Appendix D: Concept Design Study for Mine Waste and Water Management

(ATCW 2018a)
Novonix Limited

Mount Dromedary Graphite Project

Concept Design Study for Mine Waste and Water Management

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# TABLE OF CONTENTS

1 INTRODUCTION ........................................................................................................ 1  
1.1 Background ........................................................................................................ 1  
1.2 Scope .................................................................................................................. 1  

2 PROPOSED PROJECT DEVELOPMENT .................................................................... 2  
2.1 Locality ............................................................................................................... 2  
2.2 Project Basis ..................................................................................................... 2  
  2.2.1 Mineral Description .................................................................................. 2  
  2.2.2 Life of Mine Schedule ............................................................................. 2  
  2.2.3 Process Description .................................................................................. 3  
  2.2.4 Waste & Low Grade Ore Characterisation .............................................. 4  
2.3 Proposed Development ..................................................................................... 5  
  2.3.1 Options Assessment ............................................................................... 5  
  2.3.2 General Concept ..................................................................................... 6  
  2.3.3 Description of Ultimate IWTL Development ......................................... 6  
  2.3.4 IWTL Development Concept ................................................................. 7  
    2.3.4.1 LoM IWTL Sizing .......................................................................... 7  
    2.3.4.2 Development Concept .................................................................. 7  
    2.3.4.3 IWTL Decant ............................................................................... 8  
    2.3.4.4 Storage Foundation Lining ............................................................ 8  
    2.3.4.5 Seepage Interception System ....................................................... 9  
2.3.5 Earth Fill Borrow Areas ............................................................................ 9  
2.4 Site Water Management ................................................................................ 9  
  2.4.1 Clean Water Diversion Drains ................................................................ 9  
  2.4.2 Mine Water Dam ................................................................................... 9  
  2.4.3 Raw Water Dam ................................................................................... 9  
  2.4.4 Process Water Pond ........................................................................... 9  

3 BACKGROUND DATA ............................................................................................ 10  
3.1 Climate ............................................................................................................. 10  
3.2 Topography and Drainage ............................................................................. 10  
3.3 Geology ........................................................................................................... 12  
3.4 Hydrogeology .................................................................................................. 14  
3.5 Tailings Characterisation and Associated Design Implications ..................... 14  
  3.5.1 Pilot Tailings Production ..................................................................... 14  
  3.5.2 Tailings Testwork ................................................................................... 15  
  3.5.3 Testwork Results .................................................................................... 15  
    3.5.3.1 Physical Characteristics .......................................................... 15  
    3.5.3.2 Tailings Settled Densities ........................................................... 15  
  3.5.4 Tailings Seepage Geochemistry ............................................................... 15  
  3.5.5 Inferred Tailings Behaviour .................................................................. 16  

4 CONSEQUENCE ASSESSMENT .......................................................................... 17  
4.1 Regulatory Context ......................................................................................... 17  
4.2 Consequence Assessment Outcomes ......................................................... 17  

5 DESIGN CRITERIA .............................................................................................. 19  
5.1 Regulatory Environment and Basis ............................................................. 19
TABLES
Table 1 Life of Mine Quantities by Weight ................................................................. 3
Table 2 Proposed IWTL - Physical Characteristics ........................................................ 6
Table 3 Development Schedule for LoM IWTL Embankment Development .................. 7
Table 4 Average Monthly Rainfall and Evaporation Data (mm) for the Cloncurry Region ... 10
Table 5 Physical Characteristics of Tailings ............................................................... 15
Table 6 Consequence Assessment Summary ................................................................ 18
Table 7 Design Storage Allowance (DSA) Decile Method for Regulated Storages .......... 31
Table 8 Proposed Configuration of Mt Dromedary Storages ........................................ 32
Table 9 Site Water Balance - Rainfall and Evaporation Input Data .............................. 32
Table 10 Mt Dromedary Catchment Characteristics ................................................... 34
Table 11 AWBM Model Parameters ......................................................................... 35
Table 12 Site Pump Transfer ...................................................................................... 36
Table 13 Summary Results for Water Balance Model ................................................. 37
Table 14 Construction Material Types ....................................................................... 44
Table 15 Construction Bill of Quantities ..................................................................... 47
Table 16 Erosion Mitigation Strategies ..................................................................... 49

PLATES
Plate 1 IWTL Storage Curve ....................................................................................... 8
Plate 2 Mount Dromedary Topography and Drainage .................................................. 11
Plate 3 Significant Interpreted Geological Structures Relevant to Mine Planning .......... 13
Plate 4 RWD Storage Curve ..................................................................................... 28
Plate 5 MWD Storage Curve ..................................................................................... 29
Plate 6 2 Month Wet Season Rainfall Totals .............................................................. 30
Plate 7 Historical Average Monthly Climate Totals .................................................... 33
Plate 8 Site Water Balance Flowchart ...................................................................... 34
Plate 9 Conceptual IWTL Capping Arrangement ...................................................... 55

DRAWINGS
Drawing 001 Site Layout
Drawing 002 IWTL Starter Dam Layout
Drawing 003 IWTL Final Embankment Layout
Drawing 004 IWTL Final Landform Layout
Drawing 005 Typical Sections and Details
Drawing 006 Plan and Typical Sections

Appendix A Site Catchment Area Figure
Appendix B Tailings Test-work
1 INTRODUCTION

1.1 Background

Novonix Limited (Novonix), formerly Graphite Corp Operations Pty Ltd, is currently undertaking feasibility and environmental studies to develop a mining operation at the Mt Dromedary proposed development area, located some 125 km north-northwest of Cloncurry in northern Queensland. The proposed development includes the following:

- Open Cut Pit to extract the graphite ore.
- Process beneficiation plant to produce a graphite concentrate.
- Integrated waste-tailings landform (IWTL), a co-disposal structure comprising PAF and NAF waste rock with fine grained thickened tailings placed centrally.
- Low grade ore stockpile area.
- Water management system to contain mine impacted waters to minimise the risk of release from site and divert clean upstream water.
- Water supply dam/buffer storage.
- Site general waste landfill.

1.2 Scope

Novonix has commissioned ATC Williams Pty Ltd (ATCW) to complete conceptual design for mine waste and water management at the Mount Dromedary site for the purpose of obtaining an Environmental Authority.

The scope of work associated with engineering for mine waste management and surface water management is as follows:

- Characterise waste properties to be contained within the IWTL.
- Confirm the proposed layout and configuration for IWTL and water management structures.
- Compile relevant data to support engineering for the IWTL and water management structures.
- Undertake engineering analyses to confirm sizing and configuration of IWTL and water management structures.
- Provide details on proposed construction, operational approach and associated closure concepts.
2 PROPOSED PROJECT DEVELOPMENT

2.1 Locality

Mt Dromedary proposed development area is located some 125 km north-northwest of Cloncurry and 50 km south west of Four Ways, and immediately adjacent to the Burke Development Road in North Queensland. The site is within the Leichhardt River catchment at the catchment divide with the Flinders River Basin.

