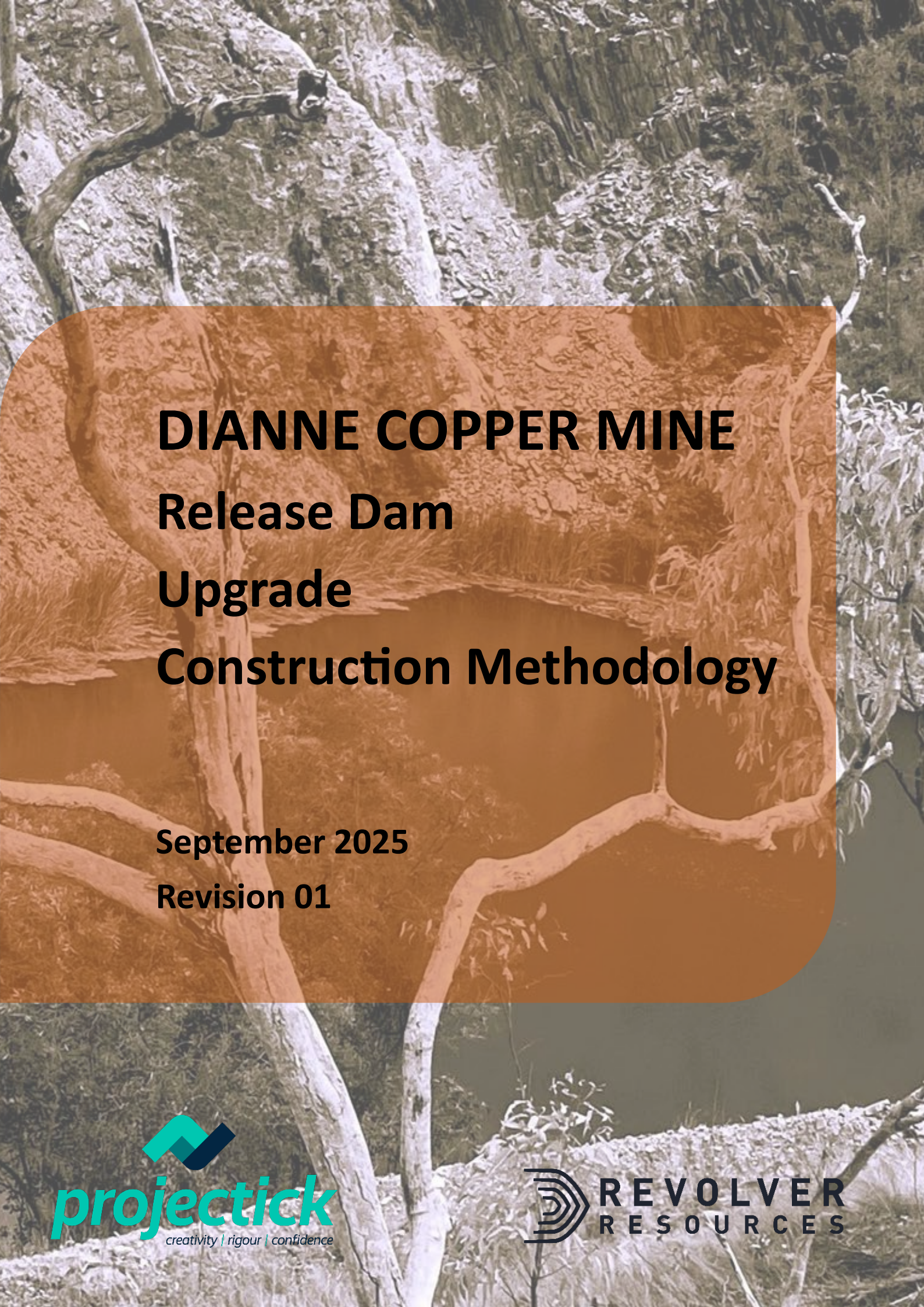

DIANNE COPPER MINE

Release Dam Upgrade Construction Methodology

September 2025

Revision 01

projectick
creativity | rigour | confidence

REVOLVER RESOURCES

DOCUMENT HISTORY

Approval					
Date	**Rev**	**Description**	**Prepared by**	**Reviewed by**	**Authorised by**
Sept 2025	01	First Revision	D Carreon	M Colecha	R McCahill

TERMS

Term	Meaning
Bentofix	A needle-punched, reinforced composite combining two durable geotextile outer layers and a uniform high-swelling powder sodium bentonite clay core
GCL	Geosynthetic Clay Liner
GST	Ground Surface Treatment
ITP	Inspection Test Plans
PPE	Personal Protective Equipment
Project Manager	Person appointed to lead and has ultimate responsibility for the delivery of the project
Construction Schedule	The time-phased plan for carrying out the works showing durations and dependencies.
RDD	Relative Dry Density
QA	Quality Assurance
QC	Quality Control

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1. SUMMARY

The Settling Dam (to be renamed Release Dam) at the Dianne Copper Mine has been under care and maintenance since the 1980's. During recent assessments, the eastern wall of the Release Dam has identified structural strain, including water seepage during clear weather conditions and general material fatigue. Addressing this requires remediation and enhancement of the Release Dam. A reinforced buttress on the downstream side will also be constructed, effectively strengthening the wall by increasing its thickness, stability, and resistance to leakage. These upgrades and remediation activities are anticipated to provide a reduced likelihood of water releases during the wet season, in addition to providing improvement to the water quality of any releases and reduce the water seepage.

