilities
WMP	Water Monitoring Program

16 Flooding and regulated structures

This chapter assesses the potential impacts of the Project on existing environmental values in relation to flooding and regulated structures and evaluates the current flood risk of the Project Mining Lease Applications (MLAs) and surrounding communities. Where appropriate mitigation, management and monitoring measures to address the identified flooding risks have been proposed. This chapter has been drafted in alignment with the following guidance and policy:

- Queensland Government, Water – EIS information guideline, ESR/2020/5312;
- Australian Government, Australian Rainfall and Runoff: A Guide to Flood Estimation, 2019;
- Queensland Government, Regulated structures – EIS information guideline, ESR/2020/5307; and
- Queensland Government, Structures which are dams or levees constructed as part of environmentally relevant activities, ESR/2016/1934.

16.1 Environmental objectives and performance outcomes

This chapter has been prepared to enable an assessment of the critical design requirements environmental objectives prescribed in Schedule 8, Part 3, Division 2 of the Environmental Protection (EP) Regulation:

- The design of the facility permits the operation of the site, at which the activity is to be carried out, in accordance with best practice environmental management.

The assessment presented in this chapter and the supporting appendices, Appendix K, Surface Water Impact Assessment, Appendix X, Watercourse Diversion Functional Design Report, and Appendix W, Technical Report for Tailings Storage Facilities, demonstrates that the Project will achieve item 2 of the performance outcomes for the critical design requirements, as it relates to the management of flooding impacts and operation of regulated structures, in satisfaction of section 2(4) of Schedule 8 of the EP Regulation, by ensuring that:

- regulated structures comply with the document called ‘Manual for assessing consequence categories and hydraulic performance of structures’, published by the department;
- containers are provided for the storage of hazardous contaminants that are secured to prevent the removal of the containers from the site by a flood event; and
- the design of the facility contains and treats hazardous contaminants rather than releasing them.

This assessment also demonstrates that the following objectives set out in the TOR will be met:

- that the construction and operation of the Project is aimed at ensuring that the risk and potential adverse impacts from flooding are avoided, minimised or mitigated to protect people, property and the environment; and
- that, in order to protect human life and the environment, the standards for the design, construction, operation, modification and decommissioning of regulated structures ought to mitigate the consequences arising from potential failure or collapse of those structures.

16.2 Flooding

16.2.1 Existing environment

The Project is located in Northern Queensland within the Norman River Catchment area, which drains north to the Gulf of Carpentaria. The Norman River Basin has a total catchment of 49,000 km2 with the main rivers being the Norman River, Clara River and Yappar River.

Warrigal Creek and the Borer River are located immediately south of Project MLA. Warrigal Creek, traverses through the western edge of the MLA, joining Borer River 9km downstream of the site. A stream order 3 unnamed tributary flows north westerly through the central line of the MLA, north of the pit.

The surface topography in the region is generally flat, which results in interactions between the major waterways during significant flood events (Figure 16-1). The surface topography in the vicinity of the Project area slopes northwest at an average grade of 0.2%.

Flooding within the Project MLAs is dominated by breakout flooding from the northern banks of Warrigal Creek and the Borer River which are influenced by flooding interactions with other major waterways. Other key breakout flooding interactions relevant to the Project MLAs are from Yappar River into Warrigal Creek (22 km and 40 km upstream of the Project) and from the Clara River into the Norman River (66 km upstream).

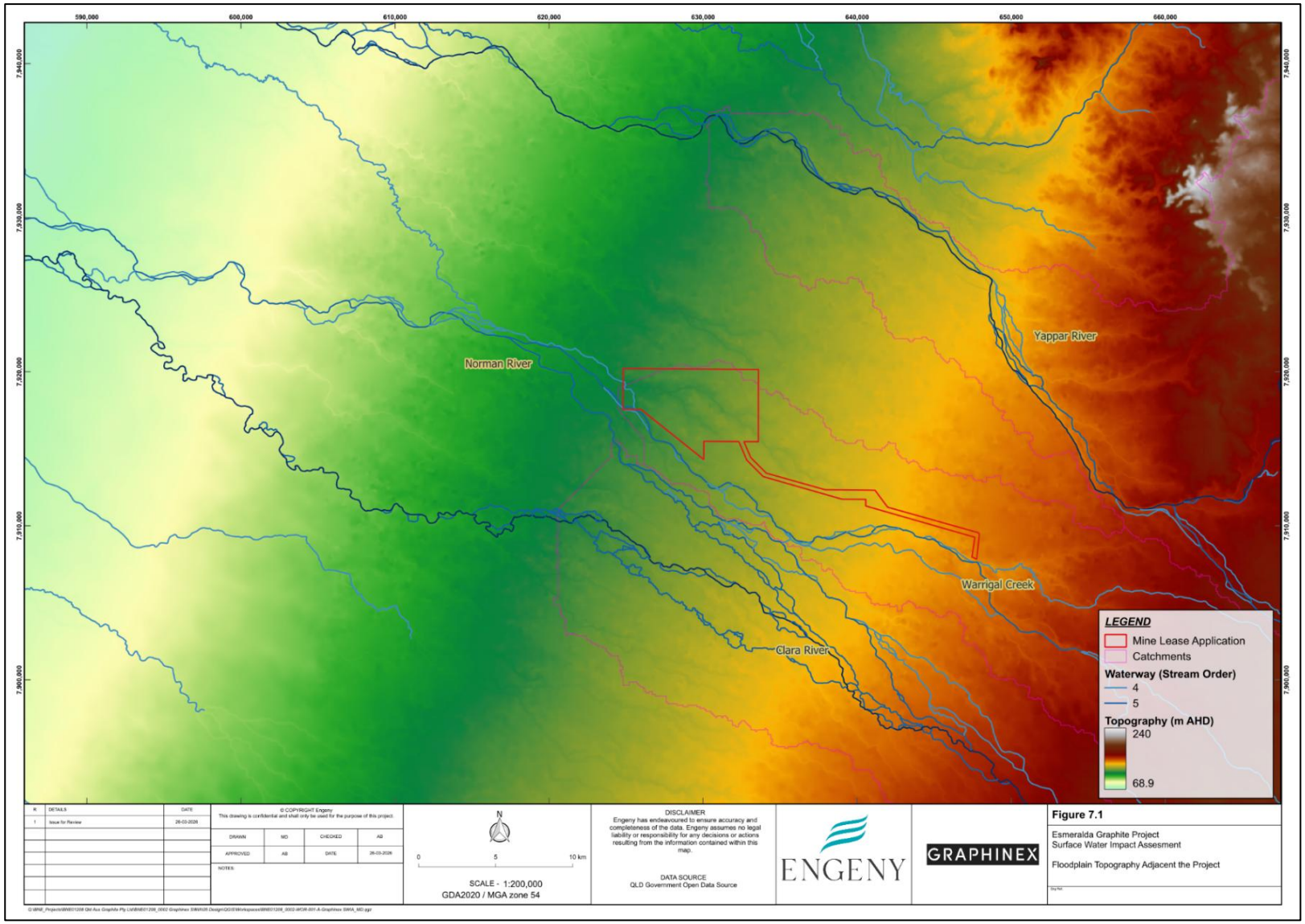


Figure 16-1: Floodplain topography adjacent to the Project

16.2.1.1 Historical flooding

Stream gauging data

Historical flooding information for the Warrigal Creek and other tributaries of Norman River is limited with stream gauging at Glenore Weir Station (916001B) on the Norman River ~150 km downstream of the Project MLAs (Figure 16-3).

Most recently this station recorded a flood event within the 2025/2026 wet season. A summary of the peak levels and flows (recorded on the 9th of January 2026) during this event is provided for within Table 16-1, whilst Figure 16-2 shows the overall hydrograph recorded at the Glenore Weir Station (916001B).

Table 16-1: Stream flow gauging data for 2025/2026 flood event

Station number	Station name	Catchment area (Km2)	Recorded Peak Flood Level (m RL)	Recorded Peak Flow Rate (m3/s)
916001B	Norman River at Glenore Weir	5,624	14.05	2545

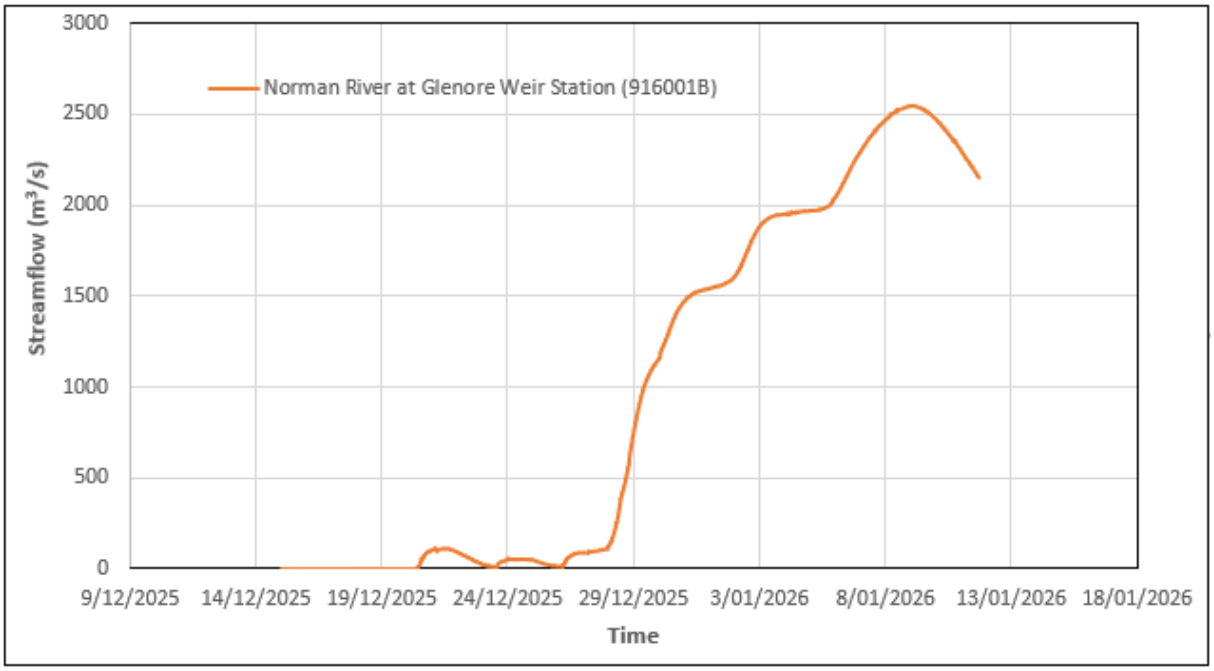


Figure 16-2: Recorded streamflow data for 2025/2026 flood event

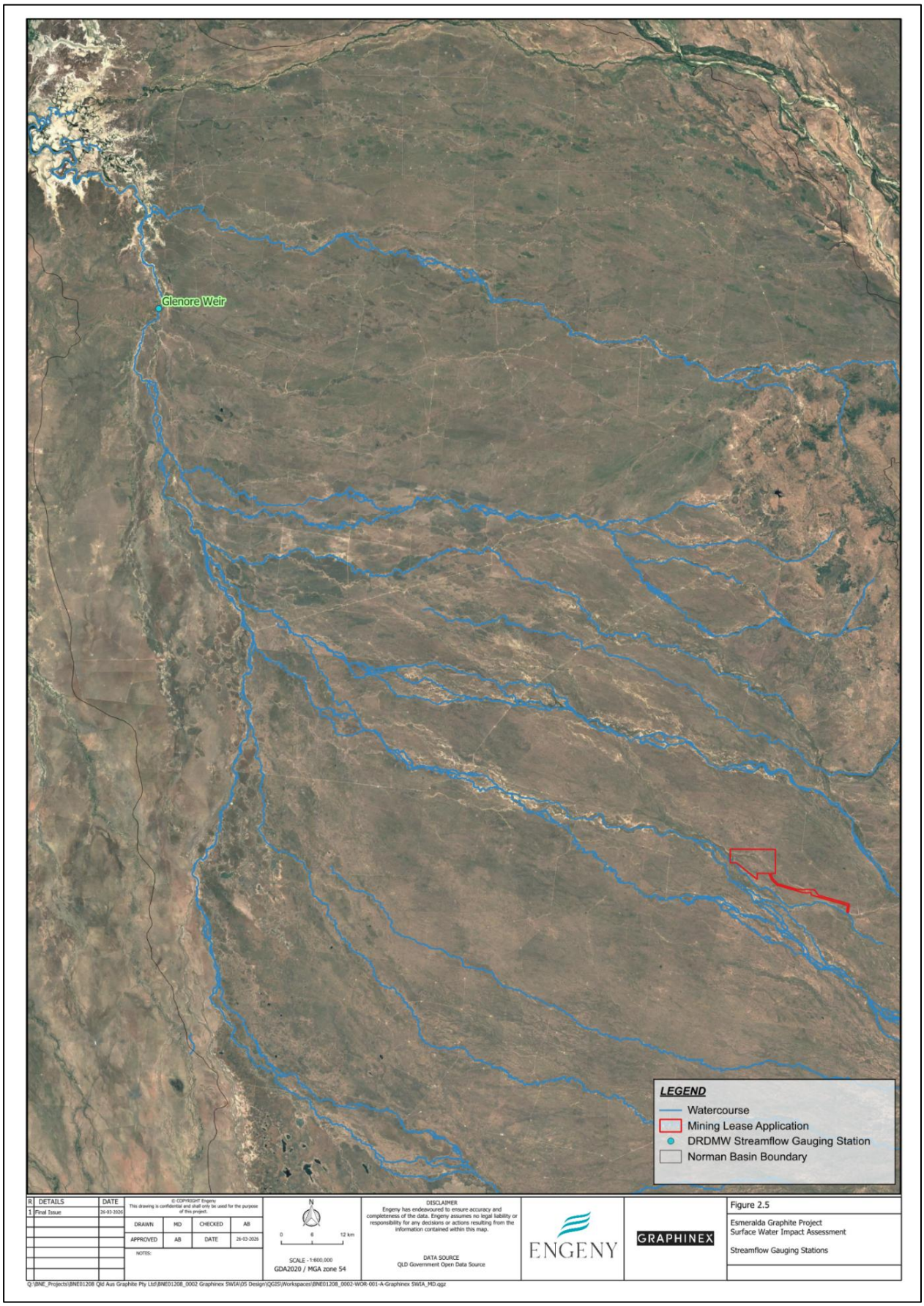


Figure 16-3: Streamflow gauging station

Recorded rainfall

Significant rainfall events have been recorded at the Yappar River Gauging Station (29154) in January 2009, January 2021 and December-January 2025/26. The most recent event was caused by a tropical low tracking south from the Gulf Coast in late December 2025, resulting in a period of heavy rainfall. In January 2026 the remanent moisture interacted with a monsoon low and an embedded trough over western Queensland (BOM 2024). Over an 11-day period, significant widespread rainfall was recorded, with peak daily rainfall totals occurring on different days across the catchment.

Cumulative rainfall recorded from the BOM rainfall gauges operational within the Norman River catchments and surrounding areas during the 2025/2026 flood event is shown in Figure 16-4. The rainfall data shows considerable spatial variation in rainfall during the event, with larger rainfall totals up to ~ 700mm recorded at the downstream extent of the catchment. As there are large distances between the pluviometer rainfall stations, there is uncertainty in the temporal distribution of rainfall during the event.