2.2 Project Basis

2.2.1 Mineral Description

The proposed Mount Dromedary Project comprises a graphite graphite resource with substantial, near surface, high grade ore contained predominantly within a Graphite Schist (Graphitecorp, 2016). The Graphite Schist at Mount Dromedary has a known strike length of at least 3 km with variable width from 35 m to 350 m. The Graphite Schist is soft, friable, dark grey-jet black coloured and fine grained and displays a strong foliation defined by flakes of graphite and fine white muscovite mica, along with grains of calcite, quartz and minor iron oxide staining, probably after minor sulphide. Coarse in situ flake graphite occurs within en-echelon tension gash calcite-siderite veins and quartz-calcite-graphite stockwork veinlets. The graphitic schist contains generally between 10 to 35% graphite, composed of 10-850 μm sized flakes of graphite and 10-300 μm size tablets of muscovite (10-20%) set in an interstitial matrix composed of <0.1 mm anhedral quartz grains (10%) and calcite (20-45%).

2.2.2 Life of Mine Schedule

Material quantities have been adopted based upon the following documents:


The life of mine operations is based on 25 years of processing at a plant throughput of some 325,000 tonnes per annum (tpa) to produce a total product concentrate of some 1.2 million tonnes (Mt). The mine materials schedule for the LoM operation is summarised in Table 1:
## Table 1

Life of Mine Quantities by Weight

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore</th>
<th>Waste Rock</th>
<th>Product Concentrate</th>
<th>Thickened Tailings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Grade (kt)</td>
<td>Medium Grade (kt)</td>
<td>Low Grade (kt)</td>
<td>Weathered Zone (kt)</td>
</tr>
<tr>
<td>2019</td>
<td>155</td>
<td>26</td>
<td>60</td>
<td>672</td>
</tr>
<tr>
<td>2020</td>
<td>169</td>
<td>23</td>
<td>60</td>
<td>351</td>
</tr>
<tr>
<td>2021</td>
<td>233</td>
<td>46</td>
<td>125</td>
<td>200</td>
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<td>2022</td>
<td>282</td>
<td>50</td>
<td>98</td>
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<td>Totals</td>
<td>5,912</td>
<td>1,327</td>
<td>2,142</td>
<td>2,973</td>
</tr>
</tbody>
</table>

### 2.2.3 Process Description

As outlined above, mined ores from the Mt Dromedary pit have been categorised into High Grade, Medium Grade and Low Grade. It is proposed that High Grade and Medium grade ores will be milled and processed, with low grade ores (currently considered uneconomical to process) stockpiled and/or returned to the mine pit to be stored for potential future processing.

Processing the mined ore would involve going through a comminution circuit comprising crushing, milling and flash flotation. The extracted ore material would then go through the separation circuit, which involves flotation and regrind. At this stage, the ore concentrate would be sent to
the concentrate thickener and processed such that the material would be caked, dried and packaged for transport.

The waste material, currently in a tailings slurry state, would be transferred via pipeline to a tailings thickener, located adjacent to the disposal location. Thickening would be undertaken to dewater the tailings, with recovered water returned directly to the Process Water Pond for reuse in processing operations.

2.2.4 Waste & Low Grade Ore Characterisation

Based on GCA (2016), the waste rock material from the pit was geochemically characterised as follows:

- **Weathered Zone (Waste-Regoliths)**

  Waste rock material containing negligible sulphides, and therefore characterised as non-acid forming (NAF). Generally located near surface at depths of less than 20m. Predominantly consisting of Meta-Arenite, Siltstone and Dolerite. Assayed data indicates that the weathered zone will comprise 30% of the total waste rock material.

- **Fresh Zone (Waste-Bedrocks)**

  Waste rock material generally located at depths greater than 20m. Predominantly consisting of Meta-Arenite, Siltstone and Dolerite and Altered Dolerite, as well as a smaller component of limestone. Assay data indicates that the Fresh Zone will comprise 70% of the total waste rock material. Classified as Potentially Acid Forming (PAF) material.

Low Grade Ore, which is not proposed to be processed, can similarly be classified as Weathered or Fresh:

- **Weathered Zone (Low Grade Oxide Ore)**

  Low Grade Ores contains negligible sulphides, and therefore characterised as non-acid forming (NAF). Generally located at depths of less than 20m and consisting of Meta-Arenite and Siltstone. Assay data indicates the Low Grade Ore weathered zone will comprise 20% of the total Low Grade Ore material.

- **Fresh Zone (Low Grade Primary Ores)**

  Low Grade Ore generally located at depths greater than 20m. Consisting of Meta-Arenite and Siltstone. Assay data indicates the Low Grade Ore Fresh Zone will comprise 80% of the total low grade ore material. Classified as Potentially Acid Forming (PAF) material.

As NAF Low Grade Ore and Waste Rock material located near the surface, initial development of the Mt Dromedary Pit will generate predominantly NAF material, available for use in construction and development of site infrastructure. Based on the mining schedule as outlined in Section 2.2.2, the life of the mine estimated quantities of NAF generating material is as follows:

- Low Grade Oxide Ores (NAF) 0.43 Mt
- Weathered Waste Rock (NAF) 4.41 Mt
2.3 Proposed Development

2.3.1 Options Assessment

The preferred LoM siting of the IWTL as detailed herein is based on options workshop facilitated by Novonix with ATCW, NRA Environmental Consultants and Runge Pincock Minarco. The basis of the siting of the tailings and waste rock infrastructure to address the requirements of the Land Use Assessment within the Environmental Protection Regulation 2008 (Schedule 5, Table 2) was based in consideration of the following elements.

1. Disturbance footprint.
   - minimize footprint
   - locate in one catchment (if possible)
   - avoid ecologically significant areas (watercourses, PNRW key habitat)

2. Understand the geochemistry and how the risks will be managed (tailings, waste rock, water)

3. Water management
   - source of water for mine
   - impact (quality & quantity on ecological and landholders)

Based on the above workshop and options engineering, the preferred site layout as presented herein has been adopted with the following project benefits identified:

- Proximity to the plant and mine area minimises piping and pumping requirements.
- Proximity to pit for haulage of waste rock.
- Integrated waste landform maximised the encapsulation/cover thickness of the PAF material.
- Upper slope broad valley storages of the IWTL and MWD is beneficial for seepage management with single primary drainage element. In addition, no significant clean water diversion works will be required.
- The Proposed storage locations are situated within a single regional catchment (Leichardt River) with infrastructure outside the mapped flooding area of the Leichardt River (DNRM, 2018).
- Thickening of the tailings will reduce the free water within the IWTL compared to conventional tailings.
- The co-disposal of the tailings with the waste rock benefits the minimisation of potential acid mine drainage and/or metal mine drainage with the use of buffered tailings to intermingle and cover PAF waste rock.
- Location of the MWD will permit the post closure surface landform of the IWTL to be able to be domed and drained thereby minimising infiltration.
- Option to place back into the mine void was assessed and is included in the proposed development, with the materials schedule as provided in Section 2.2.2 considered worst case.
• Maintains environmental buffer to Black Mountain

2.3.2 General Concept

The overall concept for the waste and tailings management associated with Mt Dromedary is to provide encapsulation of the PAF materials to minimise the potential for acid mine drainage, with both the tailings and PAF waste rock identified as PAF material. Based on the material schedule as outlined above and the site physical setting, it was determined that the most efficient encapsulation strategy was to develop a single waste landform with PAF materials placed centrally and encapsulated using a low permeability zone and buttressed with NAF waste rock materials.