In addition to reinforcing the wall, the dam's overflow needs to be re-engineered to provide a larger water storage. This improvement will entail raising the storage level by 2 metres with a weir placed in the overflow channel.

The proposed concept design is illustrated in **Figure 1**.

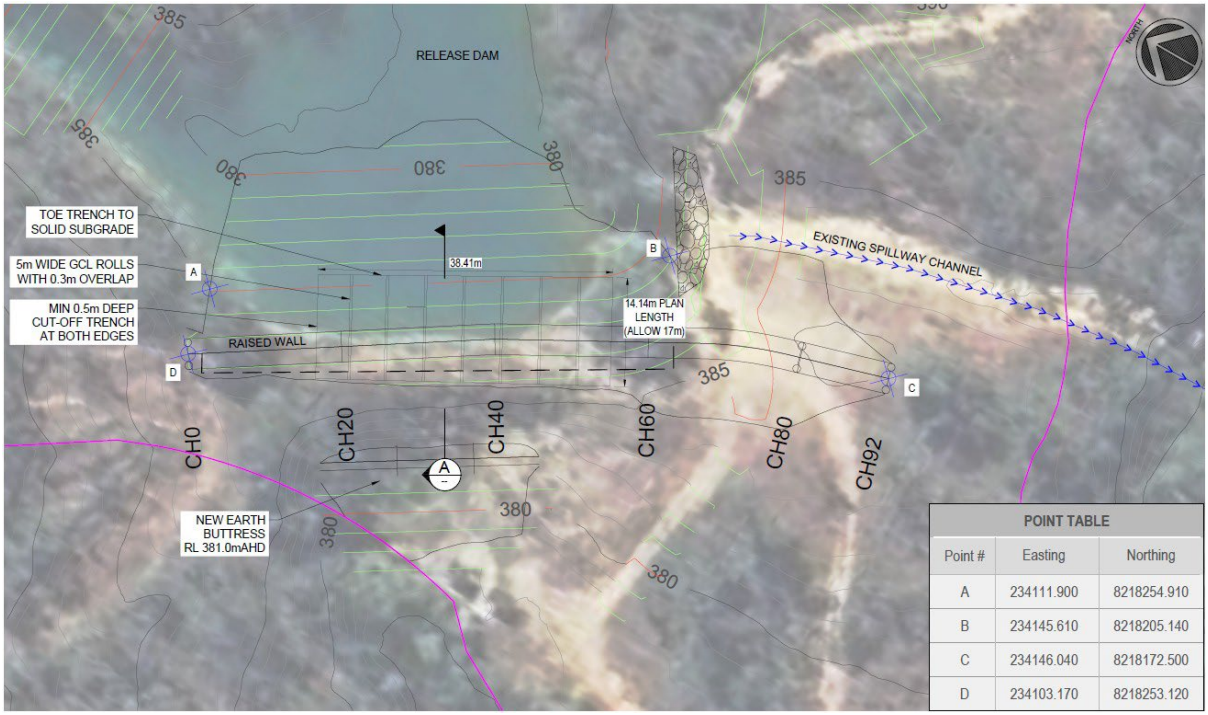

Figure 1 – Release Dam Plan View

(See Also Dwg. J022.200.40-DWG-003-Settling_Dam_-_Typical_Sections_&_Detail)

1.1. SCOPE AND REQUIREMENTS

The key activities include the following:

- Site Preparation and Material Management
- Removal of existing sediment
- Installation of Geosynthetic Clay Liner
- Placement of Fine Cohesive Fill
- Upstream Embankment Raise
- Downstream Toe Remediation
- Construction of Downstream Buttress
- Construction of Release Dam Spillway

2. DESIGN AND SPECIFICATIONS

The Release Dam has been designed to meet current operational requirements, following recent site assessments. It spans 92 metres, with a crest elevation of RL 387 metres, and side slopes graded at 3H:1V to ensure structural stability and minimise erosion. The embankment is constructed using engineered fill materials compacted in layers to comply with geotechnical standards. The dam has an estimated storage capacity of **47,000 cubic metres** and covers an area of approximately **12,600 square metres**. **Figure 3** shows the typical section detail of the Release Dam.

All works related to the Release Dam will comply with the Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (EM635) for design, construction and operation of the structure. Oversight and certification will be provided by a Registered Professional Engineering of Queensland (RPEQ). All requirements under Environmental Authority (EA) will be adhered to.