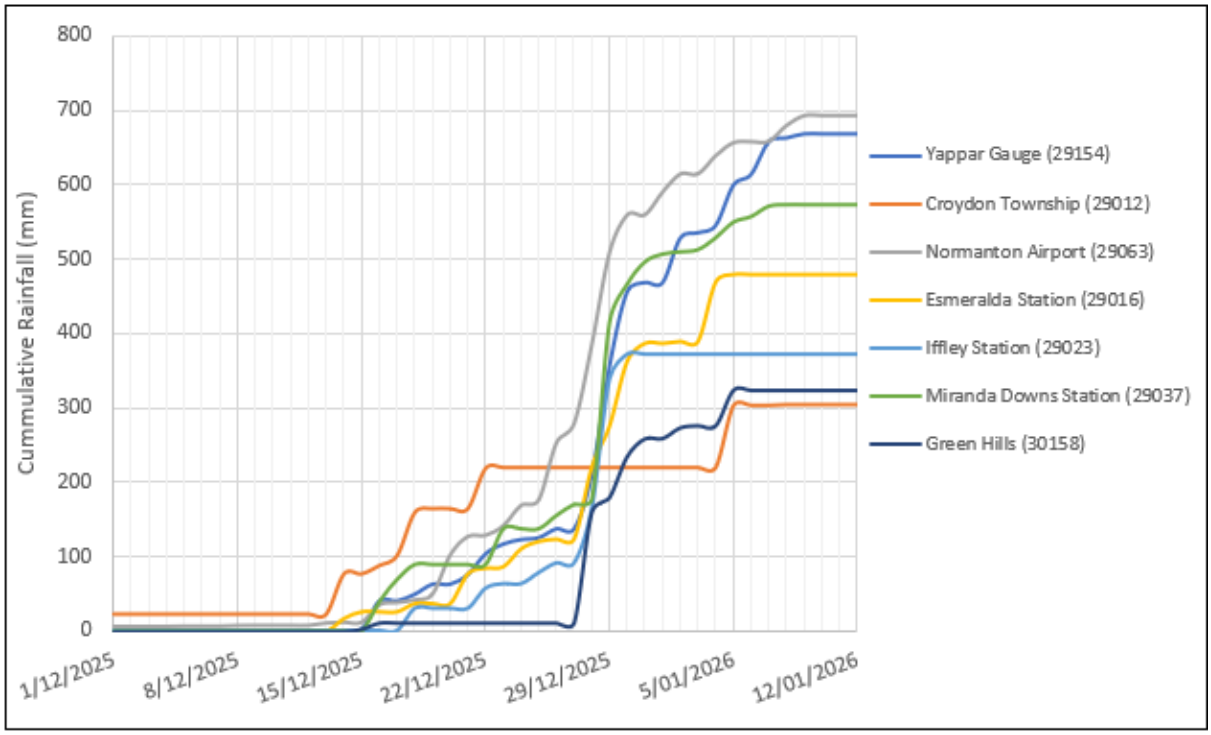


Figure 16-4: Time distribution of rainfall - December 2025/January 2026 rainfall event

Satellite imagery

Satellite imagery (Sentinel-2 L2A) of the Norman River captured on the 8th of January during the 2026 flood event is shown in Figure 16-5. The peak maximum flood extent at the MLAs is unavailable due to high cloud cover; however, the MODIS Corrected Reflectance imagery (12th January 2026) has captured flooding at the MLAs (Figure 16-6).

The landscape is characterised by the braided channels with significant overland flooding. Sentinel-2 L2A imagery illustrates the extensive breakout flooding from the Warrigal Creek and Yappar Rivers downstream of the site. Due to the limited gauging stations located within this catchment an annual exceedance probability (AEP) of this event could not be completed.

An additional significant flood event was recorded at the site in February 2009 (Figure 16-7). Imagery illustrates breakout flooding from Warrigal Creek flowing towards the MLAs, and the main channel of Warrigal Creek passing through the southeastern corner of the MLAs. Due to limited available data, it cannot be confirmed if this imagery captures the maximum flood extent.

Although not clearly depicted within the available imagery, it can be inferred that flooding impacts did not extend across the entirety of the MLAs and were likely concentrated adjacent to Warrigal Creek and associated floodplain areas.

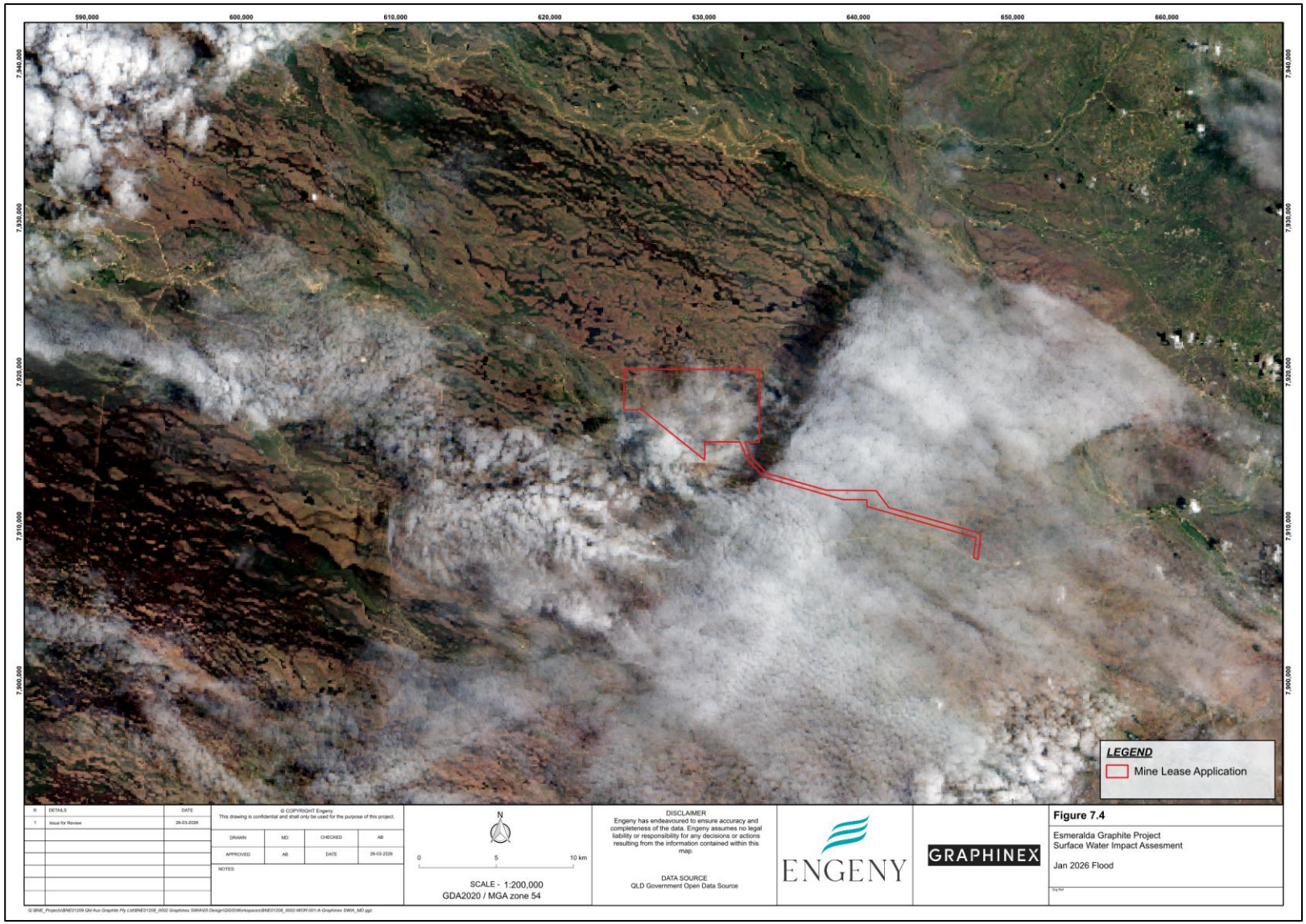


Figure 16-5: Satellite imagery (8th January 2026)



Figure 16-6: Satellite imagery (12th January 2026)



Figure 16-7: Satellite imagery (13th February 2009)

16.2.2 Flood modelling

16.2.2.1 Hydrology model

To assess extreme flooding behaviour and potential interactions with the Project, Engeny (2026a) developed hydrologic and hydraulic models of the Norman River systems including Clara River, Warrigal Creek, Borer River and Yappar River. The breakout flooding behaviour observed within the catchments results in complex redistribution of flood flows between waterways, thereby limiting the applicability of separate hydrologic and hydraulic models for accurately characterising flooding associated with the Project. Therefore the 'rain-on-grid' modelling approach was adopted for the Engeny (2026a) flooding assessment, where the model is used to simulate rainfall excess, catchment watershed and channelised flow hydraulics for the whole catchment. The two-dimensional hydraulic model was developed using TUFLOW software to quantify the flood behaviour and characteristics of each of the creek systems. The model extent is shown in Figure 16-8.

Site-specific streamflow monitoring data is not available within the immediate catchment and, consequently, it is not possible to calibrate the flood model or undertake an at site Flood Frequency Analysis for validation.

In the absence of site-specific streamflow data, model validation was undertaken at two locations within the Project's upstream catchment where flows are relatively contained to the main waterway and not significantly impacted by breakout flooding. Modelled peak flows were compared against Regional Flood Frequency Estimation (RFFE) and Quantile Regression Technique (QRT). The results of the validation indicated that the modelled peak flows were within the RFFE estimate bounds and close to the QRT estimates for all AEPs. On this basis, the hydraulic modelling approach was considered suitable for assessing Project flooding.

A streamflow gauge will be installed during site construction with data collected over the duration of operations available to then inform calibration as part of future model revisions.

The overall methodology for the flood modelling undertaken by Engeny (2026a) is as follows:

- modelling in accordance with the latest Australian Rainfall & Runoff (2019) Guidelines;
- two-dimensional hydraulic modelling utilising rainfall on grid involving combined hydrology and hydraulic analysis within the model boundary; and
- assessment of the 65.2% - 0.1% AEP and PMF design flood events with the provision of flood depth, level and velocity grid results.
    - different storm durations were modelled (12, 18, 24 and 48 hour durations) utilising a single AVM temporal pattern (TP) to determine the critical event. Areal Reduction Factors (ARFs) were utilised based on the upstream catchment of Warrigal River to the proposed mine lease area.

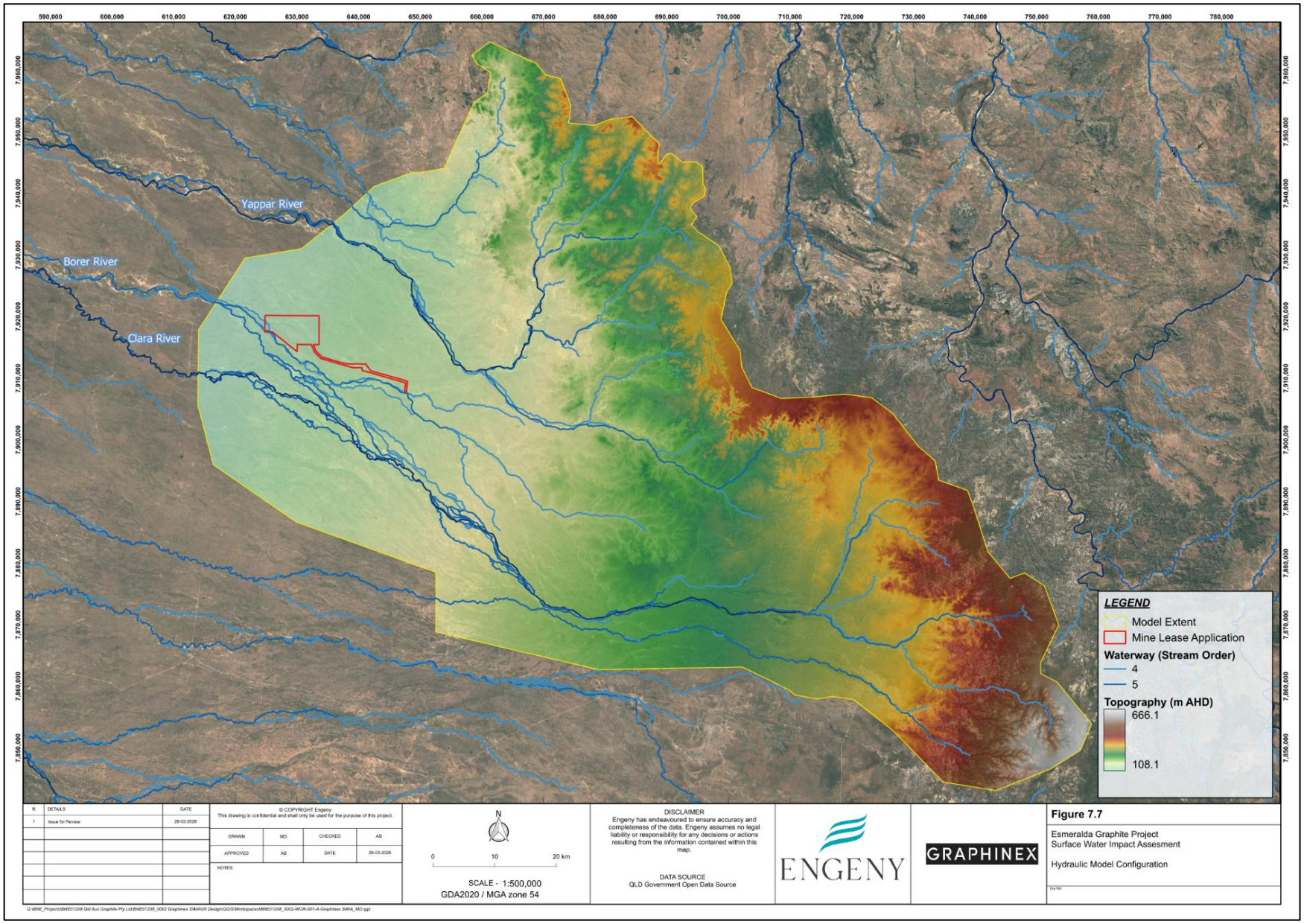


Figure 16-8: Hydraulic model extent

16.2.2.2 Flood constraints

Flood modelling identified site-specific constraints that required specific Project design choices. For example, the mine pit – as defined by the target resource - sits within the extent of the unnamed waterway (stream order 3) flood boundaries. This therefore requires a flood protection levee to prevent inflows from flood events into the pit. In consideration of this, key Project infrastructure, including the mineral processing plant, was sited within a central location and adjacent to the mine pit to allow the design of a single flood protection levee to encompass much of the Project site.

Infrastructure which is located outside of the flood protection levee includes the accommodation facility, which has been sited on an area noted as being dry during flooding events greater than 1% AEP.

16.2.3 Potential impacts

16.2.3.1 Operational phase

The Existing Case flood model was updated to represent the operational phase of the mine, with the inclusion of the flood levee around the Project perimeter and diversion drains as per design.

The Developed Case flood results were compared with the Existing Case results to produce change in flood height (afflux) and velocity result grids to determine the potential flooding impacts associated with the Project. The operational phase flood impact mapping for the 0.1% AEP peak flood depth and velocity are shown Figure 16-9 and Figure 16-10. The flood impact assessment results show the following:

- The project will have minor impacts to Warrigal Creek and Borer River flooding due to the diversion of the unnamed waterway (stream order 3).
    - This impact is expected to include isolated increases in peak flood levels at the location of the diversion drain and south of the TSFs, as well as a minor decrease in flood levels in Warrigal Creek downstream of the Project site.
    - Breakout north from the diverted unnamed waterway (stream order 3) has been modelled in events greater than 2% AEP. Breakout flows into a tributary of the unnamed waterway, with a junction to the main channel located 3km downstream of the Project site.
    - The impact in more frequent events (less than 2% AEP) is localised to the diverted unnamed waterway and regions to the south of the TSFs.
- Peak flood depth in Warrigal Creek decreases by a maximum of 0.03 m in the 1% AEP event.
- Increases in peak flood depth, in northern breakout of the diversion drain reaches 0.42 m in the 1% AEP event.
- The changes in flood depth are minor and not expected to result in any adverse impacts to the waterway, surrounding properties or flood immunity of any third-party infrastructure.
- Increases to peak flood velocity are confined to the diversion drains and associated northern breakout flooding. Decreases in peak flood velocity have been modelled at the inlet and outlet of the diversion drain.
- Peak flood velocities in natural environments are expected to increase by a maximum of 0.5 m/s in the breakout flow path north of the watercourse diversion in the 1% AEP flood event however the absolute peak velocity in the operational phase model remains <0.6m/s.