2.3.3 Description of Ultimate IWTL Development

The proposed IWTL development concept to contain the currently envisaged life of mine PAF waste rock and tailings as well as provision for freeboard to contain process water and storm-water inputs, is shown on the attached Drawings, with the physical characteristics provided in Table 2 below.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Proposed IWTL - Physical Characteristics</th>
</tr>
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<tbody>
<tr>
<td><strong>Assessment Criteria</strong></td>
<td><strong>Value/Description</strong></td>
</tr>
<tr>
<td><strong>Tailings Storage Details</strong></td>
<td></td>
</tr>
<tr>
<td>Catchment area (Inclusive of IWTL footprint) (ha)</td>
<td>46.5 ha</td>
</tr>
<tr>
<td>IWTL storage capacity to Spill Level (ML)</td>
<td>3,831 ML</td>
</tr>
<tr>
<td>Storage Area (ha) at ultimate development</td>
<td>28.4 ha</td>
</tr>
<tr>
<td><strong>Embankment Details</strong></td>
<td></td>
</tr>
<tr>
<td>Embankment type/configuration</td>
<td>Clay core with rock fill buttress, and raised using downstream/centreline methods</td>
</tr>
<tr>
<td>Final embankment crest RL (m)*</td>
<td>RL 164m</td>
</tr>
<tr>
<td>Maximum Embankment Height (m)</td>
<td>46m</td>
</tr>
<tr>
<td>Embankment Fill Volume (m$^3$) (including 10% contingency)</td>
<td>9,820,000*</td>
</tr>
<tr>
<td><strong>Pumping Details</strong></td>
<td></td>
</tr>
<tr>
<td>Maximum Pipe Distance from Plant (m)</td>
<td>1,500m</td>
</tr>
<tr>
<td>Max Elevation Head from Plant (m)</td>
<td>24m</td>
</tr>
<tr>
<td><strong>Rehabilitation/Closure Area</strong></td>
<td></td>
</tr>
<tr>
<td>Capping Area (ha)</td>
<td>46.5 ha</td>
</tr>
<tr>
<td><strong>Seepage Management Details</strong></td>
<td></td>
</tr>
<tr>
<td>Mine Water Dam Capacity (ML)</td>
<td>185 ML</td>
</tr>
<tr>
<td>Seepage Interception Drain (m)</td>
<td>1,200m</td>
</tr>
</tbody>
</table>

*Comprising zoned NAF waste rock, Clay and PAF materials
2.3.4 IWTL Development Concept

2.3.4.1 LoM IWTL Sizing

As outlined in Section 2.3.1, the capacity of the LoM IWTL was sized to accommodate the life of mine (LoM). The proposed LoM IWTL development will be constructed by starter perimeter embankment and downstream lifting, forming the LoM IWTL. Engineered earth fill will be used for embankment construction, with earth fill from internal borrows and NAF Rock Fill from mine overburden stripping for the downstream embankment shoulder/buttress. Stage 2 development will potentially occur as a series of construction stages to maintain freeboard requirements.

2.3.4.2 Development Concept

Based on the above, landform design for the IWTL has been undertaken to achieve the total storage requirement as outlined in Section 2.3.1. A LoM IWTL development schedule based on this assessment is provided in Table 3.

<table>
<thead>
<tr>
<th>Development Stage</th>
<th>Construction Type</th>
<th>Maximum Embankment Lift Height (m)</th>
<th>Embankment Crest Level (RLm)</th>
<th>Incremental Storage Increase* (ML)</th>
<th>Cumulative Storage Increase* (ML)</th>
<th>Approximate Construction Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Starter</td>
<td>Starter Embankment</td>
<td>13</td>
<td>RL 130m</td>
<td>1,075 ML (to Spill Level)</td>
<td>1,075 ML (to Spill Level)</td>
<td>6 Months prior to Plant Commissioning</td>
</tr>
<tr>
<td>2</td>
<td>Centreline</td>
<td>34</td>
<td>RL 164m</td>
<td>2,566 ML (to Spill Level)</td>
<td>3,641 ML (to Spill Level)</td>
<td>Year 2</td>
</tr>
</tbody>
</table>

*Does not include PAF material utilised in construction of the upstream PAF embankment zone.

For each stage, an emergency spillway would be constructed on the western perimeter, discharging into the Mine Water Dam catchment.

Conceptual landform of the LoM IWTL development for each construction stage are provided on attached Figures. Figure 5 provide a typical cross section through the final landform, indicating the configuration of the proposed Stages.

The final configuration of the IWTL following completion of the LoM IWTL would comprise:

- Crest level: RL 164.0m
- Spillway invert level: RL 163.0m
- Spillway width: 20.0m
- Total Embankment length: 2,300m
- Maximum embankment height: 42m
- Embankment crest width: 13m
- Storage Area (at full supply level): 19.2ha
- LoM Tailings Storage Capacity: 3,458 ML
- LoM IWTL Total Storage Capacity (including freeboard): 3,642 ML
The plan extent of the storage allows for sufficient area to generally maintain an average rate of rise of less than 1.5m per annum, which based on experience of gold tailings under site climatic conditions, provides sufficient time for consolidation and associated high achieved densities and low permeabilities of the tailings mass.

A storage curve for the proposed ultimate IWTL is provided on Plate 1.

![IWTL Storage Curve](image)

### 2.3.4.3 IWTL Decant

As part of the IWTL development, it proposed to develop a decant structure centrally on the eastern extents of the IWTL. The structure would be formed as a perimeter causeway using PAF waste rock which will allow runoff from the tailings beach to pass whilst generally retaining the tailings solids. A skid mounted centrifugal pump would be located at the decant location for return of the decant water to the Process Plant. The precise location of the decant and associated details is to be determined in detailed design.