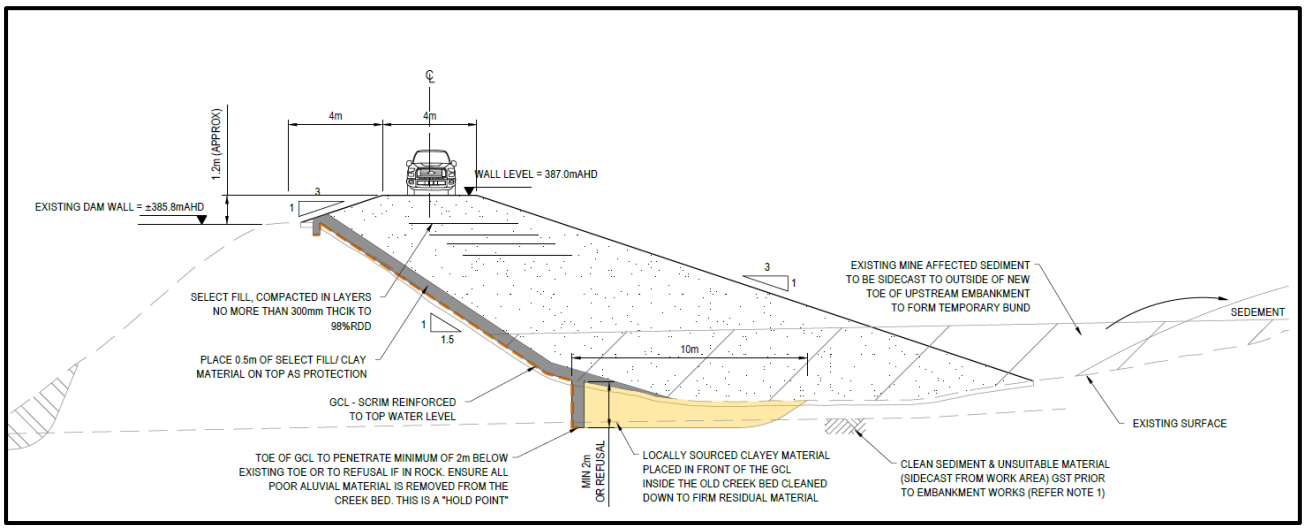

Figure 3 – Release Dam Typical Section Detail

(See Also Dwg.** J022.200.40-DWG-003-Settling_Dam_-_Typical_Sections_&_Detail**)

2.1. GEOSYNTHETIC CLAY LINER

One of the key materials identified for the dam upgrade is the use of a Geosynthetic Clay Liner (GCL). The below criteria outline the Geosynthetic Clay Liner (GCL) specifications:

2.1.1. Material Composition

Bentofix GCL is a needle-punched, reinforced composite combining two durable geotextile outer layers and a uniform high-swelling powder sodium bentonite clay core. This construction forms a shear-resistant hydraulic barrier with self-sealing characteristics.

2.1.2. Dimensions

The size of each Geosynthetic Clay Liner (GCL) roll is 4.7 metre in width and 20 metre in length.

2.1.3. Key Features

Bentofix GCL provides efficient installation and long-term performance through wide, long rolls that reduce waste. Thermal Lock technology for enhanced shear strength and self-sealing edges eliminates the need for additional sealing materials. It features clear overlap markings, requires minimal skilled labour, and is backed by ISO 9001 certification, manufacturing QA testing, and a proven track record in Australia and internationally.

2.1.4. Delivery

The rolls should be delivered to the working area of the site in their original packaging on trucks or in containers. The storage surface must be elevated, dry and smooth, to prevent any damage to the wrapping of the rolls.

2.1.5. Unloading Procedures

Unloading requires strict adherence to safety protocols, including the use of appropriate equipment and a stable subbase for both the vehicle and storage area.

2.1.6. Storage on Site

GCL rolls must be stored on a flat, dry, well-drained surface free of sharp objects and near the work area to minimise handling. The storage area should be secure with rolls and bentonite materials covered until installation. Moisture-exposed rolls must be inspected for damage before use. Rolls may be stacked up to five high, ensuring stability; higher stacking requires manufacturer approval. Access to one or two sides of the stored rolls must be maintained, and pulling rolls should be avoided. Bentonite bags and nonwoven strips must also be kept dry and protected.

2.1.7. Weather Conditions for Installation

GCL rolls must be installed under dry weather conditions to ensure proper placement and coverage.

2.1.8. Installation

GCL rolls must be delivered to the work area in their original packaging. Upon arrival, roll labels should be removed and recorded by the installer or quality control inspector to ensure traceability. Only approved materials are permitted for installation.

Packaging must be carefully removed without damaging the GCL. Overlap marks on the rolls indicate the bottom side, which should be placed directly on the prepared subgrade.

Subgrade preparation must be completed before GCL placement. The Ground Surface Treatment (GST) will include ripping to a depth of 200mm, conditioning, shaping, and compacting to achieve a firm, uniform surface suitable for GCL installation.

Panel layout must follow the direction of water runoff and any approved layout drawings. Installation typically begins from the highest elevation to prevent premature hydration of the GCL.

Before placement, each panel must be inspected for damage. Panels should be laid flat without wrinkles and deployed using approved equipment, such as a front-end loader fitted with a spreader bar.

Seam orientation is critical. On slopes, seams should run parallel to the slope; on flat areas, panels should be shingled downslope to facilitate drainage.

A geomembrane rub sheet may be temporarily used to assist with deployment. Once panels are in place, the rub sheet must be removed.

No equipment should travel directly on the GCL. If the subgrade is damaged during installation, it must be repaired before continuing.

Extend the GCL toe at least 2m below the existing embankment toe or to refusal in rock. All unsuitable alluvial material must be removed from the creek bed prior to placement. This is a hold point for inspection and must be verified before proceeding.