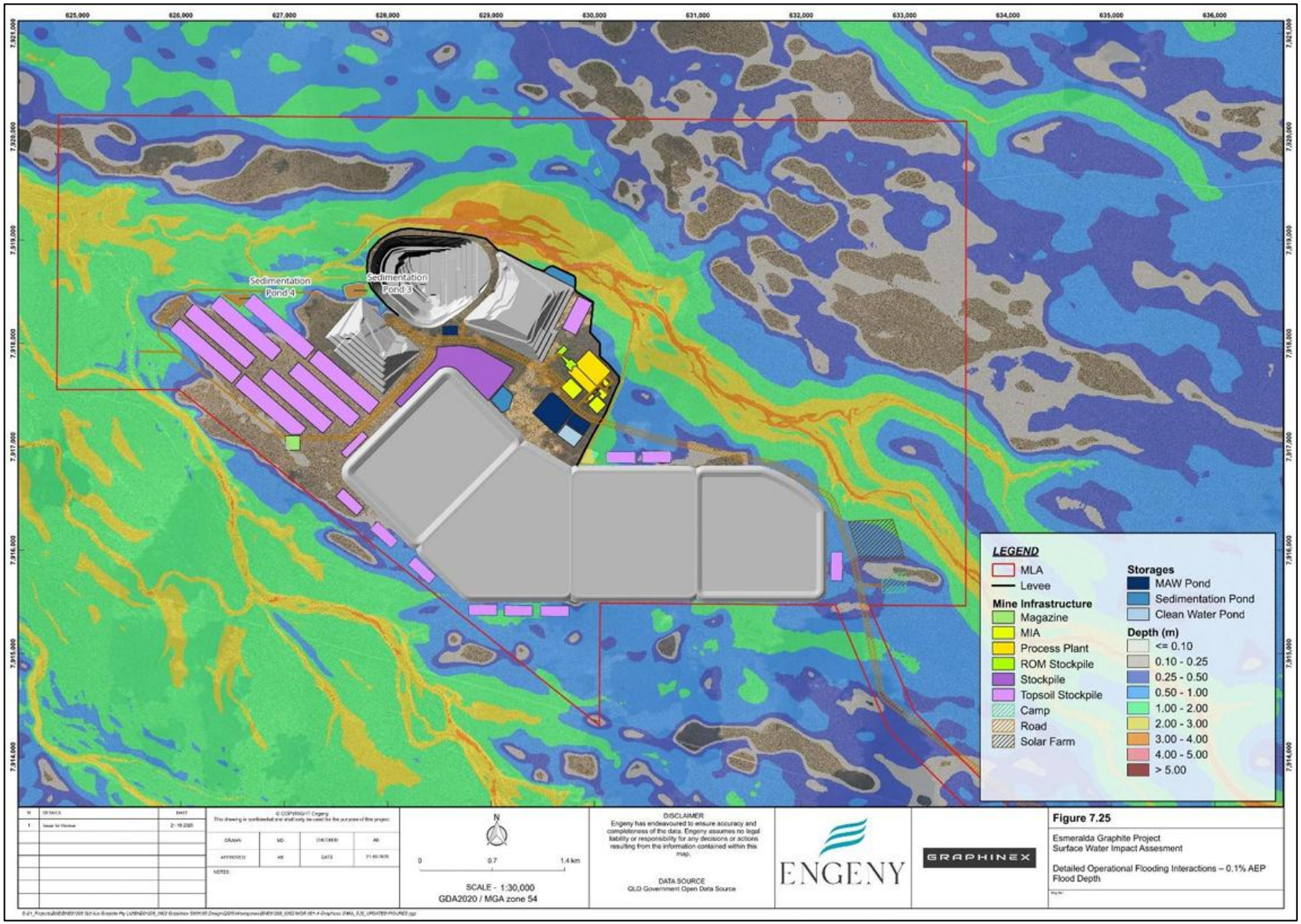


Figure 16-9: Detailed operational flood interactions – 0.1% AEP depth

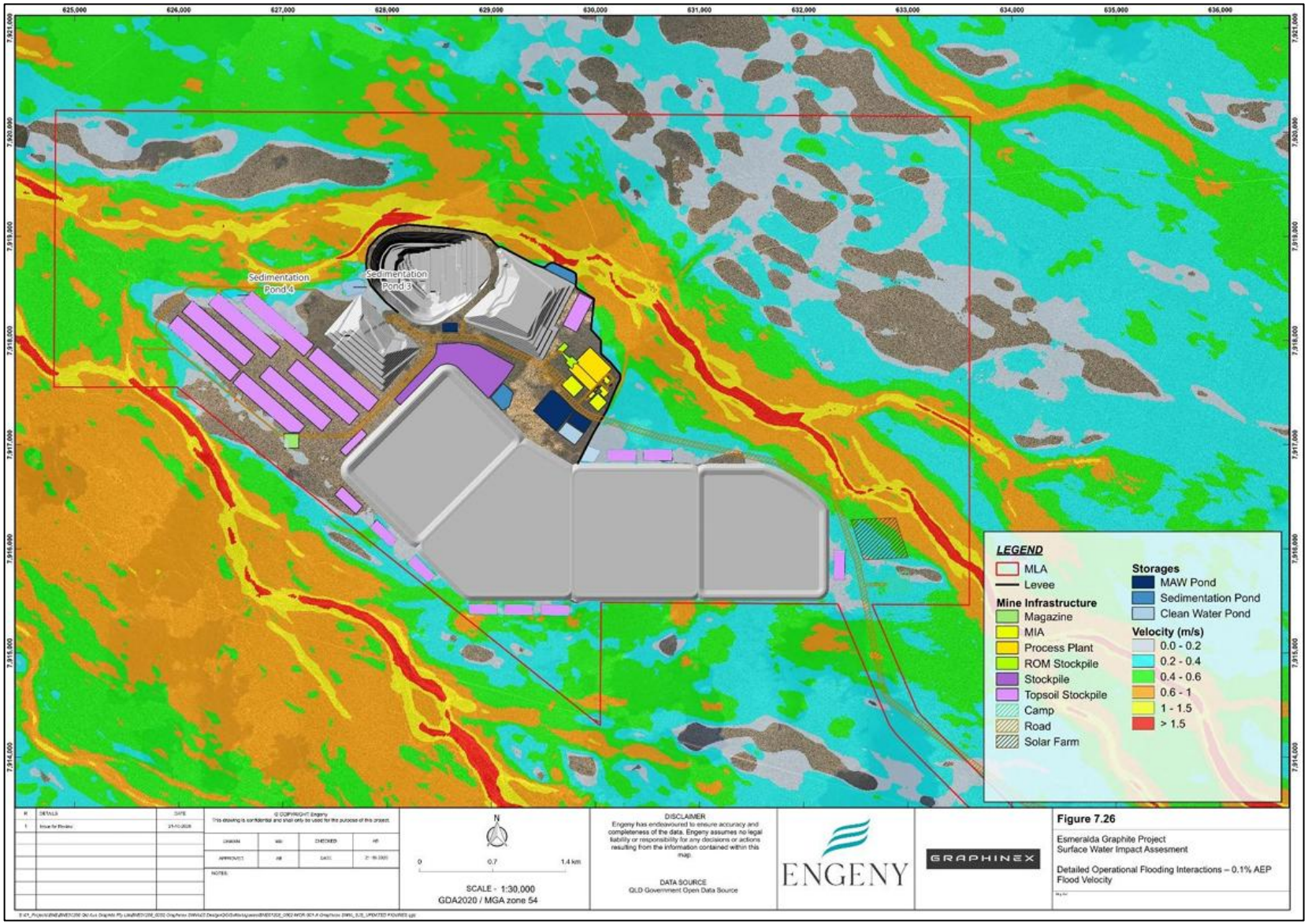


Figure 16-10: Detailed operational flood interactions – 0.1% AEP velocity

Flood risks for project infrastructure

The developed case flood results were used to analyse flood risks to the Project infrastructure. The operational mining and processing areas of the Project are protected from the flood via the levee; however, the western and southern section of the MLA are inundated during very rare flood events (0.1% AEP). Potential flood interactions were identified with the Sediment ponds 3 and 4, the topsoil stockpile area, and the southern and western TSF embankments.

The flood modelling results show flooding against the Sediment ponds 3 and 4 location in the 20% AEP flood event. Peak flood levels against the dams show inundation of sediment pond 3 occurring in the 1% AEP event, and inundation of sediment pond 4 in the 2% AEP event. Both the sediment ponds are located outside the main conveyance area of the stream order 3 tributary and experience low flood velocities. Peak flood velocities against the embankments during the 0.1% AEP event remain below 0.55 m/s at Sediment pond 3 and below 0.8 m/s at Sediment pond 4, indicating a very low and low erosion risk, respectively. Erosion protection of the dam embankments and upstream and downstream sides of the spillways will be considered during detailed design.

Meanwhile, topsoil stockpile area is located northwest of the Project area, which is outside the pit flood protection levee. The flood modelling results indicate that this area is subject to flooding from the northeast of the area from the flow in the stream order 3 tributary and the Warrigal Creek/Borer River. Flooding from the stream order 3 tributary interacts with the topsoil stockpile from the 20% AEP event, with flood depths reaching 1.8 m in the 0.1% AEP event. Despite the modelled inundation, flood velocities remain low, reaching 0.1 m/s in the 10% AEP event and remaining below 0.6 m/s in the 0.1% AEP event, indicating a low risk of erosion. Meanwhile, flooding from the Warrigal Creek/Borer River interacts with the topsoil stockpile from the10% AEP flood event, with flood depths reaching 0.75 m. Peak flood velocities remain below 0.2 m/s in the 0.1% AEP event, indicating a very low erosion risk and negligible impacts to the stockpile emplacements.

Flooding interacts with the base of the TSF embankments, with more extensive inundation occurring during the 1% and 0.1% AEP event, while peak velocities generally remain below 0.5 m/s. The flood modelling indicates a low erosion risk to the TSF embankments. The TSF design incorporates measures to protect against external erosion and maintain embankment structural stability, with the external TSF walls rock armoured using hard, durable and competent rock, while the internal walls will be HDPE-lined. The TSF design assessment identifies the risk of erosion of the external TSF walls from external sources as negligible (SRE 2026). The TSF embankments will also incorporate toe drains to divert clean water and reduce erosion risk.

Potential water-quality implications associated with flood interaction with Project infrastructure are assessed in Chapter 15, Water Quality.

16.2.3.2 Closure phase

The existing case flood model was also updated to represent the closure phase of the Project including the proposed backfill of the mine, the removal of mine infrastructure and rehabilitation of TSF1, TSF2, and TSF3. The topography was modified to include the final landforms as well as the inclusion of the diversion drain to the north of the rehabilitated pit. The western out-of-pit waste rock dump (WRD) is also proposed to be rehabilitated and retained post closure, along with the retained TSF4. However, the retained WRD was not represented in the model. The location of the retained WRD is shown on the closure phase flood maps (Figure 16-12 and Figure 16-13). Flooding impacts associated with the retained WRD are expected to be isolated to the immediate areas around the WRD due to being located outside of the floodplain conveyance area.

Post closure surface water runoff and overland flow pathways have been considered with reference to the final landform topography (Figure 16-11). Following removal of the flood protection levee, the landscape will be returned towards the pre-mining drainage setting, allowing a general return to natural surface water flow pathways across the landscape. While the on-site stream order 1 waterway will not be formally reinstated, the naturally lower topography associated with this drainage pathway will remain, and removal of the flood protection levee will allow surface water flows to drain through this area.

The final landform topography shows a general reinstatement of pre-mining topographic setting and elevations, with the landscape generally flat to gently sloping upwards to the south-southeast, and surface-

runoff and overland flow ultimately draining towards the receiving environment. Additionally, Sediment Dam 3 will be the only water storage that would be retained post closure.

The closure case flood model was simulated for the 1% and 0.1% AEP flood events under two climate change emission pathways. The closure phase flood impact mapping for the 1% AEP peak flood depth and velocity is shown Figure 16-14 and Figure 16-15. The flood impact assessment results indicate that:

- the closure of the project will continue to have minor impacts to Warrigal Creek and Borer River flooding due to the diversion of the unnamed waterway (stream order 3). However, the impact is less compared to that of the operation phase.
    - this impact is expected to include isolated increases in peak flood levels at the location of the diversion drain and south of the rehabilitated TSF4.
    - breakout north from the diverted unnamed waterway (stream order 3) has not been modelled in the closure scenario, reinstating the flow path to existing conditions.
- peak flood depth in Warrigal Creek decreases by a maximum of 0.03 m in the 1% AEP event.
- the changes in flood depth are minor and not expected result in any adverse impacts to the waterway, surrounding properties or flood immunity of any third-party infrastructure.
- increases to peak flood velocity are confined to the diversion drain and to the south of the rehabilitated TSF4. Decreases in peak flood velocity have been modelled between the two final landforms.