### 2.3.4.4 Storage Foundation Lining

Subject to detailed investigations and design, it is envisaged that the storage area of the IWTL will be formed to grade towards the Mine Water Dam (MWD) and comprise a zone/layer of very low permeability clay fill to minimise the vertical down movement of seepage. For the purpose of this conceptual development it is envisaged that the Foundation Lining would comprise a minimum 1m thick clay fill zone with a permeability of less than $1 \times 10^{-9}$ m/s or alternate system of equivalent performance.
2.3.4.5 **Seepage Interception System**

It is proposed to install an IWTL interception system as part of the development to enhance seepage performance/management, with the proposed system to comprise the following details:

- Seepage Interception Trench at the upstream toe of the clay core cut-off key. The trench will extend around the perimeter of the IWTL with the location indicated on Figure 3.
- The trench will be a minimum 4.0m in depth with a slotted drainage collection pipe and backfilled with a drainage aggregate. Typical details of the Interception Trench is shown on Figure 5.
- The Interception trench will discharge into a Seepage Sump comprising a 1500mm diameter lidded concrete chamber. Typical details of the Seepage Sump is shown on Figure 5.
- Seepage Sump to be equipped with an automated pump recovery system with a minimum pump back capacity of 50L/s, subject to detailed design and operational performance.

2.3.5 **Earth Fill Borrow Areas**

It is understood that earth fill/clay fill materials required to form the embankment core/low permeability zone will be sourced from internal borrow areas within the storage area of the IWTL and/or surrounding areas subject to mine disturbance. These borrows would be situated a minimum 50m from the upstream toe of the IWTL embankment.

2.4 **Site Water Management**

2.4.1 **Clean Water Diversion Drains**

Clean water diversion drains are proposed to be constructed where practicable to divert clean water runoff around the mine disturbance areas. The two primary drains include a western diversion for the pit area and a diversion around the eastern extent of the plant site area. The diversion drains will be formed by balanced cut and fill earthworks.

2.4.2 **Mine Water Dam**

The Mine Water Dam (MWD) is to be located immediately downstream of the IWTL main embankment. The purpose of the MWD is to both intercept sediment laded runoff from the IWTL, provide tertiary seepage interception and buffer storage for mine affected water.

2.4.3 **Raw Water Dam**

The Raw Water Dam (RWD) is located to the east of the IWTL and provides an operation buffer storage for make-up water sourced from a pipeline that runs from Lake Julius to the Ernest Henry Mine Site.

2.4.4 **Process Water Pond**

The Process Water Pond (PWP) is located at the plant site and provides a process buffer storage with water sourced from the IWTL return, MWD, pit dewatering and makeup from the RWD.
3 BACKGROUND DATA

3.1 Climate

The Mount Dromedary site is subject to a semi-arid environment with highly variable rainfall conditions. Mean annual rainfall is 490.2mm (Bureau of Meteorology - Cloncurry), with an obvious seasonal pattern of lower rainfall conditions during the winter months and highest rainfall occurring during January and February.

Mean monthly rainfall and evaporation data is summarised in Table 1. In the absence of evaporation records, monitored in close proximity to the site, two monitoring stations were selected to represent site specific conditions, one in Mt Isa and the other in Julia Creek, located 120 km south west and 195 km south east, respectively.

Table 4
Average Monthly Rainfall and Evaporation Data (mm) for the Cloncurry Region

<table>
<thead>
<tr>
<th>Location</th>
<th>Rainfall*</th>
<th>Evaporation**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cloncurry</td>
<td>Mt Isa</td>
</tr>
<tr>
<td>January</td>
<td>139.8</td>
<td>297.6</td>
</tr>
<tr>
<td>February</td>
<td>111.1</td>
<td>249.2</td>
</tr>
<tr>
<td>March</td>
<td>76.35</td>
<td>275.6</td>
</tr>
<tr>
<td>April</td>
<td>19.4</td>
<td>249.0</td>
</tr>
<tr>
<td>May</td>
<td>13.1</td>
<td>198.4</td>
</tr>
<tr>
<td>June</td>
<td>7.85</td>
<td>159.0</td>
</tr>
<tr>
<td>July</td>
<td>4.9</td>
<td>170.5</td>
</tr>
<tr>
<td>August</td>
<td>4.2</td>
<td>213.9</td>
</tr>
<tr>
<td>September</td>
<td>6.7</td>
<td>267.0</td>
</tr>
<tr>
<td>October</td>
<td>15.9</td>
<td>325.5</td>
</tr>
<tr>
<td>November</td>
<td>29</td>
<td>330.0</td>
</tr>
<tr>
<td>December</td>
<td>69.65</td>
<td>325.7</td>
</tr>
<tr>
<td>Yearly</td>
<td>490.2</td>
<td>3,068</td>
</tr>
</tbody>
</table>

Source: Bureau of Meteorology
* Cloncurry Station: #029009 and 029141
** Mt Isa Station: #029127
    Julia Creek Station: #029025

Table 1 indicates that within the region, mean evaporation far exceeds mean rainfall for each month.

3.2 Topography and Drainage

The Mount Dromedary site is located over two river basins, namely the Leichhardt and Flinders Basins. Excepting the proposed Mine Camp, site infrastructure is located within the Leichhardt Basin, which comprises a catchment of approximately 33,000 km². The Leichhardt River is ephemeral and originates to the south of Mt Isa, before flowing in a generally northern direction...
passing to the west (approximately 15 km) of Mount Dromedary and eventually reporting to the Gulf of Carpentaria.

Site drainage paths and topography within the proposed mine lease are shown in Plate 2:
Within the site, the Dromedary Ranges form a catchment divide reporting surface runoff flows to the east (Flinders Basin) and west of the site (Leichhardt Basin).
In the northern extent of the proposed mining lease, two drainage paths report eastwards, passing flows across the Burke Developmental Road. The northernmost of these is located nearby the current proposed Mine Camp.

At the southern extent of the site, an unnamed drainage path reports flows between Mt Dromedary and Black Mountain. The proposed Mt Dromedary Pit is located in the northernmost headwaters of this drainage path. A less defined minor tributary is also located at the southern limit of the proposed mining lease. Both of these drainage paths flow westwards into the Leichhardt basin. Drainage paths to the west are well defined through the Dromedary Ranges, however are poorly defined over the Leichhardt flood plain.

At the site location, these drainage paths are ephemeral.

3.3 Geology

The geology of Mount Dromedary site based on regional geological mapping (Geoscience Australia, 2016) indicates that the site is underlain with Pre Cambrian Age metamorphic rocks including quartzite, schist, some granulite, gneiss and granofels, primarily of the Corella Formation. The Coolullah fault line extends along the site’s western extent, trending North-South. Local geological mapping of the site was also undertaken by C. Tedman Jones and documented in Jones (2017). The significant outcomes in relation to the proposed site water and water management infrastructure include:

- The Northern Sector (Low Grade Ore Stockpile & Process Plant Area) exists elements of the Proterozoic Corella Formation, tightly folded in predominantly steeply west dipping metasediments. The dominant folds trend northwest-southeast and northeast-southwest. The Low Grade Ore stockpile is underlain by a zone of metalimestones and calcisilicates which would likely to provide ideal basal conditions for the stockpile to minimise Acid-Mine-Drainage. No large scale regional faults or significant structures were observed at the Low Grade Stockpile and Process Plant areas.