Only the amount of GCL that can be covered by the end of the day or before precipitation should be deployed. Exposed edges must be protected using plastic sheeting, which should be securely weighted down to prevent uplift.

Cutting around penetrations must be done with a sharp utility knife. Blades should be changed frequently to avoid damaging the GCL, and all used blades must be properly disposed of.

2.2. ENGINEERED FILL AND CLAY LAYER

- **Fine Cohesive Fill:** Select fill/clay material from upstream batter steepening placed as a 500mm thick protective layer along the GCL, extending 500mm deep and 10m beyond the embankment toe.
- **Engineered Fill**: Select fill sourced from the southeast pit disturbance will be used to raise the upstream embankment and fill the downstream toe, compacted in ≤300mm layers to 98% RDD.
- **Clayey Material**: Locally sourced clayey material placed in front of the GCL within the cleaned creek bed, extending to a minimum depth of 2m or to refusal on firm residual material.

2.3. QUALITY MANAGEMENT

To ensure that all activities from site preparation to material placement and final inspection adhere to established standards, technical specifications, and environmental regulations, a thorough systematic planning, monitoring, and documentation should be accomplished.

2.3.1. Roles and Responsibilities

- **Quality Control Inspectors**: Responsible for monitoring construction activities, verifying that materials and workmanship meet specified standards, and ensuring that all phases of the remediation work adhere to approved designs, regulatory requirements, and best practices.
- **QA/QC Engineers**: Oversees inspections, testing, and documentations

2.3.2. Quality Control

Quality controls must be embedded in every phase of the remediation plan. This includes verifying engineering designs, reviewing material specifications, and ensuring proper execution of construction activities such as excavation, backfilling, and compaction. Each step should be monitored to confirm that it meets the approved standards and contributes to the overall integrity of the Release Dam.

2.3.3. Inspection and Testing Protocols

An inspection and testing program is vital to validate the quality of work and materials used. Inspection and Test Plans (ITPs) should be developed for each activity, detailing procedures, frequency, and acceptance criteria. Common tests include soil compaction tests, material conformity checks, and water quality monitoring. These protocols help identify issues early and ensure corrective actions are taken promptly.

2.3.4. Training and Competency

Ensuring that all personnel involved in the remediation are properly trained and competent is essential for maintaining quality standards. Regular training sessions, toolbox talks, and certification checks help reinforce best practices and safety protocols. Skilled workers are better equipped to execute tasks accurately and respond effectively to unexpected challenges.

2.3.5. Documentation and Reporting

Accurate and comprehensive documentation is a cornerstone of quality management. Daily logs, inspection reports, test results, and non-conformance records must be maintained throughout the project. These documents provide traceability, support compliance audits, and serve as evidence of quality assurance during final handover and future maintenance.

- **Inspection and Test Records**: Each ITP activity will be documented, including inspection dates, test results, and any corrective actions taken. These records will be kept in a quality assurance log for easy reference.
- **Material Certificates**: Certificates of compliance for all materials used in the project, including the liner and fill, will be retained as proof of quality.
- **Non-Conformance Reports (NCRs)**: Any deviations from the specifications will be documented in an NCR. Corrective actions will be implemented promptly, and follow-up inspections will verify that issues have been resolved.
- **Quality Control Reports**: Weekly quality control reports will summarise inspection findings, test results, and any issues encountered. Upon project completion, a final quality report will be prepared, providing a comprehensive overview of all QA/QC activities.

2.3.6. Final Verification and Handover

Before construction completion, final inspections and testing must be conducted to verify that all remediation work meets the required standards. A comprehensive quality dossier, including as-built drawings and test results, should be submitted for review. Once approved, the project can be formally handed over, ensuring transparency and confidence in the dam's restored condition.

3. WORK ACTIVITIES

3.1. SITE PREPARATION

3.1.1. Release Dam Dewatering

Dewatering process begins with a site assessment to evaluate the condition of the surrounding areas. Dewatering equipment such as pumps, siphons, or gravity outlets is installed, ensuring that sediment control measures are in place to prevent downstream contamination. Water is discharged gradually through designated outlets to maintain controlled flow and minimize erosion risks. Throughout the operation, water levels, equipment performance, and weather conditions must be continuously monitored. Upon completion, a post-dewatering inspection is conducted to assess any structural changes and prepare the site for subsequent remediation activities.

3.1.2. Downstream Preparation

As part of site preparation for dam remediation, the downstream area is to be cleared of unsuitable material—such as loose sediment, organic debris, and unstable fill—down to the residual layer to ensure structural integrity and proper drainage. This work is strictly confined to within 10 meters of the embankment toe. All removed material is stockpiled adjacent to the sediment stockpile in a clearly marked area, facilitating organised handling and minimising environmental impact.

3.1.3. Upstream Face Preparation

The clearing involves removing vegetation, boulders, roots, and other obstructions from the upstream face of the existing wall to ensure clear access and prepare for structural works. Within the impoundment area, the upstream embankment—extending from the wall down to the toe and out to 10 metres in front—will be stripped of loose material and sediments.

3.2. MATERIAL MANAGEMENT

3.2.1. Sediment Reallocation within Impoundment

This activity encompasses strategic handling of stripped sediments and loose materials removed during upstream clearing. Once the upstream embankment and adjacent 10-meter zone are cleared down to the residual layer, the excavated sediments are temporarily retained within the impoundment area. These materials are sidecast to form a temporary bund outside the new toe of the upstream embankment. This bund serves as a containment structure, creating a dry working platform that facilitates compaction and supports the reconstruction of the dam wall.