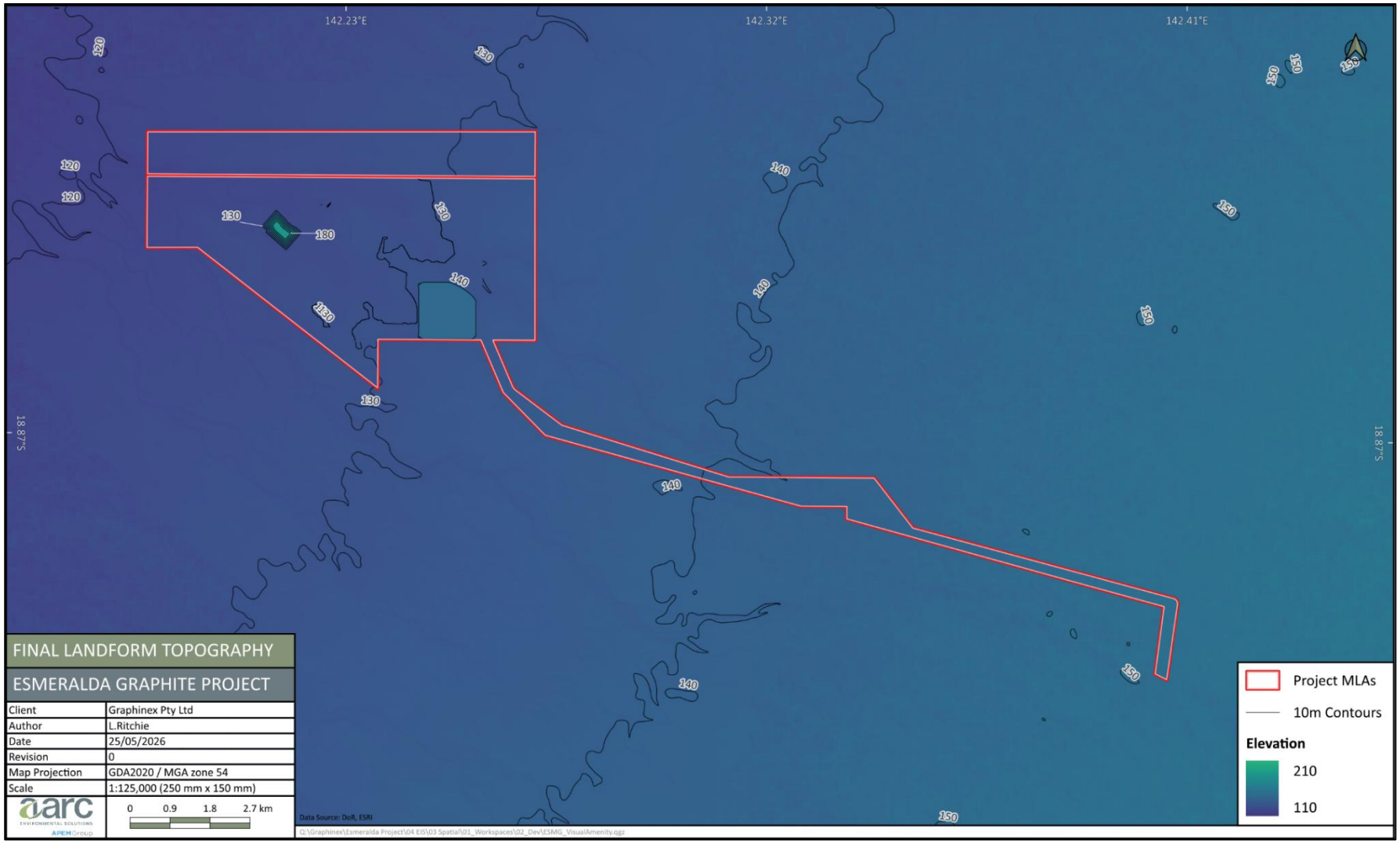


Figure 16-11: Final landform design

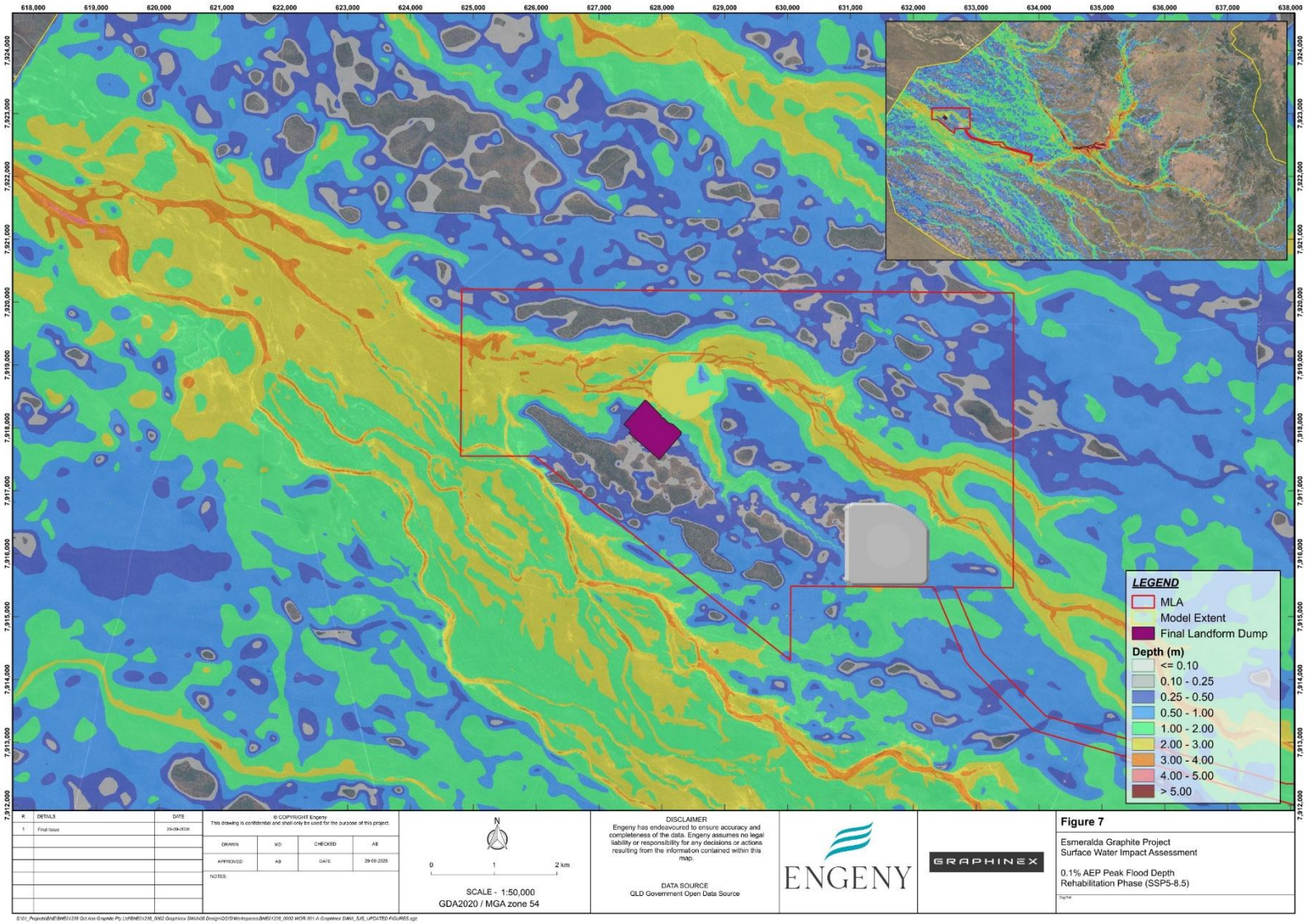


Figure 16-12: 0.1% AEP depth for closure phase (SSP 5-8.5)

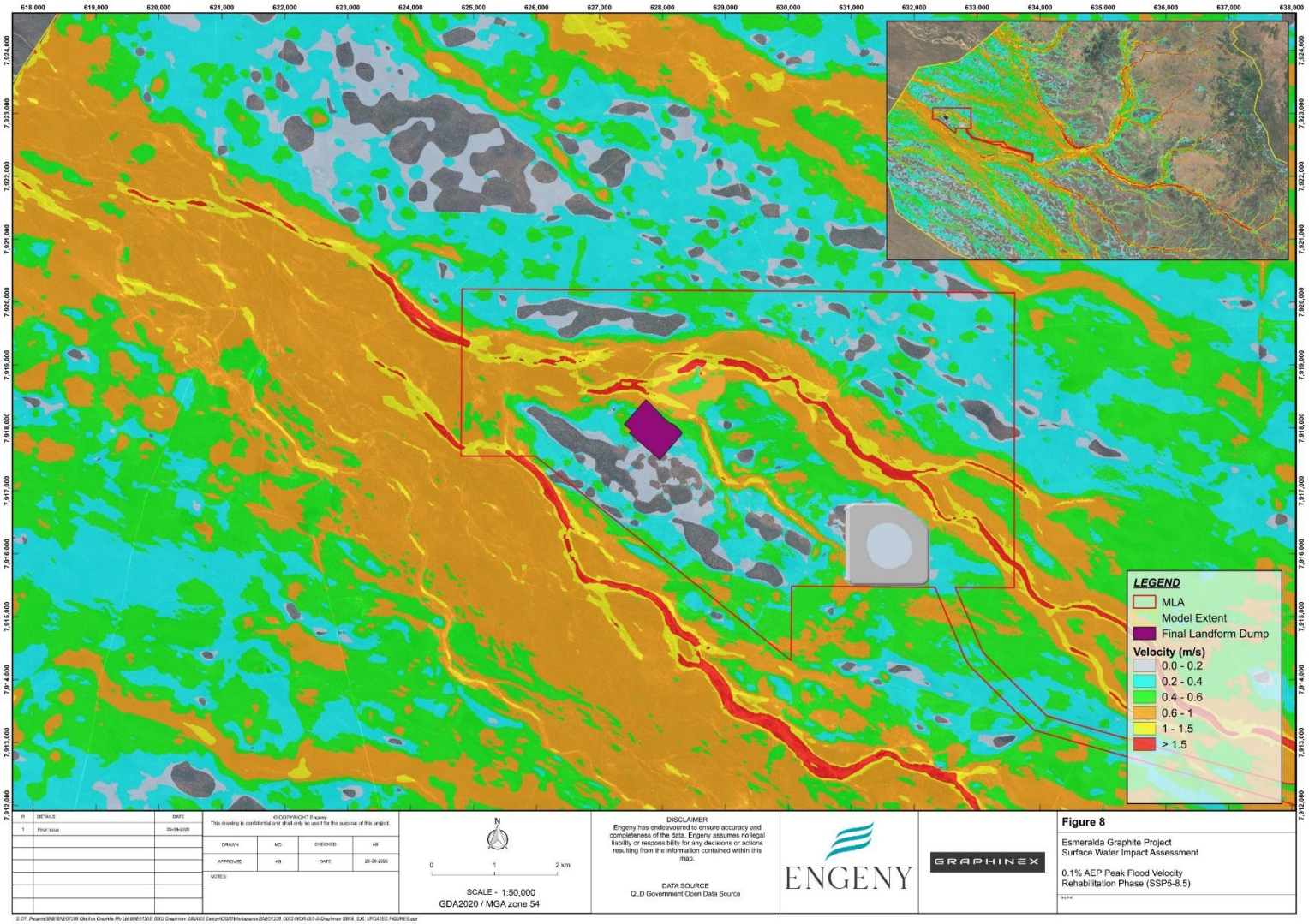


Figure 16-13: 0.1% AEP velocity for closure phase (SSP5-8.5)

16.2.3.3 Climate change sensitivity

The Existing Case flood model was simulated for both the 2090 median and high emission pathway climate change scenarios to assess potential changes in flood behaviour, including afflux and flow velocities, under different Shared Socioeconomic Pathway emission pathways. The modelling results for the 2090 median and high emission pathway scenarios were compared against the current day (2030) model results to quantify the resulting changes in flood levels and flow behaviour.

These results provide an indication of the incremental changes to existing flooding conditions that may occur under future climate scenarios. The current day modelling scenario was adopted for assessment of operational phase flooding impacts, while the 2090 high emission pathway scenario was adopted for assessment of closure phase flooding impacts associated with the Project.

The flood impact assessment results show:

- increases in flood levels from climate change was most pronounced in the upstream major waterways where flooding is more contained to the main river channels and decreases downstream where there is significant breakout flooding.
- The median emissions pathway for 2090 results in an increase in depth across the floodplain. Breakout flooding towards the MLAs has increased by up to 0.33 m, in the 0.1% AEP event and 0.37 m in the 1% AEP event. Flooding at the MLAs increases by 0.18 m in both the 0.1% and 1% AEP events. Minimal changes to flood velocity were modelled for this scenario.
- The High emissions pathway for 2090 results in an increase in depth across the floodplain. Breakout flooding towards the MLAs has a modelled afflux of up to 0.75 m in the 0.1% AEP event and 0.82 m in the 1% AEP event. Flooding at the MLAs increases by 0.45 m in both the 0.1% and 1% AEP events.
- Flood velocity afflux in the high emissions pathway was minor, modelled at 0.15 – 0.35 m/s for the 0.1% and 1% AEP events.

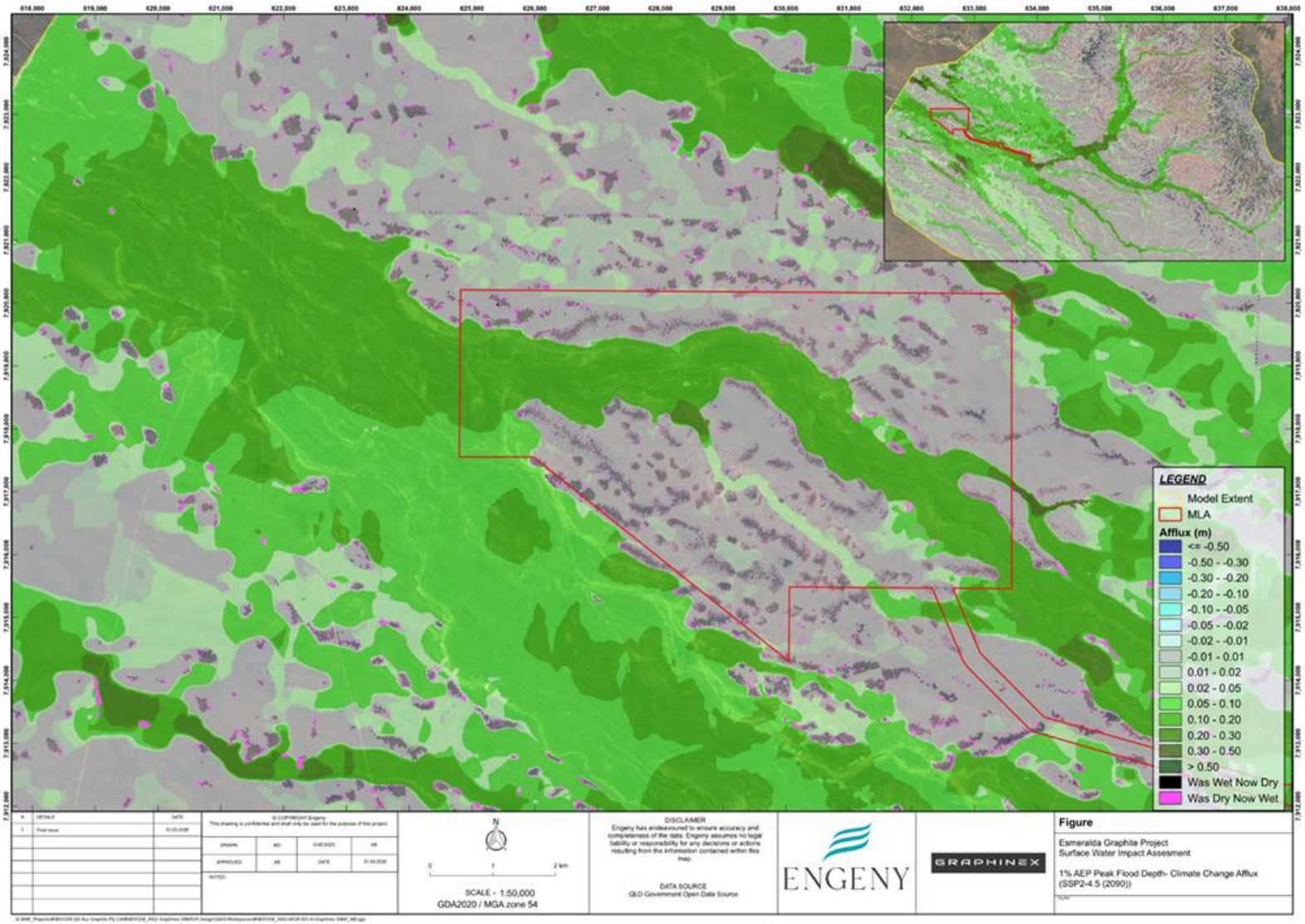


Figure 16-14: 1% AEP Flood Afflux for the Closure Phase (SSP2-4.5 2090)

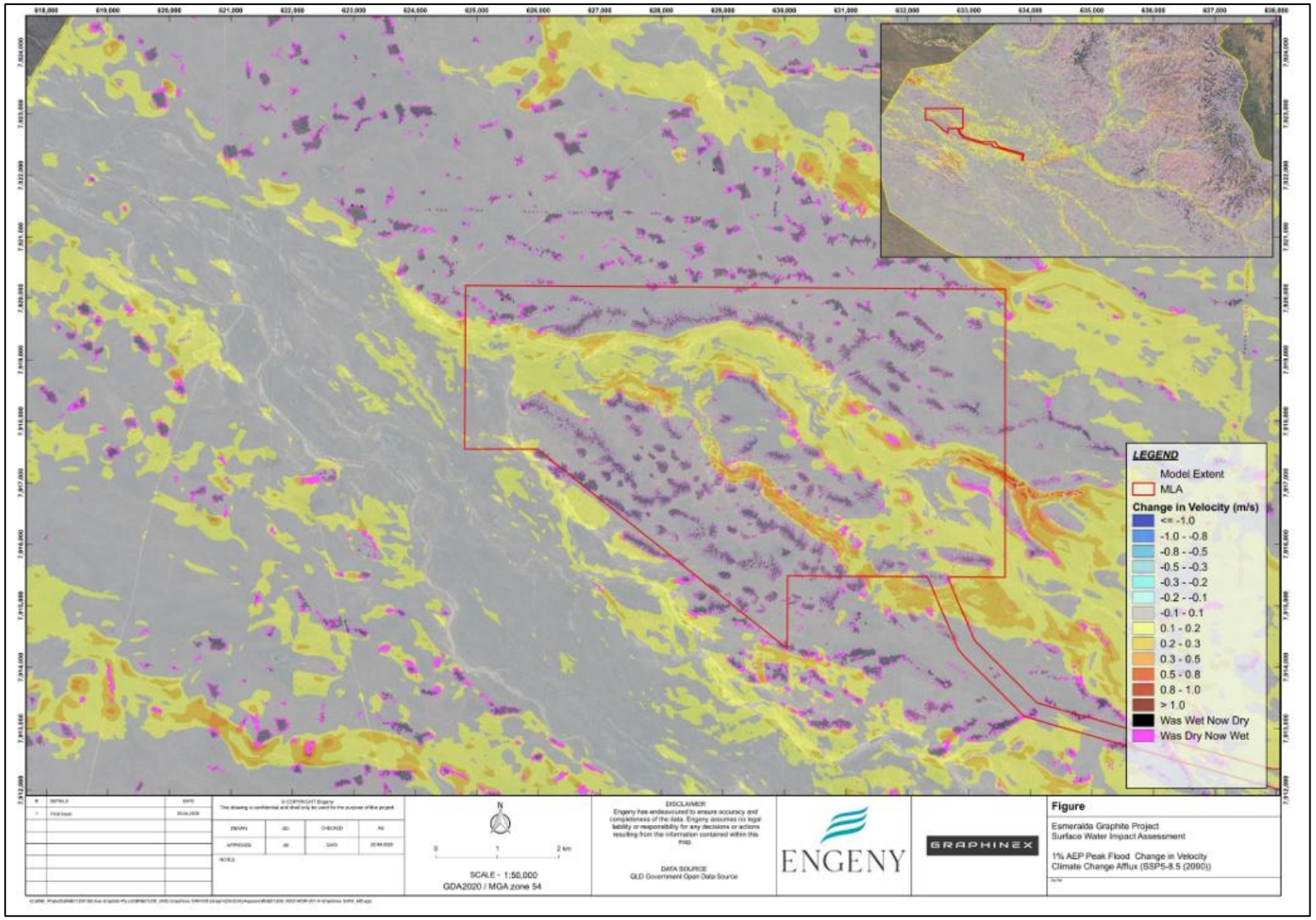


Figure 16-15: Change in 1% AEP peak flood velocity for the closure phase (SSP 2-4.5 2090)

16.2.4 Mitigation, monitoring and management

Flooding risks and potential impacts for the project have been assessed using detailed combined hydrologic and hydraulic model with modelled design flows validated to regional flood estimation techniques. The flooding assessment identified there are localised flood impacts in rarer flood events however there is limited receptors associated with the flooding changes. The flood impacts also show there is negligible change in flood velocity in the affected waterways and not cause further erosion that would occur without the Project.