- Southern Sector (IWTL, RWD, and MWD) is predominantly overlaid with alluvium and colluvium masking observable structures. In some locations generally localised quartz filled annealed shears are present. The majority of the Southern sector consists of steeply dipping quartzite and calcisilicate. Significant geological structures identified are depicted in Plate 2, relative to the proposed site elements:
Plate 3
Significant Interpreted Geological Structures Relevant to Mine Planning
(Reproduced from Jones, 2017)
With respect to the identified significant geological structures, the following is noted:

- **Cooloollah Fault**
  
The Cooloollah Fault is located to the west of proposed site elements, and is not anticipated to impact on proposed site structures.

- **Middle Fault**
  
The ‘Middle Fault’, inferred from regional magnetics only, has been mapped at the eastern limit of the proposed IWTL location. It is noted that no evidence of this fault was visible at surface outcrops during C Tedman-Jones’ site visit, and the existence and location of the fault is unconfirmed.

- **Creek Fault**
  
A minor potential fault was interpreted in the proposed location of the RWD, referred to as the ‘Creek Fault’. The potential shear fault is aligned north-south, following the drainage line the RWD is sited across.

### 3.4 Hydrogeology

Hydrogeological investigations at the site location have been undertaken by Rob Lait & Associates and are detailed in RLA (2016a, 2016b).

The hydrogeological investigation concluded that the site location is limited to the Proterozoic Corella Formation and Boomarra Horst, indicating that site areas are not hydrogeologically connected to the Great Artesian Basin. Falling head permeability tests, performed in the general proximity of the proposed pit location, indicate generally low hydraulic conductivity. An aquifer, comprised of fractured calc-silicates was present between 15m-25m in depth proximate to the proposed pit location. Low airlift yields from this aquifer indicates generally low connectivity and permeability.

RLA (2016a) also concluded that the Mt Dromedary Pit is likely to comprise a groundwater sink over the longer term.

### 3.5 Tailings Characterisation and Associated Design Implications

#### 3.5.1 Pilot Tailings Production

Tailings produced from pilot metallurgical work was provided by Graphite Corp to ATCW as a dewatered filter cake product to facilitate transport. The material was produced by Outotec in Brazil on the 2 ore types (weathered/oxide ore and fresh/primary ore) for purpose of assessment of tailings thickening (Outotec, 2017).

Based on these two materials, tailings testing, inferred tailings characteristics and geotechnical properties for the LoM IWTL development as provided below.
3.5.2 Tailings Testwork

Tailings geotechnical testwork undertaken by ATCW on the two samples as described above (sample references are GSW for the weathered ore and GSP for fresh), with testwork comprising the following suite of testing:

- Particle Size Distribution
- Particle Specific Gravity
- Atterberg Limits
- Settled Densities (drained and undrained conditions)

3.5.3 Testwork Results

ATCW laboratory test-work records are attached in Appendix B.

3.5.3.1 Physical Characteristics

Physical and geotechnical test-work has been undertaken on samples of tailings derived from pilot testing. Test-work results are summarised in Table 5.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Weathered Ore</th>
<th>Fresh Ore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geotechnical Classification</td>
<td>CLAYEY SILT (ML-CL), Medium Plasticity</td>
<td>CLAYEY SILT (ML-CL), Medium Plasticity</td>
</tr>
<tr>
<td>Particle Density</td>
<td>2.6 t/m$^3$</td>
<td>2.72 t/m$^3$</td>
</tr>
<tr>
<td>Particle Size Distribution</td>
<td>P80 35µm</td>
<td>P80 40µm</td>
</tr>
<tr>
<td>Atterberg Limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid Limit</td>
<td>42%</td>
<td>48%</td>
</tr>
<tr>
<td>Plastic Limit</td>
<td>25%</td>
<td>30%</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>17%</td>
<td>18%</td>
</tr>
<tr>
<td>Linear Shrinkage</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

3.5.3.2 Tailings Settled Densities

Tailings settling tests for the two samples is currently being undertaken with results expected in early February 2018.

3.5.4 Tailings Seepage Geochemistry

Tailings water testing was undertaken by GCA (2018a), utilising samples generated from a pilot plant in Brazil. Tailings slurry water quality is summarised as follows:
- **Weathered Ore Composite Sample**

  Tailings slurry water generated from weathered ore composites is circum-neutral (pH 7.3). Abundant bicarbonate alkalinity was noted (88mg/L), suggesting some buffering capacity in the weathered ore composite tailings water may exist. Minor element concentrations are generally low.

- **Primary Ore Composite Sample**

  Testwork undertaken indicated that the tailings slurry water generated from the Primary Ore stream is acidic (pH 3.7) with elevated metal contaminants (i.e. Al, Fe). The acidity and metalliferous contaminants were attributed to sulphide-oxidation processes occurring during sample transit and storage. GCA concluded that, accounting for flotation pH buffering, the estimated pH range of (Primary ore) tailings water is pH 7-8. At this acidity, the aforementioned minor elements are not expected to be present in significant amounts, excepting potential elevation of Selenium.

  Additionally, trace amounts of hydrocarbons (diesel) were noted in both samples, attributed to flotation processes in the pilot plant.

### 3.5.5 Inferred Tailings Behaviour

Based on the tailings characteristics as defined in Sections 5.2.1 and by correlation with available literature and previous experience with tailings of similar properties, the following potential behaviour related to tailings slurry deposition has been interpreted:

(i) **Tailings Dam Densities**

  Based on an average beach area of and controlled thin layer for sub-aerial beaching of tailings, a 1.6m/annum is estimated as a nominal rate of tailings surface rise. Accordingly, based on this rate of rise and the site climatic conditions likely to result in tailings beach drying sufficiently, it is anticipated that an achievable average dry density for consolidated tailings will be of the order of 1.4 t/m$^3$ to 1.6t/m$^3$.

(ii) **Tailings Water Recoveries**

  Based on the achievable densities as outlined above, and taking into account losses of water to evaporation, seepage and storage within the tailings mass, a conservative (lower bound) rate of tailings water recovery of some 30% of the total tailings water input is likely to apply. Note that the water recovery potential can be affected by the quantity of rainfall experienced, as well as the relative areas of exposed tailings beach/decant pond, as well as the condition of the beach on which the tailings are discharged.

(iii) **Beach Slopes**

  Beach slopes expected to be achieved, subject to sub-aerial deposition methods, would be of the order of 0.5% to 1.0%, with steeper slopes closer to the discharge points and the beach generally forming a slightly concave beach shape representing a segregating beach deposition regime consistent with the operating slurry densities achieved.