3.3. EXCAVATION AND TRENCHING

3.3.1. Upstream Toe Trenching

The work involves excavating a trench along the upstream toe of the embankment slope, carefully removing all materials considered unsuitable for structural stability. This includes soft sediments, loose alluvial deposits, and other unconsolidated or unstable soil layers. The excavation should continue until a firm, undisturbed residual subgrade is exposed. This subgrade will serve as a dependable foundation for constructing the upgraded dam wall.

3.3.2. Abutment Trench Extension

Once the initial upstream toe trench has exposed the firm residual subgrade, the excavation must be extended an additional 750mm into the residual material. This deepening ensures the trench reaches a sufficiently stable and undisturbed foundation layer.

The trench must then be continued laterally and vertically along each abutment, carefully following the interface between the embankment wall and the natural abutment. It should be carried to the crest elevation, maintaining consistent depth and alignment.

Extending the trench into residual material and along the abutments reinforces the foundation, maintains continuity of protective systems, and minimises risks of seepage and structural failure.

3.3.3. Anchor Trench Excavation

Following the extension of the trench along the abutments, the next process involves excavating an anchor trench along the crest of the wall. This trench is designed to securely anchor filter materials, geosynthetic clay liner, and other protective layers at the top of the embankment or the Release Dam wall.

Excavate the trench accurately, matching the design's depth, width, and crest alignment to ensure seamless integration with adjacent works. Aside from anchoring filter materials, this prevents displacement under pressure or settlement, and secures protection against erosion, uplift, and seepage.

3.4. INSTALLATION OF GEOSYNTHETIC CLAY LINER

3.4.1. Batter Surface Preparation

To ensure the integrity and performance of the Geosynthetic Clay Liner, the upstream batter must be meticulously prepared:

- **Surface Uniformity**: The batter should be uniformly graded and compacted to create a smooth, continuous surface. This minimises stress points and ensures full contact between the GCL and subgrade.
- **Removal of Protrusions**: All rocks, stones, roots, and debris that could puncture or deform the liner must be removed. Even small protrusions can compromise the liner's sealing capability.
- **No Indents or Voids**: Depressions or uneven areas can lead to bridging or gaps beneath the liner, increasing the risk of leakage or structural failure. These should be filled and levelled.
- **Compaction Standards**: The surface should be compacted to the specified density using appropriate equipment, ensuring it is firm and stable without loose material.
- **Moisture Conditioning**: The surface moisture content should be adjusted to facilitate proper compaction and adhesion of the GCL.
- **Inspection**: Conduct a thorough visual and tactile inspection before liner placement to confirm the surface meets all criteria.

3.4.2. Geosynthetic Clay Liner Installation

- **Site Preparation**: Following batter surface preparation, roll out the GCL panels according to the layout plan as shown in **Figure 4**, ensuring both ends are tucked into anchor trenches. Round off trench edges and top of batter to eliminate sharp transitions that could damage the GCL during placement.
- **Joint Preparation**: Prepare joints according to specifications, which involves aligning adjacent panels with the required overlap, trimming edges, cleaning the contact surfaces, applying bentonite, and ensuring full contact without voids.
- **Overlap Assurance**: Ensure overlap assurance by maintaining the specified overlap between adjacent GCL panels in accordance with the specification and as shown in **Figure 5**.
- **Installation**: The layout and sequence of panel placement are guided by the direction of water runoff. Panels are installed following the approved Panel Layout Drawings, beginning at the

top of the slope and highest elevation to ensure rainfall drains toward the lower part of the impoundment. This approach prevents premature hydration of the GCL. Once positioned, each panel is inspected for physical damage and must be laid in a relaxed state, free from folds or tension.