Review of the flood model and flooding risks associated with the Project can be re-assessed following capture of streamflow monitoring data during significant flood events in the Borer River, Warrigal Creek and the stream order 3 tributary.

To ensure flood risk associated with the Project remains minor or negligible throughout the life of the Project, a range of mitigation, management, and monitoring measures will be implemented. These measures are expected to avoid, minimise, or mitigate potential flooding impacts with respect to the safety of people, property, and the environment.

Flood protection

As part of initial construction and site development, up until approximately year 3 of operations, an interim flood protection levee would be developed around the pit and central mine infrastructure area. The flood protection levee is proposed to protect operational areas, including the pit and central mine infrastructure area, from flood ingress. It would wrap around the northern and eastern extents of the project to provide 0.1% AEP flood immunity (as depicted in Figure 16-10). The concept design for this levee is detailed further in section 16.3.4. As the pit extends to the north, in the area of the interim levee, the levee will be extended around this pit extent, and remain in this location until it is removed as part of site rehabilitation and closure.

Watercourse diversion

The mining pit will intercept a stream order 3 waterway unnamed tributary by approximately year 3 of operations. This tributary is considered a declared watercourse under the *Water Act 2000*. To maintain a hydrologic connection between the unnamed tributary and Warrigal Creek, as well as prevent inundation of the proposed mining pit, a 1.8 km long permanent watercourse diversion is proposed.

The diversion would be developed in approximately year 3 of operations, and intercept the existing waterway east of the pit and divert it around the pit's northern extent to tie back into the original waterway as depicted in Figure 16-16. A conceptual cross-section of the proposed diversion for operation scenario is shown in Figure 16-17 and for the post-mining scenario is shown in Figure 16-18. This design includes:

- a central low flow channel within a broader flood conveyance channel to maintain hydraulic connectivity and accommodate flood flows;
- batter slopes have been designed at shallow grades to support long term channel stability and revegetation;
- an adjacent flood levee is proposed to provide flood protection to operational areas during major flood events; and
- topsoil placement and revegetation are proposed to support rehabilitation and long term geomorphic stability.

To ensure the proposed watercourse diversion achieves the objectives of the former DNRME (2019) Guideline, including maintaining hydraulic function, sediment transport processes, and long-term self-sustaining channel stability, a two-dimensional hydraulic model was developed in TUFLOW to assess the hydraulic and sediment transport behaviour of the existing watercourse and proposed diversion (Engeny 2026b). The model extended approximately 2.5 km upstream and downstream of the proposed diversion and included adjacent floodplain areas to assess potential breakout flows during rarer flood events. The proposed diversion and levee were incorporated into the model using a 12D DEM of the conceptual design. Boundary conditions were developed

using hydrologic model inflows upstream and normal depth outflow conditions downstream. The model was used to assess flood behaviour, including flood levels, velocities, bed shear stress, and stream power for the 39%, 2%, and 0.1% AEP events.

The hydraulic modelling indicated that, during operations, hydraulic thresholds within the diversion are generally higher than the upstream and downstream reference reaches, resulting in a slightly elevated erosion risk and potential sediment deposition downstream of the diversion. However, with the exception of velocities during the 2% AEP event, the diversion remained within relevant ACARP guideline criteria. These risks are proposed to be managed through inspection, monitoring, and maintenance during operations. Figure 16-19 and Figure 16-20 show flood depth and velocity for 0.1% AEP events during operations.

Post-mining modelling indicated that hydraulic thresholds within the diversion are consistent with ACARP guideline values and comparable to upstream and downstream reference conditions. The modelling suggests that reinstatement of the floodplain over the backfilled pit is expected to maintain the pre-mining dynamic equilibrium and sediment transport capacity of the watercourse system into the post-mining landform. Figure 16-21 and Figure 16-22 show flood depth and velocity for 0.1% AEP events post-mining.

The modelling outcomes of the proposed watercourse diversion indicate that the diversion is capable of maintaining hydraulic and geomorphic functionality during both operational and post-mining conditions. Further details regarding the diversion design, modelling methodology, assumptions, and assessment outcomes are provided in Appendix X, Watercourse Diversion Functional Design Report.