(iv) **Tailings Permeabilities**

  Permeability of deposited tailings subject to drained settlement of $1 \times 10^{-7}$ m/s is considered typical. For the purpose of design, saturated permeabilities for tailings within a range of $10^{-6}$ to $10^{-8}$ m/s is considered reasonable.
4 CONSEQUENCE ASSESSMENT

4.1 Regulatory Context

Dams, water storages and other hydraulic structures associated with environmentally relevant activities under the \textit{Environmental Protection (EP) Act 1994}, are subject to assessment of consequence category. The benchmark reference relevant to consequence assessment and definition for design criteria is the DEHP’s \textit{Manual for Assessing Consequence Categories and Hydraulic Performance of Structures} (DEHP, 2016).

Based on this manual, dams or containment structures classified as ‘SIGNIFICANT’ or ‘HIGH’ consequence are referred to as regulated, with criteria relevant to performance of these structures applied as per DEHP’s guidelines.

The consequence assessment for existing dams and containment structures referred to as regulated is based on two failure scenarios, as follows:

- \textit{Failure-to-contain} condition, comprising spills or future releases from regulated structures; and
- \textit{Dam Break} condition, comprising collapse/gross failure of regulated structures.

4.2 Consequence Assessment Outcomes

The Consequence Category Assessment for the Mt Dromedary project was prepared under separate cover (ATCW, 2018), with summary outcomes provided in Table 6.
Table 6
Consequence Assessment Summary

<table>
<thead>
<tr>
<th>Assessment</th>
<th>IWTL</th>
<th>RWD</th>
<th>MWD</th>
<th>PWP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consequence Category Seepage</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Consequence Category Overtopping Failure</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Consequence Category Dam Break Failure</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Overall General Environmental Harm</td>
<td>SIGNIFICANT</td>
<td>LOW</td>
<td>SIGNIFICANT</td>
<td>LOW</td>
</tr>
<tr>
<td>Overall</td>
<td>SIGNIFICANT</td>
<td>LOW</td>
<td>SIGNIFICANT</td>
<td>LOW</td>
</tr>
<tr>
<td>Regulated Structure, as defined in the Manual (Y/N)</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

Given the above assessment, the IWTL and MWD are classified as a ‘Regulated Structure’ and the RWD and PWP are considered ‘Low’ consequence structures in accordance with DEHP (2016).
5 DESIGN CRITERIA

5.1 Regulatory Environment and Basis

It is proposed that the site will operate in accordance with conditions outlined in the following relevant legislation:

- Environmental Protection Act 1994 (EP Act)
- Environmental Protection (Water) Policy 2009
- Water Act 2000
- Environmental Authority Mining Lease.

The Objective of the EP ACT is to protect Queensland’s environment while allowing for development that improves the total quality of life, both now and in the future in a way that maintains the ecological processes on which life depends. The EP act outlines the general duty to take all reasonable and practical steps to avoid harm to the environment.

The purpose of the Environmental Protection (Water) Policy 2009 is to:

- Identify environmental values and management goals for Queensland waters.
- State water quality guidelines and water quality objectives to enhance or protect the environmental values.
- Provide a framework for making consistent, equitable an informed decisions about Queensland waters.
- Outline monitoring and reporting on the condition of Queensland waters.

The Water Act (2000) provided guidelines for failure impact assessment in addition to providing sustainable and integrated management procedures for the utilisation of water sources in QLD for the benefit of both present and future generations.

The Environmental Authority for a Mining Lease, issued by the Queensland Department of Environment and Heritage Protection, is a license to cause environmental harm with limitations.

5.2 Standards and Guidelines

Criteria for conceptual design and operation of the IWTL Development is summarised in the following section. The criteria adopted for the conceptual design of LoM IWTL are based on the following key references:

- Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (DEHP, 2016)

Related references include ANCOLD publications addressing design guidelines for earthquakes (ANCOLD, 1998) and guidelines on risk assessment (ANCOLD, 1999a), as well as ICOLD Bulletins 74, 77, 97 and 98 (ICOLD, 1989, 1990, 1994 and 1995).
The conceptual design criteria relevant to the LoM IWTL and associated works relate to the following design issues:

- Storage/Containment Requirements
- Surface Water Management
- Embankment Stability
- Seepage Management
- Construction Materials
- Emergency Spillway

5.3 Design Criteria

5.3.1 Storage Capacity (Process Inputs)

A mine production rate for the project of 325ktap for a projected mine life of 25 years has been adopted. The design slurry density for tailings is to be within the range of 45% to 50% wt/wt.

5.3.2 Surface Water Management

5.3.2.1 General Design Philosophy

The design philosophy behind the surface water management strategy is based on the following general principles:

- Limiting the extent of site disturbance.
- Separating contact water from non-contact water where practical.
- The collection and treatment of contact water prior to discharge to the environment.
- Construction of the IWTL eastern diversion drains.

These general principles have been used to inform the design and guide in the conceptual design of the site water infrastructure including:

- Diversion drains to divert the upstream non-contact catchments around the pit, low grade stockpile and process plant areas and during operation phase.
- A seepage interception trench is included beneath the IWTL Embankment toe. This trench will convey seepage and runoff infiltration into the seepage recovery sump where collected contact water can be pumped to either decant pond or process plant.
- MWD is included downstream of the IWTL toe to collect seepage and contact water from the IWTL. This is further discussed in following sections.

5.3.2.2 Clean Water Diversion Drains

Clean-water diversion drains will be constructed upstream of the proposed IWTL to divert the upstream non-contact catchments. These drains are required to extend to the west of the IWTL where surface runoff reports to the downstream drainage lines.
The clean water diversion drains are conceptually designed to convey peak runoff up to 1:100 AEP event. Clean water diversion design, associated with IWTL, is further discussed in Section 7.

5.3.3 Hydrology and Hydraulics

5.3.3.1 Storm Water Containment Capacity

- **IWTL**

  Criteria for storage/containment for IWTL are based on DEHP (2016), which defines storage capacity required for a process tailings dam, as the Design Storage Allowance (DSA). The DSA is calculated as the excess storage volume occurring at 1 November of each year that will be filled by runoff from the nominated design critical wet period as well as the process inputs for the critical wet period.

  Based on Section 4, the consequence rating for the IWTL is SIGNIFICANT. The storage allowance as outlined in DEHP (2016), will be based on a 1 in 20 AEP, 2-month duration wet season event.

- **MWD**

  Based on Section 4, the consequence rating for the MWD is SIGNIFICANT. The storage allowance as outlined in DEHP (2016), will be based on a 1 in 20 AEP, 2-month duration wet season event.

5.3.3.2 Emergency Spillway Design

5.3.3.2.1 IWTL

The emergency spillway for the IWTL throughout the development is to be designed in accordance with DEHP (2016) and ANCOLD (2000). The minimum criterion is for the spillway to achieve a capacity equivalent to a 1 in 10,000 year ARI event, with provision for sufficient dry freeboard to reduce the risk of embankment breaching during a spill event.