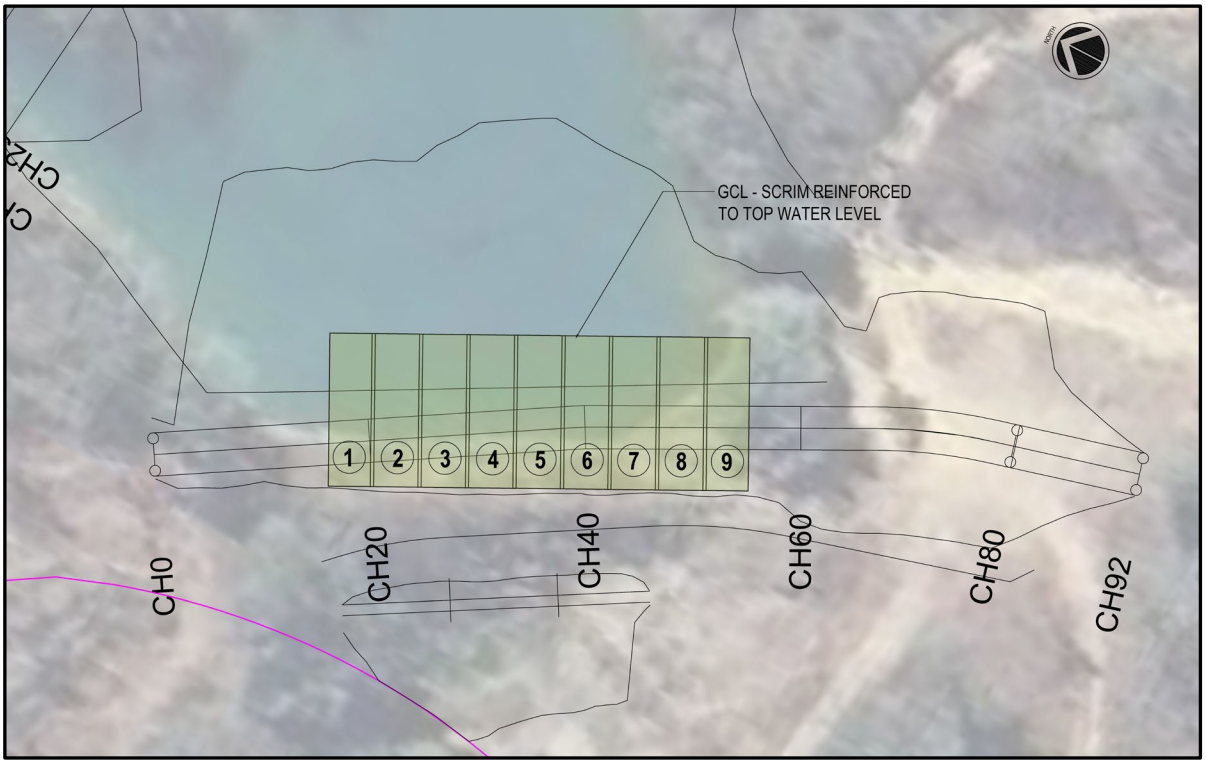

Figure 4 – GCL Panel Layout

(See Also Dwg. J022.200.40-DWG-001.00B-Settling_Dam_GCL_Plan_View)

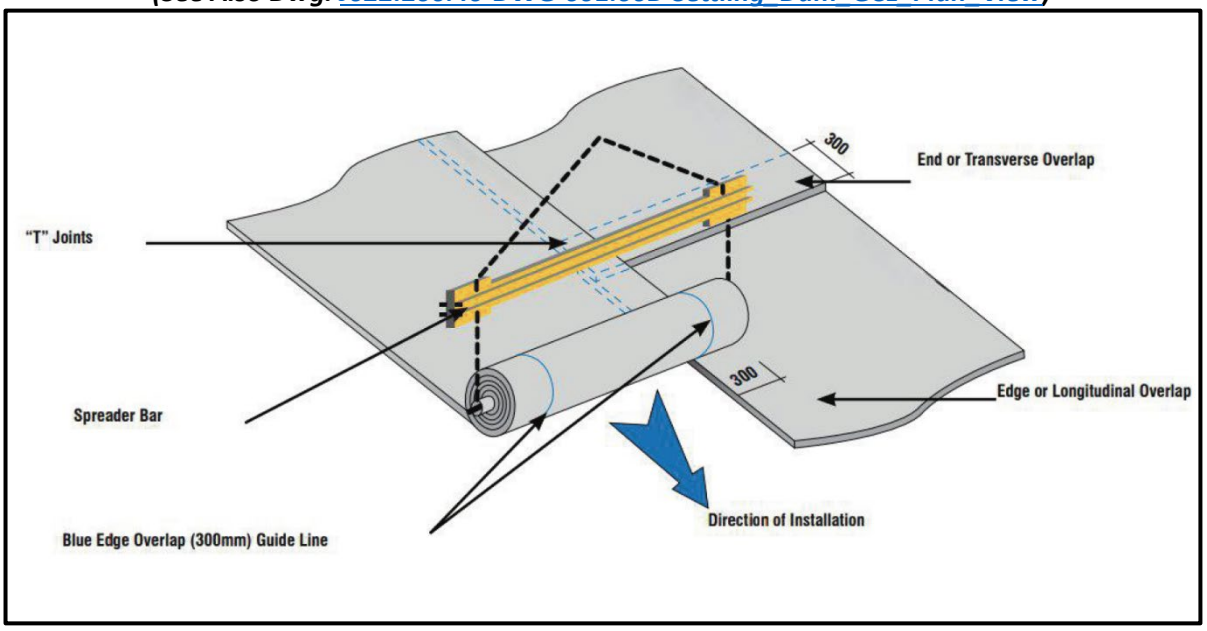

Figure 5 – GCL Paneling Deployment

(See Also Dwg. J022.200.40-DWG-003-Settling_Dam_-_Typical_Sections_&_Detail)

3.4.3. Inspection and Protection

- **Joint Inspection**: This involves assessing all panel connections, including verifying that overlaps are sufficient, confirming precise alignment to maintain barrier continuity, and checking for any gaps, folds, or wrinkles that could impair hydraulic performance or create unintended flow paths.
- **Timely Coverage**: After placement and inspection, GCL must be promptly covered with the specified overlying material to prevent premature hydration from rainfall or ambient moisture, which could compromise its effectiveness. Immediate coverage also reduces the risk of wind uplift or displacement, particularly in exposed or elevated areas, and shields the GCL from UV degradation and potential physical damage.
- **Traffic Control and Surface Protection**: Traffic control and surface protection should strictly limit the movement of personnel, equipment, or vehicles over the installed GCL. If access is unavoidable, protective measures such as wooden boards, geotextile mats, or other approved materials should be used to distribute loads evenly and prevent punctures or surface abrasion. Any temporary pathways must be removed prior to final coverage to ensure they do not compromise the liner's performance or continuity.