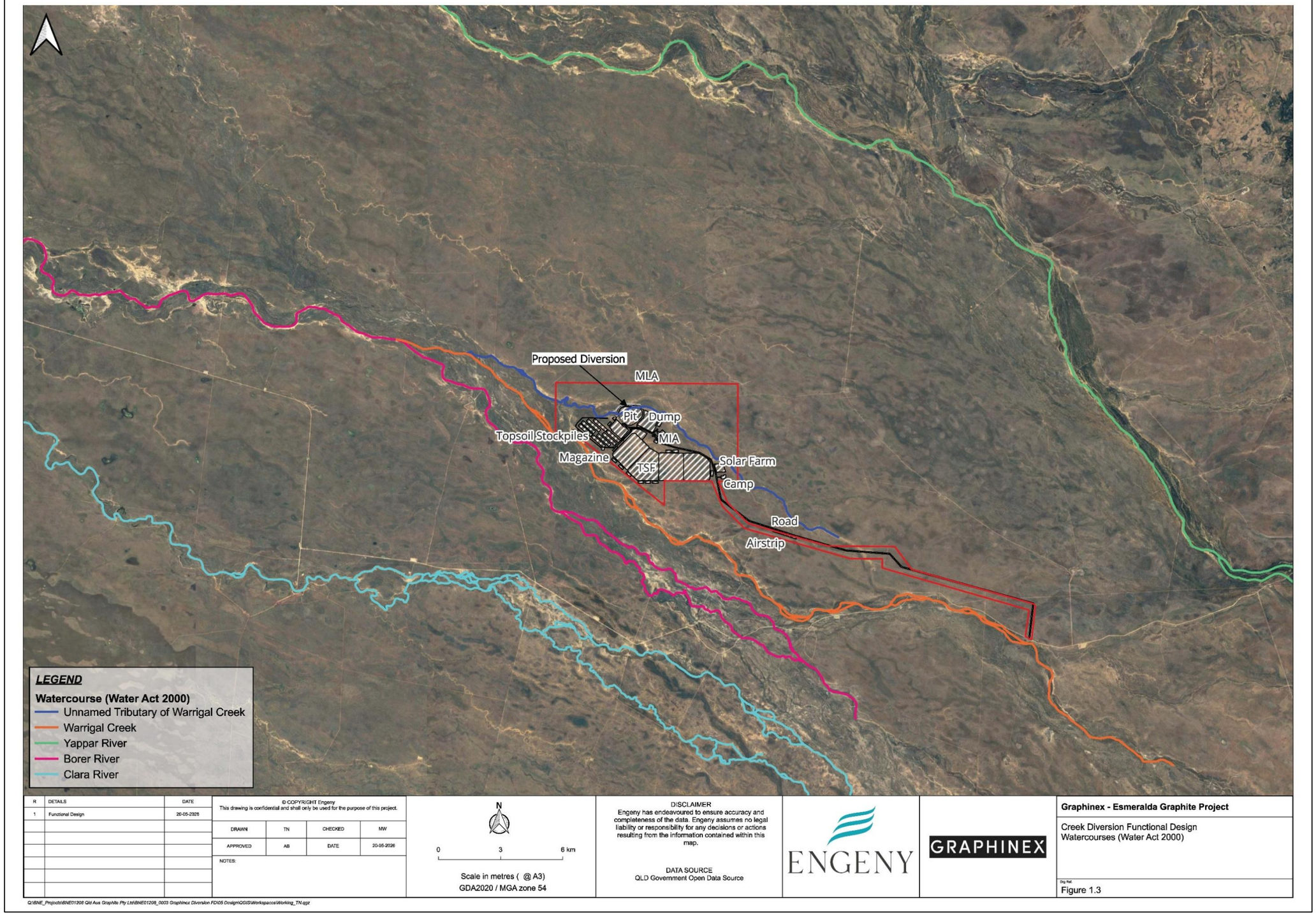


Figure 16-16: Watercourse and diversion

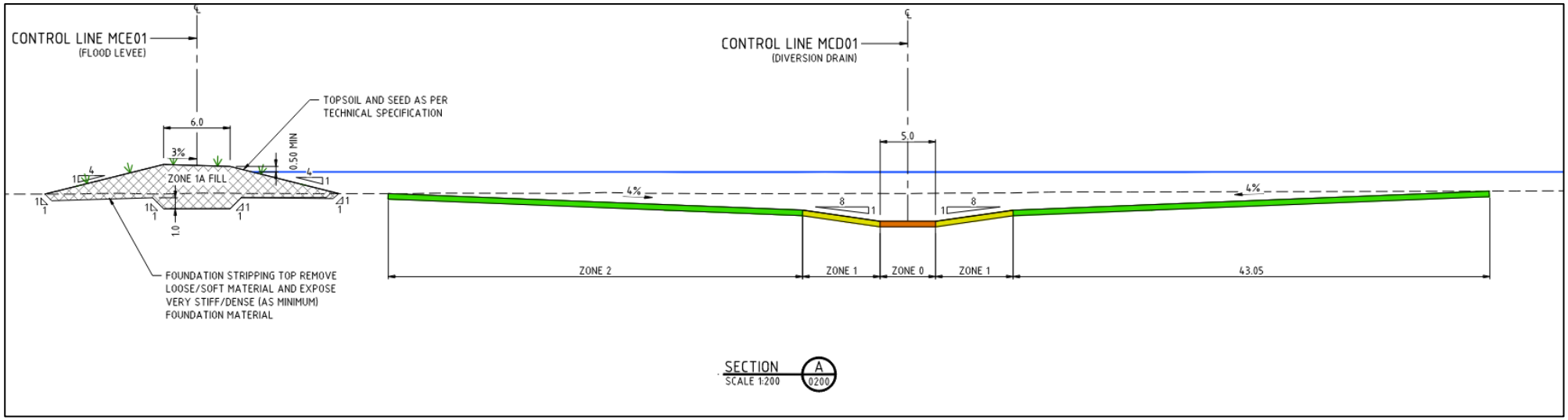


Figure 16-17: Conceptual diversion drain cross-section - operational scenario

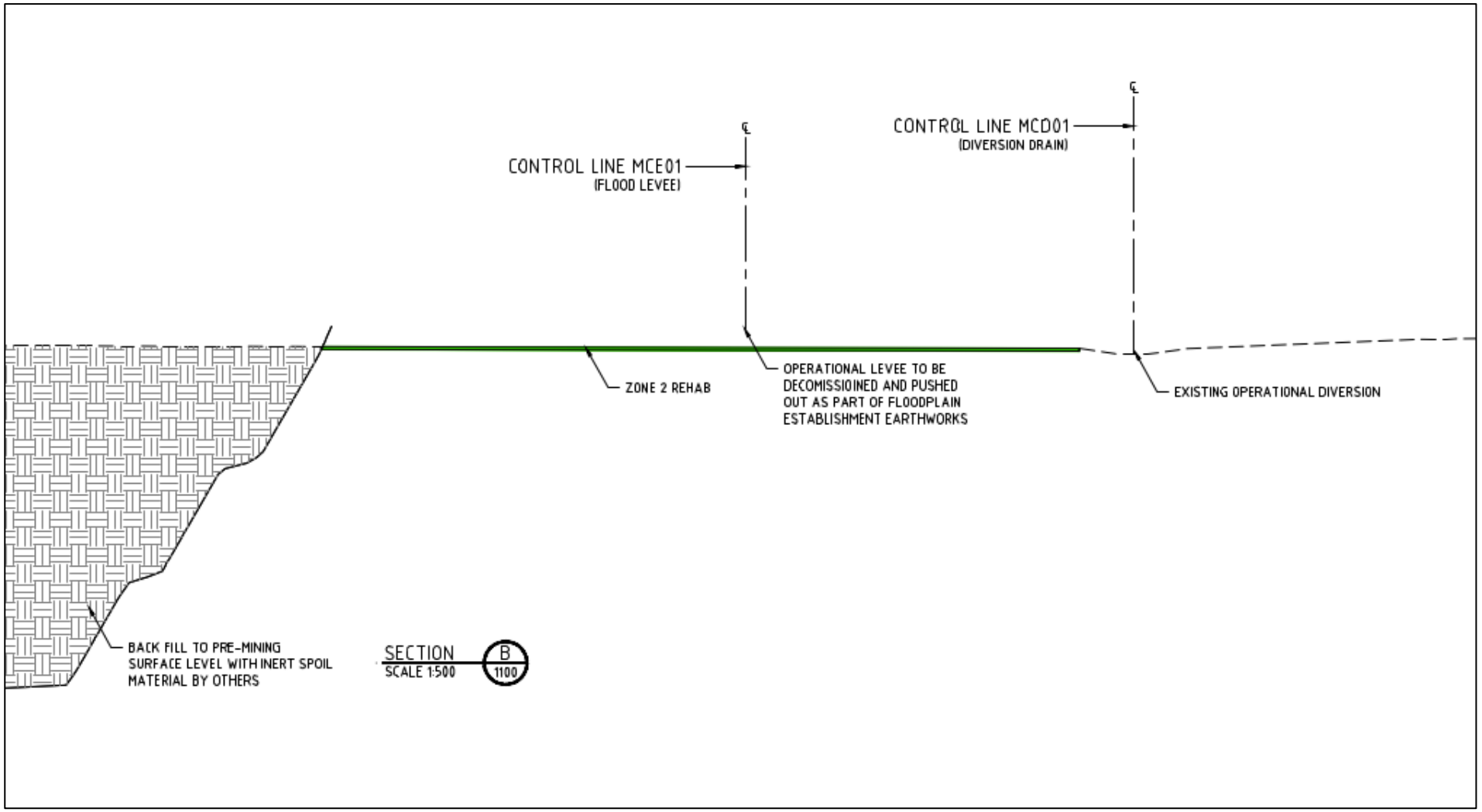


Figure 16-18: Conceptual diversion drain cross section - post- mining scenario

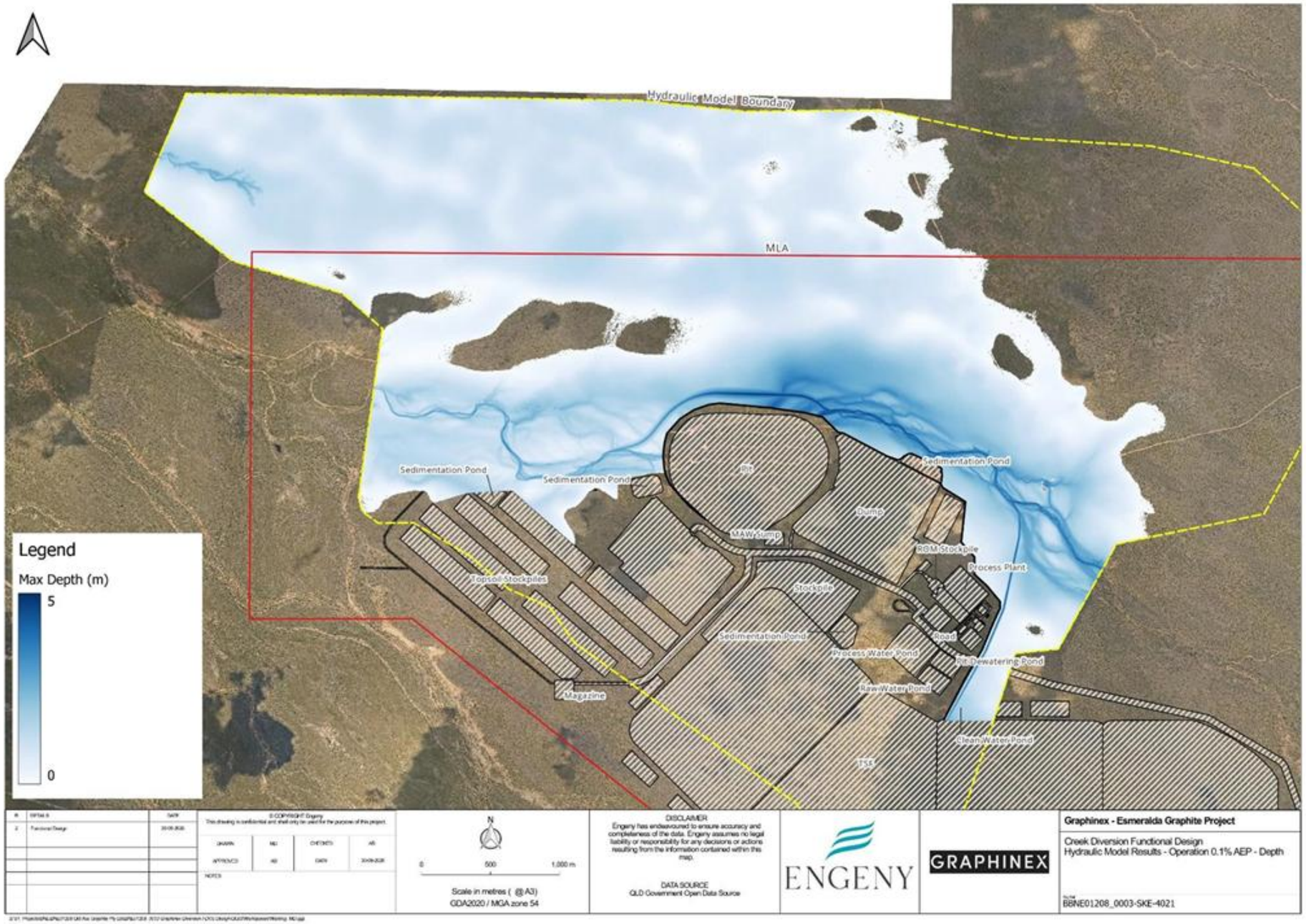


Figure 16-19: 0.1% AEP peak flood depth - operation

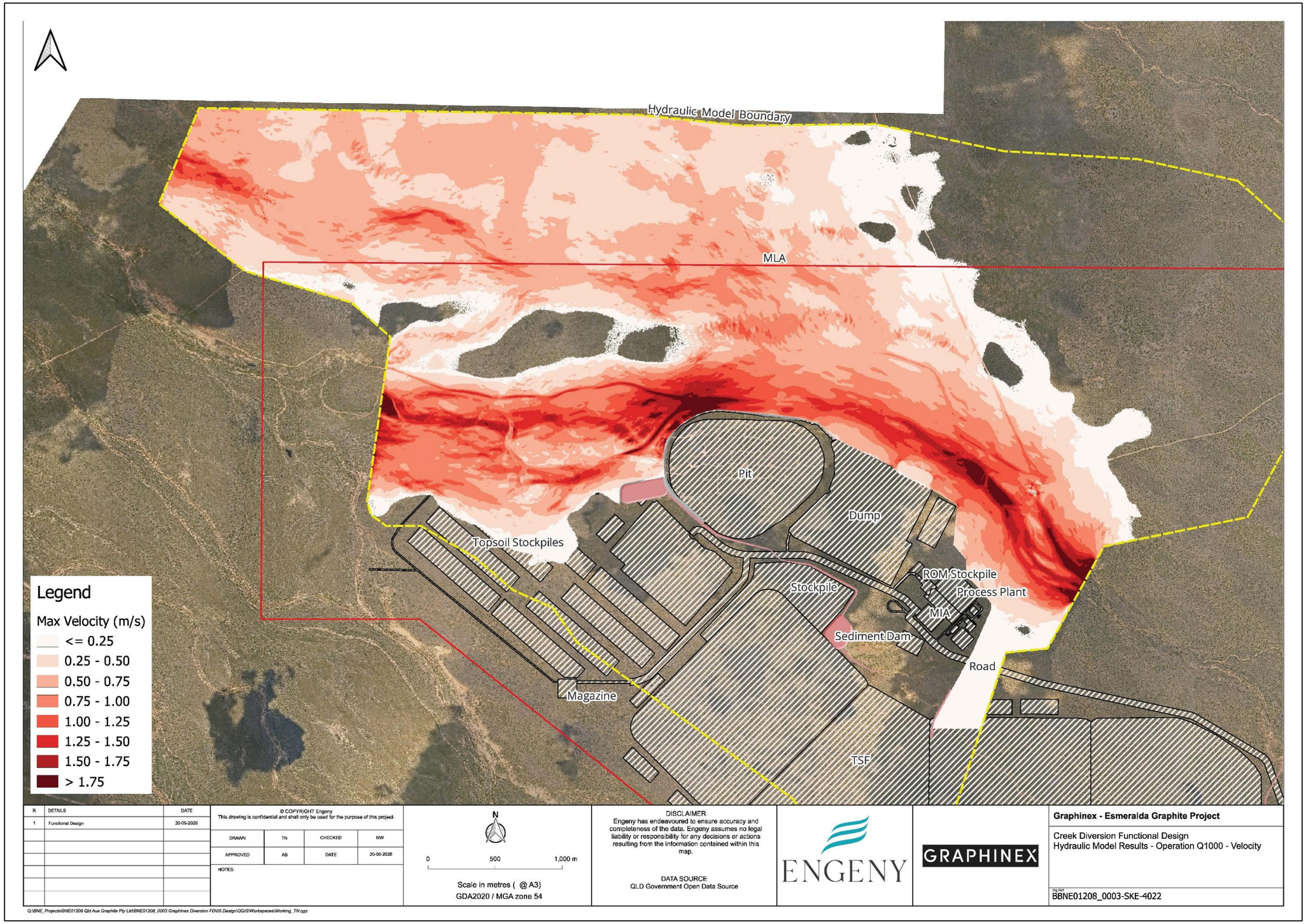


Figure 16-20: 0.1% AEP peak velocity - operations

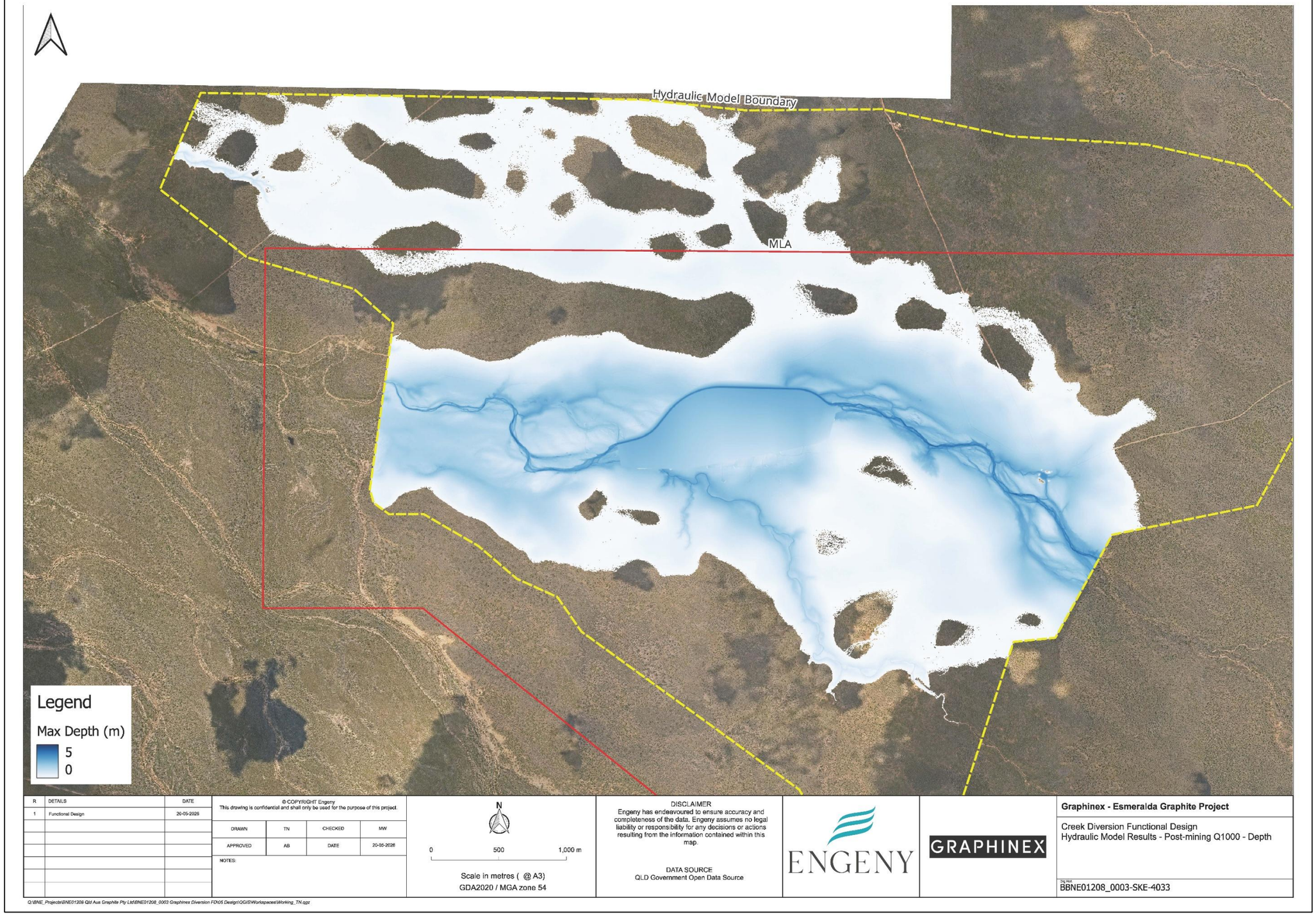


Figure 16-21: 0.1% AEP peak flood depth - post-mining

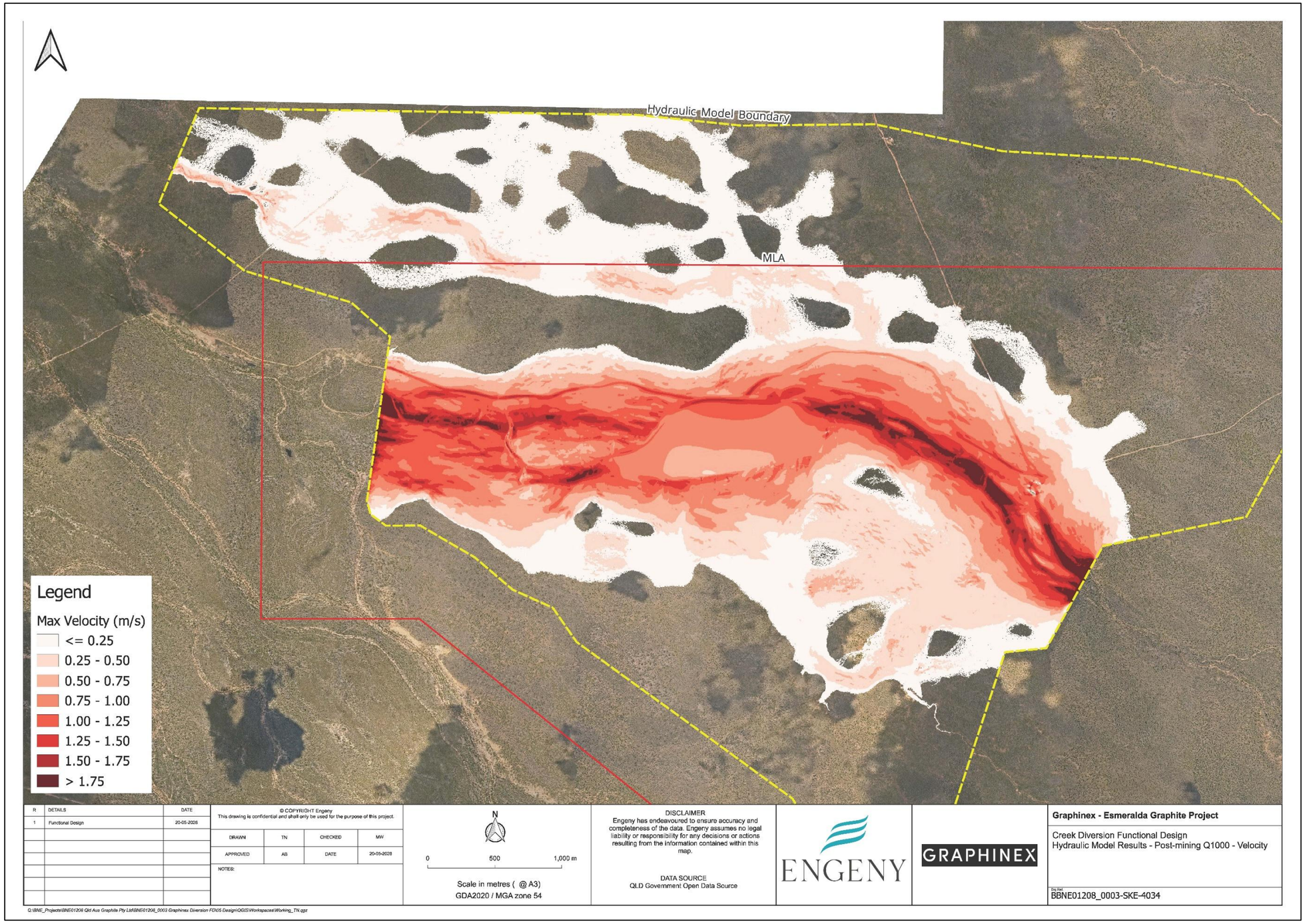


Figure 16-22: 0.1% AEP peak velocity - post-mining

Watercourse diversion monitoring

Monitoring of the proposed diversion will be undertaken throughout the life of the diversion, from baseline data collection through to relinquishment, to confirm that the diversion remains safe, stable and functions in accordance with the design intent. Monitoring stages will include baseline monitoring, construction monitoring, operational monitoring during the initial establishment period, long term operational monitoring, and relinquishment monitoring.

Baseline monitoring will establish reference conditions for the upstream control reach, diversion reach, and downstream reach prior to construction. Construction monitoring will then verify that the diversion has been constructed in accordance with the approved design and rehabilitation requirements. Operational monitoring will focus on assessing geomorphic stability, vegetation establishment and maintenance requirements, particularly during the first five years following construction when the diversion is considered most susceptible to erosion and instability. Long term monitoring will continue over the life of the Project to assess ongoing diversion performance and identify any maintenance or remediation requirements. Relinquishment monitoring will ultimately demonstrate that the diversion has reached a condition of dynamic equilibrium with the surrounding landscape.

Monitoring of the diversion will be undertaken in accordance with the ACARP Planning, Design, Construction and Rehabilitation of Watercourse Diversions for Open Cut Mines guideline, including application of the Index of Diversion Condition (IDC) methodology for assessing geomorphic and vegetation condition. Further detail regarding the proposed monitoring framework, maintenance requirements and diversion design is provided in Appendix X, Watercourse Diversion Functional Design Report.

16.3 Regulated structures

The proposed water management system is detailed in Chapter 14, Water Resources, and Appendix K, Surface Water Assessment. Further details regarding the design and operational aspects of the proposed water management infrastructure are provided in Section 16.3.1 thru to section 16.3.4. In summary, mine-affected water (MAW) storages will be used to contain surface water runoff, including water collected from de-watering the mining pit, recycled water from the mineral processing plant, and runoff from the mine infrastructure area. Other water storages for the Project include four sediment dams, and a raw water dam. Clean water drainage will be used to prevent clean water from flowing into the mine-affected water catchments. Sediment water drainage will direct sediment laden water to sediment dams.

Water collected within the pits from rainfall runoff and groundwater ingress is dewatered to the Pit Dewatering Dam (PDD) which is then transferred to PWD for use in the processing plant. As a second priority, supernatant water from tailings deposition and rainfall is pumped from the TSFs to the PDD.

These dams will be preferentially used to supply the mineral processing plant (MPP) and meet dust suppression demands. The preferential use of water from these storages will ensure that the dams are not kept full. In the unlikely event releases from the PDD or PWD are required, they will overtop to the MAW sump, a small storage that recirculates MAW back to the PDD. The PWD, PDD and MAW Sump all overflow to the mining pit. The mining pit has excess storage capacity and will contain any overflows from these storages and prevent all discharges reporting to the environment. Figure 16-23 shows the water management infrastructure layout at the Project site.

Based on the technical assessments undertaken by Engeny (2026a) and SRE (2026), project water management infrastructure was assessed in accordance with the Manual for assessing consequence categories and hydraulic performance of structures (ESR/2016/1933) (the Manual). The assessment considered the conceptual designs, intended operational strategies and expected contaminant concentrations associated with each structure. As summarised in Table 16-2, only the Process Water Dam (PWD), Pit Dewatering Dam (PDD) and TSF Cells 1 to 4 were identified as regulated structures under the Manual. All other assessed structures were determined to have a low consequence category and are therefore not considered regulated structures.