5.3.3.2.2 MWD

The design criteria for capacity of the emergency spillway for MWD has been based on the upper bound values for a SIGNIFICANT consequence category (DEHP, 2016) which shall pass a 1:1,000 year AEP with provision for sufficient dry freeboard to reduce the risk of embankment breaching during a spill event.

5.3.4 Structural Stability

On the basis of limit equilibrium conditions, the following typical minimum factors of safety for embankment stability would apply:
<table>
<thead>
<tr>
<th>Condition</th>
<th>Minimum Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Term/Steady State Seepage (at maximum storage level)</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Seismic Conditions</strong></td>
<td></td>
</tr>
<tr>
<td>• Pseudo static (OBE)</td>
<td>1.2</td>
</tr>
<tr>
<td>• Maximum Design Earthquake (MDE)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*OBE: Operating Base Earthquake, producing a level of ground motion which will cause only minor and repairable damage to the structure. OBE recurrence interval based on the consequence category of High is 1 in 1,000 year event.
*MDE: Maximum Design Earthquake, with the design requirement being that the dam may be badly damaged but the facility should maintain its integrity and cannot allow the release of impounded water. MDE recurrence interval based on a consequence category of High is 1 in 10,000 year event

5.3.5 Seepage Management

For the purpose of embankment design and stability, criteria with respect to seepage management based on ANCOLD (2012), inference the following:

(i) Seepage water from the IWTL must not enter surface waters
(ii) excessive surface expression of seepage discharge downstream from the embankment should not occur;
(iii) a significant impact on the environmental status of receiving waters should not result from the IWTL; and
(iv) the potential beneficial uses of surface and groundwater down gradient from the site should not be compromised.

It is noted that the existence of the ‘Middle Fault’ and ‘Creek Fault’ (Refer Section 3.3) may have implications for seepage management for the IWTL and RWD, respectively. Therefore, geotechnical site investigations to be performed as part of the detailed design phase of works should determine the existence and extent (if present) of these local geological features.

If the ‘Middle Fault’ is present at the proposed footprint of the IWTL, it is anticipated that potential seepage impacts can be minimised through the basal foundation layer, included in the IWTL concept. It is noted that a groundwater monitoring bore (GWMB06) is proposed within the inferred location of the ‘Middle Fault’, to measure seepage performance of the IWTL. The location of GWMB06 is shown on Drawing 002.

If the ‘Creek Fault’ is present at the proposed footprint of the RWD, an additional basal liner may be required. As the RWD has been assessed as a ‘Low’ consequence structure (ATCW, 2018), any seepage performance impact upon the RWD by a potential fault would be considered an operational concern, rather than an environmental issue.

5.3.6 Construction Materials

Embankment construction materials would be sourced locally (i.e. within close proximity to the IWTL), with the open cut mining operation providing the construction fill source for rock fill materials. Target properties of the materials used in IWTL lift construction, based on past experience and performance assessment are as follows:
(i) Clay Fill (for use as low permeability zone)

- Clay dominant material (clay/silt fraction greater than 20% and Liquid Limits ranging from 25% to 60%).
- Undrained shear strength in excess of 50kPa after compaction.
- Achievable compacted permeability of less than $5 \times 10^{-9}$ m/s.
- Engineerable to reduce potential “internal” erosion/piping.

The key to the above suite of properties is to create a fill layer that possesses high strength, compacts well, is stable (i.e. not subject to significant vertical settlement under load or volume instability due to variation in moisture content) and importantly, provides an appropriately low level of permeability.

(ii) Rock Fill (for use as embankment fill)

The purpose of rock fill within an embankment would be to enhance structural strength as well as to provide erosion protection to external portions of the embankment. General requirements for rock fill would be as follows:

- High load bearing capacity.
- Stable and durable (with respect to potential settlement, volume instability, erosion potential and weathering).
- High permeability relative to adjacent embankment or subgrade zones.
- Geochemically stable (i.e. non-acid producing).

5.4 Operational Criteria

5.4.1 Tailings Deposition Approach

Tailings deposition is proposed to occur from spigotted peripheral discharge pipelines, which facilitate subaerial deposition of tailings within the storage. The main deposition will be from the Main Embankment, which will form a beach sloping to the east, creating the decant on the eastern margin of the storage area. This approach will minimise seepage potential by minimising the risk of ponding water against the main embankment, maximise the embankment stability and maximise the settled densities of the tailings thereby reducing the overall height of the IWTL.

5.4.2 Decant/Return Water Quality

Appropriate practices with respect to maintaining the quality of decant/return water (to be reused within the process) are to be adopted. As a minimum, provisions to be made to limit the significant alteration of decant water quality within the IWTL will include:

(i) Maintaining a sufficiently large enough decant pond to enable sufficient residence time for settlement of suspended solids prior to recovery.

(ii) Maintaining an appropriate tailings deposition regime (in terms of cycling periods) such that the tailings beach consolidation is maximised, thereby maximising tailings storage efficiency.
5.4.3 Seepage Management

Appropriate practices to manage the rate or quality of seepage water that may be released from the system are to be adopted. These practices will be implemented to comply with environmental requirements, specifically referring to the downstream and downgradient water quality requirements. To achieve the water quality requirements and as a minimum, provisions to be made to manage seepage migration effects will include:

(i) Maintaining an appropriate tailings deposition regime (in terms of cycling periods) to maximise consolidation of the tailings and water recovery.

(ii) Whilst maximising water recovery, as outlined above, the volumes of free water occurring within the decant pond is limited. This outcome requires an effective balance between deposition scheduling and decant water recovery rate.

(iii) Operating and maintaining a seepage interception and recovery systems, which for IWTL comprise downstream seepage collection drains, seepage cut-off key trench, dewatering bores and implementation of additional seepage pump back bores and dewatering bores, subject to need.

(iv) Undertaking groundwater monitoring to assess the IWTL performance in terms of seepage losses and to identify preferred flow paths/basement sequences, with the monitoring to provide a feedback trigger for implementation of additional and targeted dewatering works.

Monitoring of surface water and groundwater quality around the IWTL to detect excessive seepage migration is a key seepage management aspect, contributing to assessment of seepage sources and management approach.

Specific details of the monitoring of surface water and groundwater quality and quantum around the IWTL will be addressed by others.
6 MINE WASTE DISPOSAL MANAGEMENT

6.1 General

An initial assessment was undertaken for mine waste management to optimise the proposed infrastructure in terms of the following parameters:

- Process Infrastructure
- Mine/Development economics
- Water use and recovery
- Area of disturbance
- Environmental impacts

Options considered included conventional tailings and waste rock dumps, dry stacking and thickened tailings disposal into an integrated landform.

The outcome of this assessment indicated that the current preferred methodology would be co-placement creating an Integrated Waste-Tailings Landform (IWTL). This methodology involves the placement of benign waste rock such that an open void space is created within for tailings storage.