3.5. PLACEMENT OF FINE COHESIVE FILL

- **Cushion Material Placement:** To protect the GCL liner during upcoming wall raise activities, approved cushion material with the correct particle size distribution must be placed up the batter in advance. This protective layer acts as a buffer against mechanical damage and ensures the integrity of the liner as additional earthworks are placed in controlled layers in front of the batter.
- **Fine Cohesive Fill Specification**: A selectively sourced fine cohesive fill will be placed to a thickness of 500 mm directly against the GCL, and to a depth of 500 mm extending 10 meters outward from the toe of the existing embankment. This material provides structural support and enhances the interface stability between the GCL and the embankment.
- **Material Sourcing**: The cohesive fill will be sourced by steepening the existing cut batters located upstream within the impoundment area. Only material that meets the required specifications for cohesion and gradation will be used, ensuring consistency in performance and compatibility with the GCL system.

3.6. UPSTREAM EMBANKMENT RAISE

- **Wall Raise Material Placement**: Raising the embankment wall begins with placing engineered fill material in controlled layers. Each layer must not exceed 300 mm in loose thickness and is compacted thoroughly to meet the required density specifications. This method ensures the structural integrity of the embankment and minimises the risk of differential settlement. The placement continues progressively until the embankment reaches the newly designed crest level, which marks the final elevation of the raised structure. Compaction testing and quality assurance measures are implemented throughout the operation to maintain consistency and compliance with geotechnical standards.
- **General Fill Sourcing and Placement**: To form the upstream extension of the embankment, general fill material will be sourced from existing disturbed areas located on the southeast side of the Pit. This approach not only reduces the environmental footprint but also efficiently uses available resources. The fill will be inspected to ensure it meets suitability criteria and placed and compacted in accordance with the embankment design.

3.7. DOWNSTREAM TOE REMEDIATION

Saturated sections of the downstream toe will be excavated and replaced with coarse general fill to restore stability. The replacement material will be sourced from the disturbed southeast Pit area, ensuring consistency with upstream fill and minimising haul distance.

3.8. CONSTRUCTION OF DOWNSTREAM BUTTRESS

- **Buttress Foundation Preparation**: Excavate and level the area downstream of the eastern wall to prepare for the buttress construction. The foundation area must be stabilized to provide a solid base for the engineered fill.
- **Buttress Build-Up**: Begin constructing the buttress by placing and compacting engineered fill material in layers, gradually building up to the specified height and thickness. This approach will increase the wall's structural support and resistance to leakage.
- **Structural Reinforcement**: Integrate structural reinforcements, such as steel mesh or concrete support, into the buttress design if required. These reinforcements will enhance the stability and durability of the buttress under variable pressure conditions.
- **Final Compaction and Inspection**: Perform a final compaction of the buttress layers, followed by a structural inspection to confirm that the buttress meets design standards for stability and load-bearing capacity.

3.9. CONSTRUCTION OF RELEASE DAM SPILLWAY

The current spillway design for the Release Dam is planned to be a concrete or reinforced blockwork weir constructed across the existing spillway channel, excavated into natural rock. Clearance between spillway and wall crest is 1.0m, the spillway is 20m wide and will have a capacity of 38m3/s at a depth of 400mm over the spillway, leaving 600mm freeboard to the crest. **The Figure 6** shows the Release Dam spillway plan and section.

Outlined below is the approach for constructing the spillway to ensure optimal performance and resilience under varying flow conditions:

- **Channel Excavation and Height Adjustment**: Excavate the existing spillway channel into natural rock to achieve the required depth and profile. Ensure the base is levelled and widened as necessary to accommodate the 20-meter-wide spillway structure. This step establishes a stable foundation for the weir, facilitating efficient water conveyance.
- **Weir Construction**: Construct a concrete or reinforced blockwork weir across the prepared channel. The weir will be designed to handle a discharge capacity of 38 m^3/s at a flow depth of 400 mm above the crest, maintaining a 600 mm freeboard to the wall crest. The total clearance between the spillway crest and the wall crest will be 1.0 metre, ensuring safe overflow margins during peak flow conditions.
- **Erosion Control and Channel Lining**: Apply erosion-resistant lining materials—such as concrete facing or riprap—along the channel sides and base to prevent scouring and maintain structural integrity during high-velocity flows. This lining will be integrated with the natural rock substrate to enhance durability.
- **Final Inspection and Testing**: Conduct a comprehensive inspection of the completed spillway, including hydraulic flow tests to verify that the weir meets the specified discharge capacity and freeboard requirements. Confirm that the structural elements are sound and that the spillway can safely manage design flood events.