Table 16-2: Preliminary Consequence Category Assessment Summary

Structure	Failure to Contain - Seepage	Failure to Contain -Overtopping	Dam Break	Regulated
Process Water Dam (PWD)	Significant	Low	Low	Yes
Pit Dewatering Dam (PDD)	Significant	Low	Low	Yes
MAW Sump	Low	Low	Low	No
Sedimentation Pond 1	Low	Low	Low	No
Sedimentation Pond 2	Low	Low	Low	No
Sedimentation Pond 3	Low	Low	Low	No
Sedimentation Pond 4	Low	Low	Low	No
Raw Water Dam	Low	Low	Low	No
Clean Water Sump	Low	Low	Low	No
TSF Cells 1 to 4	Significant	Significant	Significant	Yes
Levee	-	-	-	Yes

The flood protection levee that follows the proposed watercourse diversion will protect operational areas from flood ingress. The Manual determines levees or bunds that are required to provide flood immunity to operational areas in events up to and including the 0.1% AEP are considered regulated (DETSI 2025). Based on

this the flood protection levee is determined to also be a regulated structure and must comply with the hydraulic design criteria for levees in the Manual.

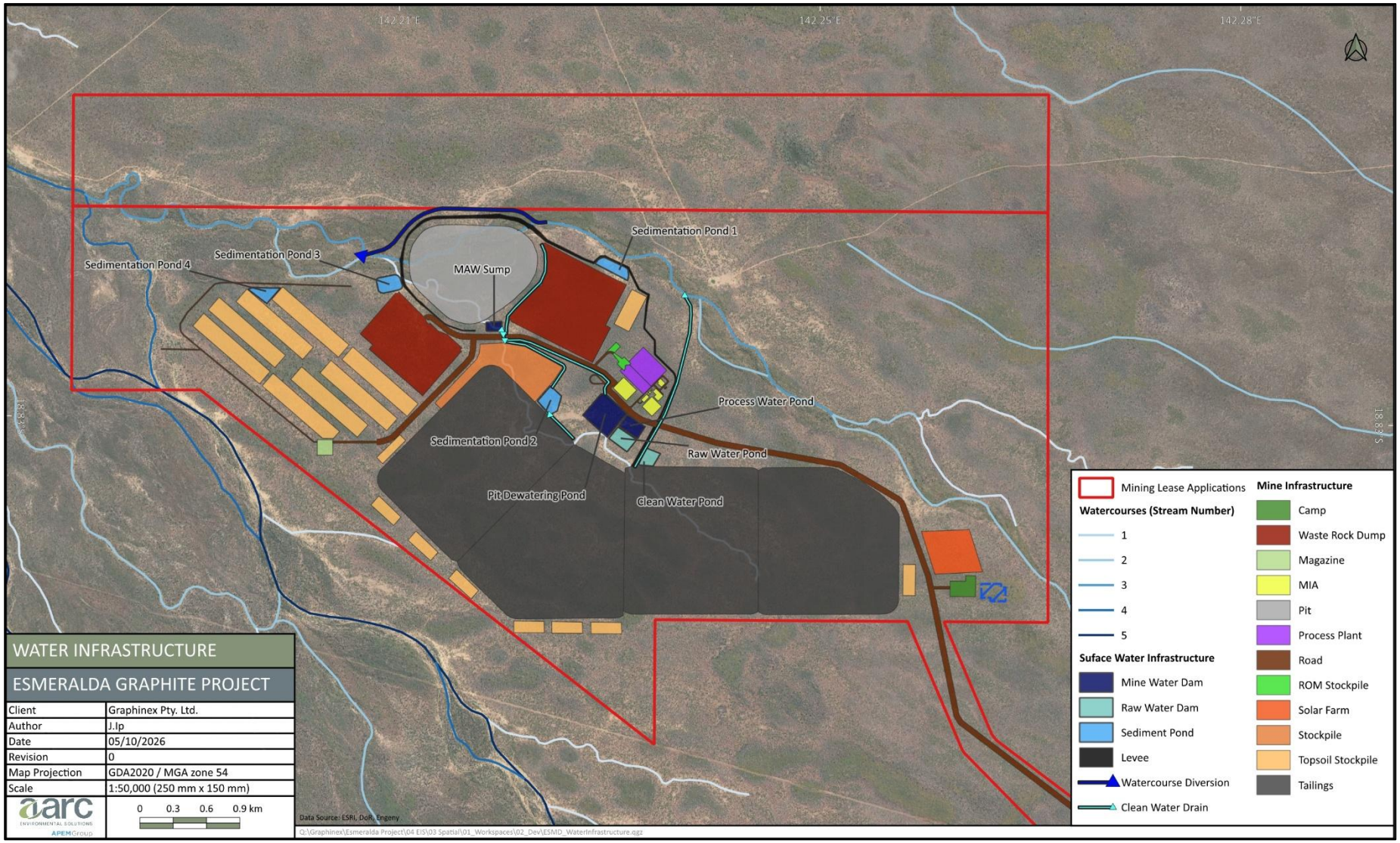


Figure 16-23: Water Management Infrastructure

16.3.1 Process Water Dam

The PWD will be located within the processing area and will provide process water supply while receiving recycled water flows from the plant and runoff from the processing area. Excess water from the PWD will overflow to the MAW Sump and ultimately the mining pit, which has sufficient storage capacity to prevent off-site discharge.

Water quality within the PWD is expected to be poor due to contaminants associated with ore processing and ore body geochemistry. Recycled process water may contain elevated concentrations of copper (Cu), molybdenum (Mo), rhenium (Re), sulphur (S) and tellurium (Te), with potential for acid mine drainage generation.

The PWD will be a lined storage designed to prevent seepage and potential environmental harm. The conceptual design comprises an approximately 8.2 ha footprint, a primarily excavated storage with perimeter embankments, and a spillway designed to contain the 1% AEP flood event with 0.5 m freeboard, which is conceptually depicted in Figure 16-24.

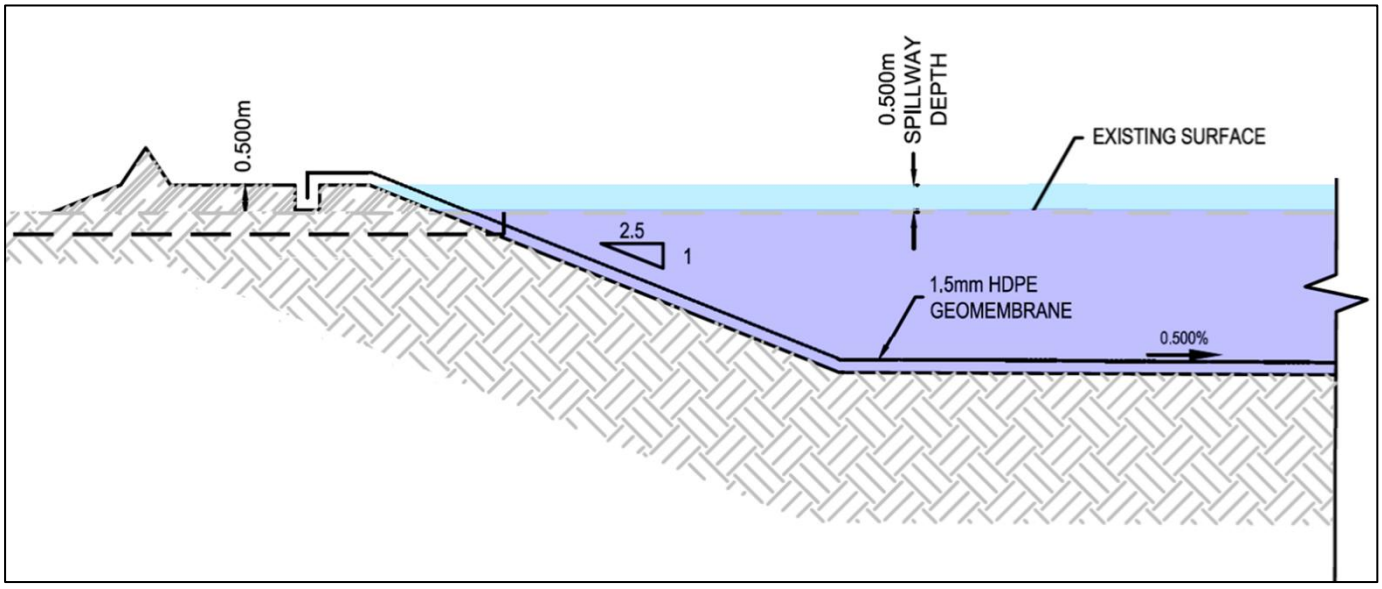


Figure 16-24: Process Water Dam typical cross section

16.3.2 Pit Dewatering Dam

The PDD will be located south of the processing area and will receive dewatering flows from the mining pit and TSFs for reuse as process water. The PDD and PWD have been sized to maintain pit and TSF dewatering requirements while preventing uncontrolled overflows to the mining pit. The PDD will generally operate at low storage volumes due to prioritised use of water for process demands.

Water quality within the PDD is expected to reflect groundwater inflows, seepage from the MAW system and tailings-related contaminants, although contaminant concentrations are expected to be lower than the PWD due to dilution from pit runoff. The PDD will comprise a lined, excavated storage with perimeter embankments to prevent seepage and provide spillway freeboard. Conceptual design features include an approximately 4 ha footprint, a 6 m excavation depth, and a spillway designed for the 1% AEP flood event with 0.5 m freeboard. The construction of the PDD will be very similar to the conceptual design provided in Figure 16-24.

16.3.3 Tailings storage facilities

The Project includes four engineered tailings storage facilities – TSF 1, TSF 2, TSF3, and TSF4, which will operate independently. The cells will be used sequentially for the deposition of tailings fines produced by the mineral

processing circuit, and recovery of water to supply water demands. TSFs 1, 2 and 3 will be removed and rehabilitated as part of the pit backfill for mine closure, and TSF 4 will be capped and remain in place at closure.

A typical cross-section of the proposed TSFs is presented in Figure 16-25.

The design concept for each cell of the TSF incorporates a pontoon-mounted return-water recovery system and perimeter monitoring/recovery bores located downstream, to the south of the TSF (SRE 2026). This is in addition to an underdrainage collection system and sump for capturing seepage and water draining to the base of the TSFs.

The proposed design concept is based on downstream construction techniques with both upstream and downstream slopes of 2.5:1 (H:V). The perimeter embankments are to comprise an engineered, compacted 'select' soil embankment with a cut-off trench on the upstream face, with a minimum crest width of 5 m. The downstream section of the embankment will have a minimum crest width of 15 m and comprise traffic compacted mine waste (Wave International 2025). Key design details of the tailings storage facilities relevant to surface water include:

- High-Density Polyethylene (HDPE) Liner Dam Liner to reduce the risk of seepage;
- Design Storage Allowance of 1.62 GL to 1.70 GL to achieve 1:100 AEP wet season containment reduce the risk of overflow;
- Emergency Storm Storage of 0.75m in each dam to provide containment of the 1:100 72 hour storm event; and
- spillway width of 25 m to convey a storm event rarer than the 0.1% AEP event with suitable wave freeboard allowance, noting all four TSFs are designed to overflow towards the mining pit and do not discharge from site.

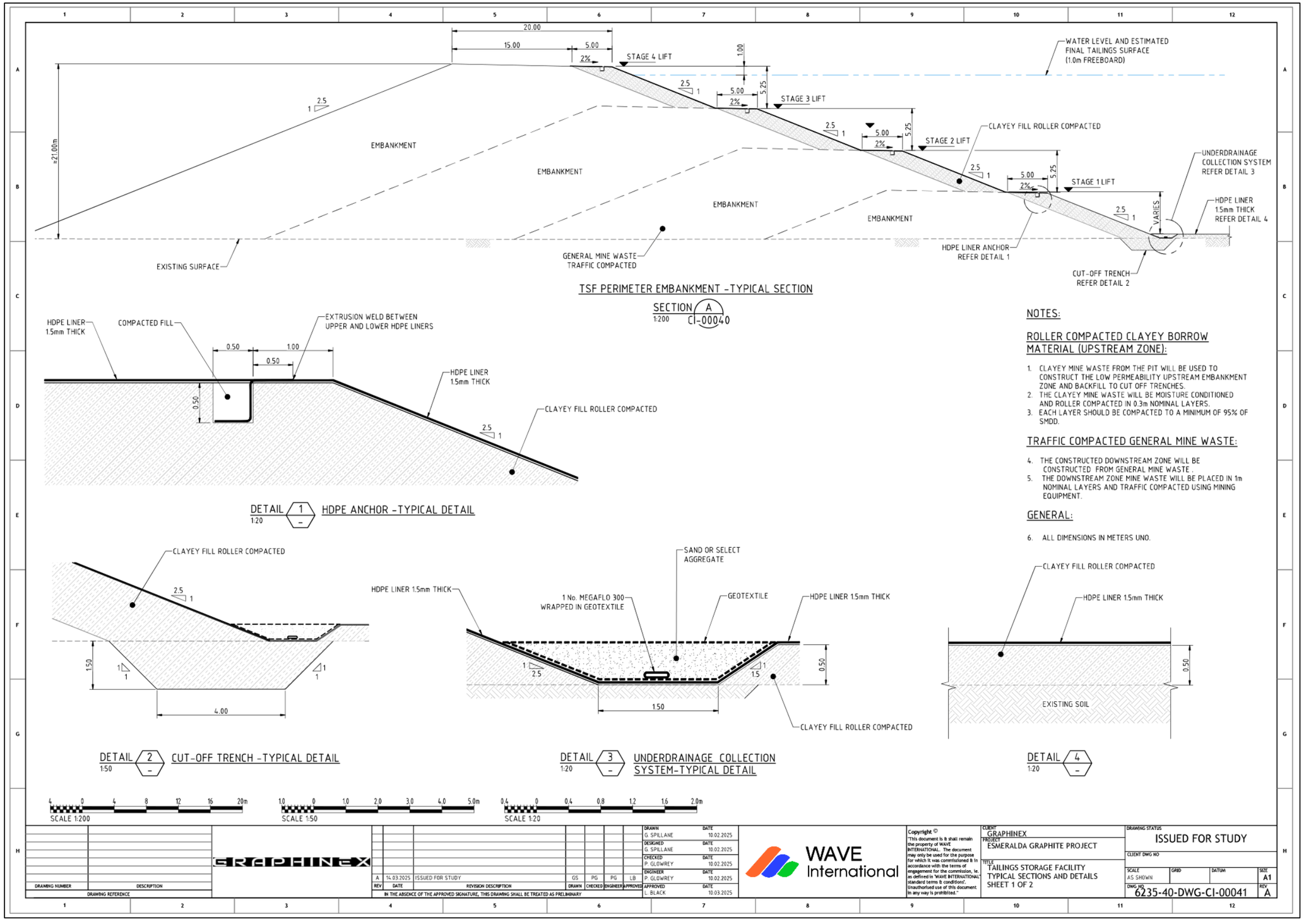


Figure 16-25: Typical TSF cross-section

16.3.4 Flood protection levee

A flood protection levee is proposed along the southern edge of the watercourse diversion to protect the mining pit from the flooding up to the 0.1% AEP flood event, with an additional 0.5 m allowance for freeboard. The 2D hydraulic model shows that under the 0.1% AEP design flood event, with the nominated freeboard (Engeny 2026a).

The levee alignment was selected based on flood modelling results and the natural topography within the Project area. The levee follows the natural ridgeline along the western Project boundary to prevent any ponding and minimise flood impacts before wrapping around the ultimate pit extent.

During the first three years of the Project, a temporary section of levee will be located between the southern bank of the Stream Order 3 waterway and the mining pit. Following construction of the watercourse diversion, the levee will be completed around the pit extent and will remain in place until the end of mining.

The site access road will cross over the central clean water drain and levee near the process plant. At this location, the road will locally ramp up and over the levee with sufficient fill so as to not affect the levee construction, while culverts will be constructed under the road in the central clean water drain to maintain the drain flow capacity.

The levee will be constructed from non-dispersive, low permeability earth fill (clay), with foundation stripping and a cutoff trench to minimise the potential for piping

The levee extent is shown in Figure 16-23, while a typical section is shown in Figure 16-26. The concept details of the levee are:

- length = 5.4 km;
- crest width = 6 m;
- crest Elevations = Starting at 127.1 m AHD (Flood level of 126.6 m AHD) decreasing down to 121.7m AHD (Flood level of 121.2 m AHD);
- batter slopes = 1V:4H; and
- containment standard = 0.1% AEP flood event with 0.5m freeboard.

The flood protection levee will be removed as part of rehabilitation and closure works, allowing for reinstatement of the flood plain on both banks of the watercourse diversion.