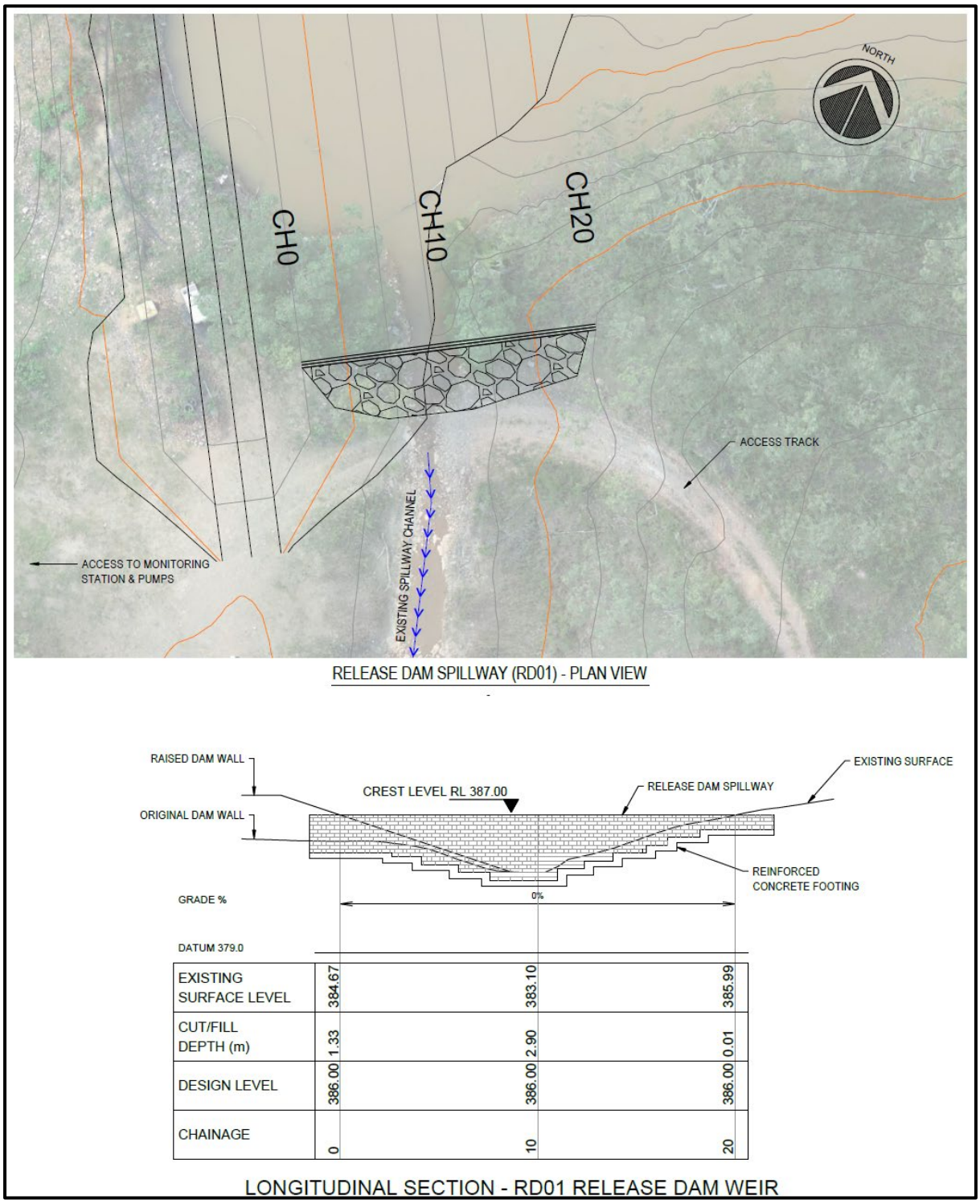

Figure 6 – Release Dam Spillway Plan and Section

(See Also Dwg. J022.200.40-DWG-003-A-RELEASE DAM SPILLWAY - PLAN & SECTION***)***

3.10. IMPOUNDMENT AREA FINAL WORKS

This scope of work involves the removal of existing sediment from the impoundment area, which will be repurposed as liner over-cushion material in the leaching area.

Upon site closure, once upstream areas are stable and inflows meet discharge standards for Gum Creek, the release dam embankment will be dismantled. Its fill will restore natural contours in the impoundment zone, and all disturbed areas will be revegetated.

The following are the safety justifications for the above scope of work:

- **Sediment for Liner Cushion**: Sediment removed from the impoundment area is repurposed as liner over-cushion in the leaching zone. This practice minimises waste and ensures material compatibility, following geotechnical standards for stability and containment.
- **Upstream Stabilisation Prior to Closure**: Closure activities commence only after upstream areas are fully stabilised. This prevents uncontrolled sediment flow and ensures the structural integrity of surrounding zones.
- **Water Quality Compliance for Discharge**: Inflows into the release dam are monitored to meet water quality standards suitable for direct discharge into Gum Creek via controlled release and in accordinace with Environmental Authority conditions. This protects downstream ecosystems and complies with environmental regulations.
- **Controlled Removal of Release Dam Embankment**: The embankment is dismantled using engineered protocols to avoid sudden structural failure or sediment release. Fill material is placed in cut areas to restore natural contours and reduce erosion risk.
- **Revegetation for Long-term Ecological Recovery**: All disturbed areas outside of the dam wall are revegetated with native species per the Progressive Rehabilitation and Closure Plan, which stabilise soil, reduce runoff, and support biodiversity. This aligns with ecological restoration principles and ensures sustainable land rehabilitation.