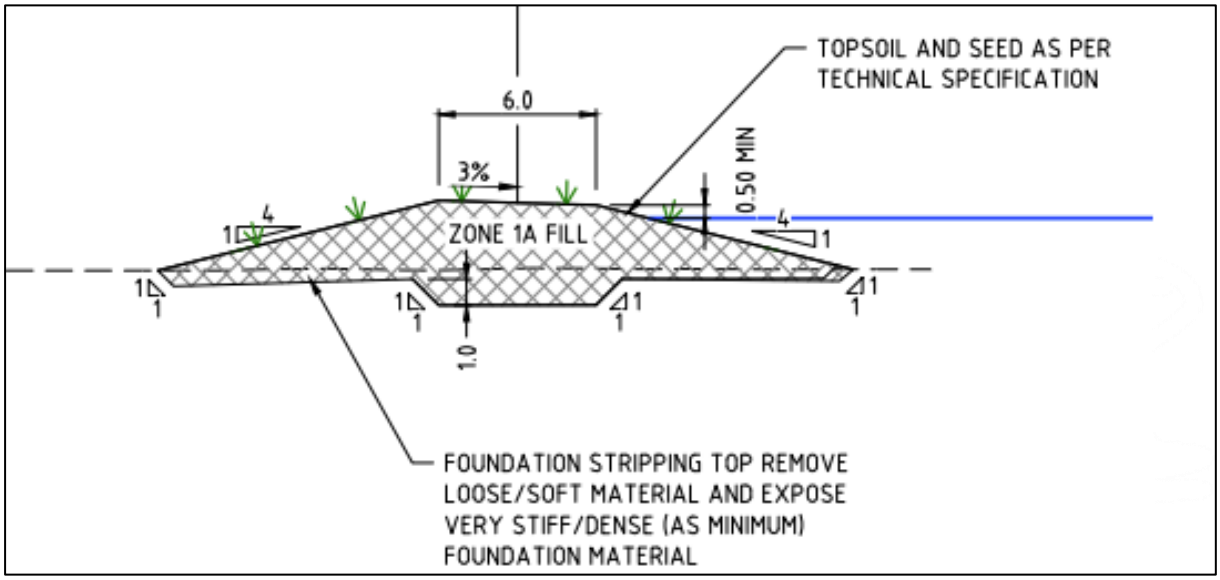


Figure 16-26: Levee typical section

16.4 Potential impacts

Water retaining structures are assessed using the Manual to determine if their consequence category is low, significant, or high. Structures deemed to be of significant or high consequence category are referred to as regulated structures. The manual requires the assessment of the consequences of the following failure event scenarios:

- 'Failure to contain – seepage' – spills or releases to ground and/or groundwater via seepage from the floor and/or sides of the structure;
- 'Failure to contain – overtopping' – spills or releases from the structure that result from loss of containment due to overtopping of the structure; and
- 'Dam break' – collapse of the structure due to any possible cause.

For each failure event scenario, the Manual requires the consequences to be assessed for each of the following categories of harm.

- harm to humans;
- general environmental harm; and
- general economic loss or property damage.

16.4.1 Dam break

The mine water storages are located upstream of the mining pit, such that any flows resulting from a dam break are expected to be contained withing the pit void. Sediment dams 1, 3 and 4 contain small embankments of 3 m or less and could feasibly fail towards the stream order 3 tributary. However, there is no third-party infrastructure or population at risk in the areas downstream of the Project that could be affected by a dam break. Water retained within the Sediment dams is expected to have relatively good water quality and, therefore, a dam break event is not expected to result in significant environmental harm.

The PWD and PDD are expected to be excavated structures, resulting in a low potential for a dam break scenario. In the event of a dam break, flows would be directed to the mining pit, which has sufficient capacity to contain the dam break volume and prevent discharge to the receiving environment. Therefore, a dam breal is unlikely to impact the receiving environment and the structures have been assigned a low consequence category for a dam break.

The TFS embankment design comprises a single-sided textured HDPE liner placed over a low permeability upstream zone, constructed from the sedimentary rock sequence or waste rock (weathered sandstone, siltstone and claystone, granite), with similar mine waste in the downstream zone. Perimeter embankment raising will be executed by downstream construction techniques as appropriate to the conditions at the time of construction. These measures are intended to minimise the potential for loss of confinement that could lead to a dam break. However, a dam break remains a low-probability but credible failure mode (SRE 2026).

If a TSF dam break scenario occurs, the consequences include potential loss of life, economic losses associated with plant shutdown and production loss, and environmental impacts from tailings released downstream and contaminating soils and surface water. Therefore, the TSF has a consequence category of significant for dam break.

16.4.2 Failure to contain overtopping

Engeny (2026a) determined that PWD, MAW Sump and PDD were considered low risk for a failure to contain overtopping. Although water stored in these structures are expected to be poor quality due to contact with material stockpiles and processing, the open cut pit and groundwater inflows, in the event of overtopping, the

PWD and PDD ultimately report to the mining pit and therefore are not likely to have significant impacts on the receiving environment.

The TSFs receive surplus water during the wet season. Spillways are designed to operate only when rainfall event exceeds the design storage requirements. If an extreme rainfall event exceeds the design criteria, overtopping could result in uncontrolled release of water from the TSFs, however any discharge from the spillway would be highly diluted, given the size of a rainfall event required to trigger overtopping, with further dilution occurring downstream as flows mix with other catchments.

The flood protection levee is designed to provide protection against the 0.1% AEP flood event, including consideration of climate change impacts and 0.5 m of freeboard. Although considered extremely unlikely, flooding exceeding the levee design standard could result in overtopping and floodwater ingress to the Project area. The Probable Maximum Flood (PMF) assessment indicates that peak flood levels are approximately 2 m higher than the 0.1% AEP flood level near the process plant and approximately 1.5 m higher near the mining pit. With the 0.5 m freeboard incorporated into the levee design, the PMF could exceed the levee crest by approximately 1.0-1.5 m. Overtopping could result in inundation of the process plant and mining pit and may also result in scour and failure of the levee embankment, increasing the volume of floodwater ingress (Engeny 2026a). A PMF event is extremely rare and far exceeds the design requirements of a flood protection levee. The risk of levee overtopping or failure is managed by the levee being classified as a regulated structure and needing to meet the requirements of the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (DETSI, 2025).

16.4.3 Failure to contain seepage

The storage and handling of hydrocarbons and chemicals will be managed in accordance with best practice and legislated requirements at mine sites to prevent contamination of the groundwater regime . These include the appropriate storage of hydrocarbons in bunded areas and immediate clean-up of spills which are standard practice. This will mitigate operational risk of seepage from general Project spills.

In addition to this, during mining operations, the open pit void will behave as a groundwater sink. The maximum predicted drawdown in the Gilbert River Formation extends under the proposed waste rock emplacements, water storages, and tailings storage facility. Given the activities proposed, the controls that will be adopted, and the hydraulic gradient that will be generated in the Project mining area, the Project has a very limited potential to give rise to groundwater contamination.

The TSFs will be HDPE lined, creating an impermeable layer between the tailings and receiving environment. A sump and underdrain have been designed to draw water from within the TSFs to external water storage for use in mineral processing. Modelling of the tailings indicates that water will migrate toward the embankment toe where higher-permeability materials facilitate flow into the underdrain (Appendix W, Technical Report for Tailings Storage Facilities).

16.5 Mitigation, monitoring and management

The Manual for Assessing Consequence Categories (DES 2016a) states that the water management strategy for a site must entail active management of contaminated water in regulated structures so that in the event of an incident, the impact is avoided or reduced to as great an extent as possible. The proposed surface water management measures, including management measures to avoid and reduce potential impacts are discussed in detail in Chapter 14, Water Resources and Chapter 15, Water Quality.

16.5.1 Water storage monitoring

A water monitoring program (WWP) is one of the key controls for the ongoing performance assessment of the site and identification of potential impacts. The aim of the WMP is to identify and quantify potential impacts on the receiving waters during operations and assess the adequacy of or improvements to the mitigation measures. A WWP will be developed for the Project that will include water storage monitoring.

Routine sampling of the site water storages will be conducted monthly to track water quality trends in the storages and allow review of risks to environmental harm. Sampling of water storages will also be completed during overflow events to determine the concentration and quantity of released contaminants to allow investigation into the extent of environmental harm. Water storages will be sampled for the water quality parameters presented in the following section. Water levels in the storages will be monitored by the automatic monitoring and alert system proposed for the Project which will capture real time water levels in storages with trigger alarms.

In addition to the Project water storage monitoring, a network of six shallow groundwater monitoring bores and three deeper bores associated with the TSFs will be installed around the perimeter of the TSFs (Figure 16-27). These bores will be established prior to the operation of the TSFs and are designed to:

- establish monitoring sites that are located downgradient of the TSFs;
- establish monitoring sites capable of monitoring groundwater flow paths between the TSFs and potential shallow receptors; and
- provide the ability to assess whether there is potential for environmental harm.

The detection of seepage from the TSFs will allow corrective actions to be undertaken, including remediation of any damaged impermeable barriers, and targeted extraction of water from the TSFs.

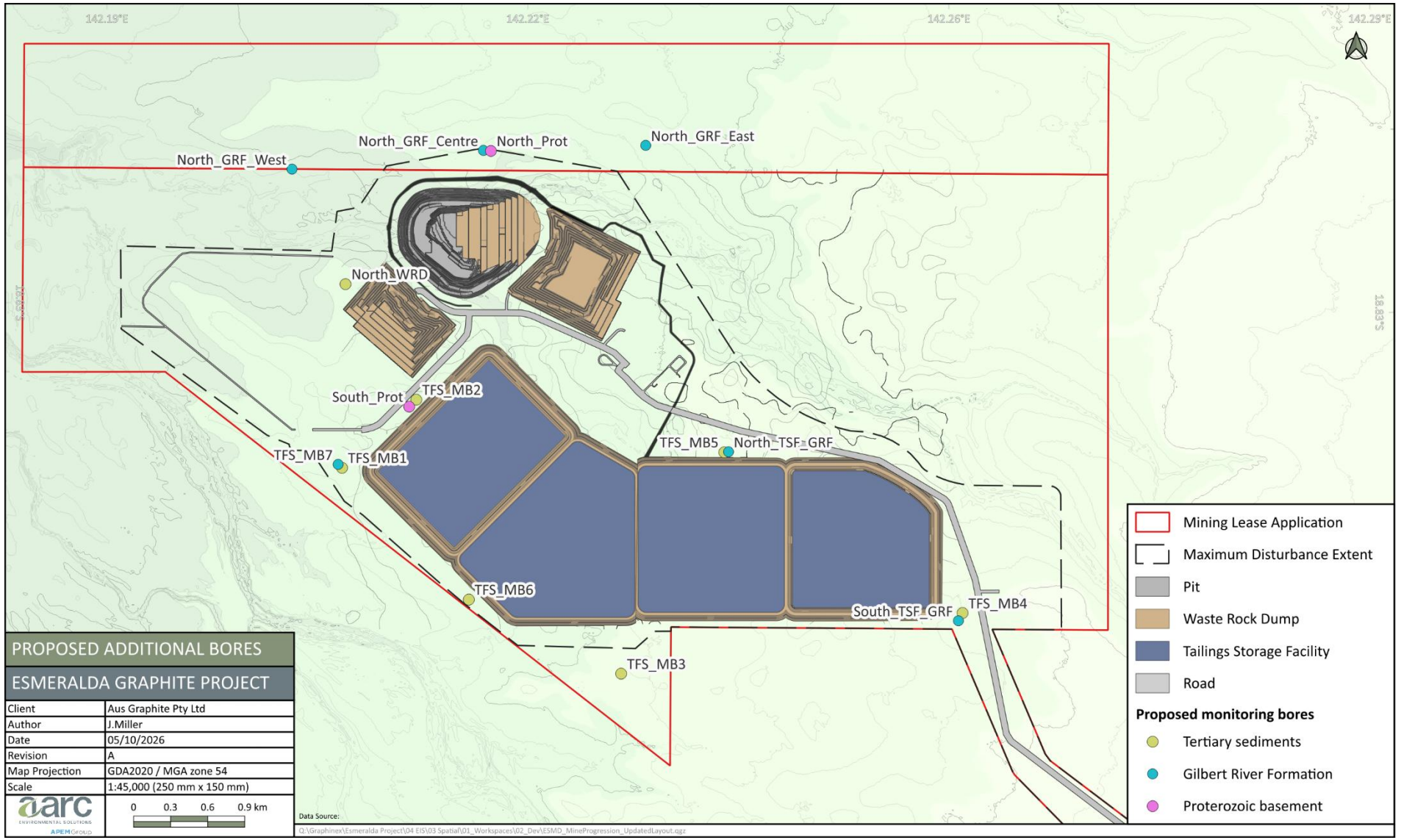


Figure 16-27: Proposed additional monitoring bores

16.6 TOR Reconciliation table

Terms of reference - Content requirements of the EIS		EIS Section
Section 16 - Flooding and regulated structures		
16.1	The following guidance is relevant for the assessment of flooding and regulated structures: (a) Queensland Government, Water – EIS information guideline, ESR/2020/5312 (b) Australian Government, Australian Rainfall and Runoff: A Guide to Flood Estimation, 2019 (c) Queensland Government, Regulated structures – EIS information guideline, ESR/2020/5307 (d) Queensland Government, Structures which are dams or levees constructed as part of environmentally relevant activities, ESR/2016/1934.	Section 16
Flooding and regulated structures - Flooding and regulated structures		
16.2	Provide a hydraulic and hydrological flood model demonstrating the design flood peak discharges for the project footprint and surrounding area which exist in the pre- and post development scenarios for all flood and stormwater events. This should include at least the following flood and stormwater events: 86.5%, 63.2%, 50%, 20%, 10%, 5%, 2%, 1% and 0.1% Annual Exceedance Probability (AEP), and Probable Maximum Flood.	Section 16.2.2
16.3	Describe the likelihood and history of flooding (from all sources) within the project footprint and surrounding areas that may be modified by the project or have the potential to impact on the project. Evaluate flood-related constraints and considerations in the existing environment relevant for the impact assessment.	Section 16.2.1.1
Flooding and regulated structures - Impact assessment		
16.4	Describe and map where project infrastructure would lie in relation to the existing and predicted flood risk from all sources for the following flood and stormwater events: 86.5%, 63.2%, 50%, 20%, 10%, 5%, 2%, 1% and 0.1% AEP, and Probable Maximum Flood. The maps and modelling are to detail the location of infrastructure prior to disturbance, during operations (including progressive development and rehabilitation of infrastructure such as waste rock dumps, tailings storage facilities, dams and voids) and at the end of operations.	Section 16.2.2
16.5	Use flood modelling (and any additional data) to assess how the project may potentially change flooding and run-off characteristics within the project footprint, and both upstream and downstream of the project footprint. The assessment must consider all project infrastructure and all design measures to avoid or minimise impacts. Mapping (afflux, water level/depth and velocity) should be provided to clearly illustrate the pre-development scenario, and the post development impacts for all relevant design events. The flood modelling assessment should consider impacts and risks to people, property (including damage to other properties), community and environmental values during flooding events.	Section 16.2.2 Section 16.2.2.2
16.6	Assess the project's vulnerabilities to climate change (e.g. changing patterns, frequencies and severities of rainfall, hydrology, temperature and extreme weather events) and demonstrate that flood storage capacity is maintained.	Section 16.2.3.3
16.7	Identify, map and describe (including their purpose) existing or proposed dams, levees and regulated structures in the project footprint.	Section 16.3.3 Section 16.3.4
16.8	Undertake a consequence category assessment to determine the consequence category (low, significant or high) for each dam, levee, or potential regulated structure according to criteria outlined in the relevant guidelines.44 The assessment must be undertaken for the 3 different failure event scenarios, i.e. seepage, overtopping and dam break. Provide copies of the consequence category determination for each structure assessed.	Section 16.3

Terms of reference - Content requirements of the EIS		EIS Section
16.9	Develop environmental objectives and performance outcomes for dams, levees and regulated structures with reference to guidelines published by the Australian National Committee on Large Dams as well as other relevant guidelines.	Section 16.1
16.10	Assess the potential impact on regulated structures in accordance with relevant guidelines.	Section 16.4
Flooding and regulated structures - Mitigation measures		
16.11	Describe how the project has been designed to avoid or minimise flood risks.	Section 16.2.4
16.12	Describe management actions to minimise impacts of flooding to mine infrastructure and manage mine pit water post-flooding, if required.	Section 16.2.4
16.13	Describe how risks associated with dam failure, seepage, and overtopping will be avoided or minimised to protect people, property and environmental values.	Section 16.5.1
16.14	Describe how dams, levees and regulated structures would be monitored and managed during periods of high incidental rainfall and/or flooding to minimise potential impacts.	Section 16.2.4 Section 16.5.1
16.15	Demonstrate how the project will meet the environmental objectives and performance outcomes in Schedule 8 of the EP Regulation.	Section 16.1