This methodology was chosen for the following reasons:

- Preference to contain the acid producing material in one area
- There would be sufficient NAF material to encapsulate a single PAF cell
- Simplify water management (Single dirty water dam)
- Reduced Land Disturbance:
  - Reduced impact on wildlife habitat and agricultural uses
  - Reduced watershed disturbance
  - Reduced impact to local waterways
- Enhanced landform stability and erosion performance
- Closure related issues including:
  - Reduced closure area
  - Reduced surface water and groundwater impact to monitor
  - Reduced number of visual landforms
  - Reduced post-closure maintenance requirements.
6.2 IWTL Design Sizing

The IWTL will be developed as a single integrated structure to contain the following mine wastes:

- Thickened Tailings Waste
- Unprocessed Low Grade Ore (NAF Component)
- Waste Rock material (PAF and NAF)

It is noted that disposal of the PAF component of the Low Grade Ore will include stockpiling adjacent to the pit and in-pit stockpiling as development of the Mt Dromedary pit allows.

For the design of the IWTL, material densities have been estimated as follows:

- Assumed Densities
  - Thickened Tailings 1.6 t/m³
  - Low Grade Oxide Ores (NAF) 2.0 t/m³
  - Waste Rock Material 2.2 t/m³

Based upon the schedule presented in Section 2.1.2, and the densities above, a total disposal volume has been calculated of some 10.7 million cubic metres. Notwithstanding this, the total design volume adopted for the IWTL is some 12.5 million cubic metres conservatively allowing a contingency.

6.3 IWTL Design Configuration

The proposed IWTL will have a crest elevation of RL 164.0 m AHD and an embankment slope of 3:1 (H:V). The layout and cross section of the IWTL is shown on Figures 002 and 004.

All PAF waste rock materials will be encapsulated within NAF materials. This will include at least a 1 m layer of well compacted low permeability basal zone at the base of the IWTL. The basal zone shall be graded to the MWD to intercept seepage/infiltration water and allow recovery from the MWD. The top of the IWTL will be sealed with a compacted low permeability layer of suitable NAF waste rock or other material.

Staged development of the IWTL throughout the life of mine of the project is expected to comprise a staged lift approach. Benefits of this approach include; reduced capital expenditure costs and a reduced footprint exposed to rainfall. It is anticipated that design of IWTL staging will be performed in the detailed design phase.
7 SITE WATER MANAGEMENT

7.1 Background and Strategy

Water management strategy in relation to the proposed Mt Dromedary development is summarised as follows:

- **Clean Water Management**
  
  Clean water associated with the site comprises storm water runoff occurring outside the limits of the mine disturbances, which is able to be diverted away from the mining areas. Clean water diversion drains are to be located around the mining pit and process plant area.

- **Tailings Water Management**
  
  The limits of the IWTL catchment are defined by the storage embankments. The total catchment area of the IWTL is some 28.4 ha.

  Water occurring within the IWTL is derived from the following sources:
  
  - direct rainfall over the tailings surface and decant pond;
  - water liberated from deposited tailings.

  The recovery of water from the decant pond will occur via a sled mounted recovery pump. Decant water shall be returned to the Process Water Pond within the plant area. The decant pump shall be operated to minimise the ponded volume within the decant pond.

7.2 Description

7.2.1 General Layout

Two water management facilities will be constructed to manage water needs for the mine site, a Raw Water Dam (RWD) and a Mine Water Dam (MWD).

It is envisaged that the RWD will contain water pumped from a pipeline that runs from Lake Julius to the Ernest Henry Mine Site. This pipeline crosses the Burke development highway approximately 60 km south of the mine site. Additional water could be collected from field production bores, subject to water quality.

The MWD will contain water pumped from the pit, mine impacted surface runoff, and seepage and surface water runoff from the IWTL.

Water required for the process plant will be first taken from the MWD and then make up water drawn from the RWD.

7.2.2 Raw Water Dam

A Raw Water Dam (RWD) will be constructed to the east of the IWTL, in an adjacent catchment. A layout and cross section of the RWD is shown on Figures 002 and 004. It is envisaged that the RWD will be comprised of zoned embankment with the following configuration:
7.2.3 Mine Water Dam

A mine water dam (MWD) will be constructed directly downstream of the IWTL. It is envisaged that the MWD will be comprised of a zoned embankment with following configuration:

- **Embankment Crest Level:** RL 122.0 m AHD
- **Embankment Slopes:** 2:1 (H:V), both upstream and downstream
- **Embankment Crest Width:** 8 m
- **Embankment Footprint:** 1.3 ha
- **Spillway Invert (Full Supply) Level:** RL 121.0 m AHD
- **Emergency Spillway Width:** 15.0 m
- **Storage Capacity:** 188 ML
- **Area at Full Supply:** 10.1 ha
A layout and cross section of the MWD is shown on Figures 002 and 004.

7.2.4 Diversion Drains and Bunds

Diversion drains and bunds will be constructed around the pit to limit surface runoff entering the pit and to divert clean water. The layout of the drain and bunds are shown on Figure 003 and typical sections are shown on Figure 004.

Diversion drains will also be constructed around the Low Grade Ore stockpile(s) to direct clean water around the stockpile.

7.3 Regulatory Requirements

7.3.1 Storage Performance Criteria

According to the DEHP (2016) guidelines, the key criteria relevant to regulated structures relates to accommodating a Design Storage Allowance (DSA). The DSA is a calculation of the required wet season containment for the storage. The storage capacity required for regulated structures, and associated release mitigation strategies, will need to be such that containment is maintained for all but extreme rainfall events.
Containment criteria for regulated storages, as recommended by the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (DEHP, 2016), are as follows:

- **“HIGH” CONSEQUENCE** 1:100 AEP
- **“SIGNIFICANT” CONSEQUENCE** 1:20 AEP
- **“LOW” CONSEQUENCE** nil

7.3.2 Design Storage Allowance Estimates

Design storage allowances have been estimated using the “Method of Deciles” described in ATCW, (2018) of the *Manual* (DEHP, 2016). Rainfall data was sourced from the SILO Data Drill Program (DSITI, 2016) for the project site coordinates. Two (2) month duration rainfall totals were sampled across the regulatory wet season period to develop a series representing wet season rainfall maximums. This data was then fitted to a log pearson III distribution using statistical methods described in *Australian Rainfall and Runoff: Volume 1, 3rd Edition* (Institute of Engineers Australia, 1999). The data and statistical fit are depicted in Plate 6:

![Plate 6: 2 Month Wet Season Rainfall Totals](chart.png)

Catchment areas for the proposed storages are depicted in Appendix A. Calculated Design Storage Allowance (DSA) volumes are listed in Table 7:
Table 7
Design Storage Allowance (DSA) Decile Method for Regulated Storages

<table>
<thead>
<tr>
<th>Regulated Dam</th>
<th>IWTL</th>
<th>MWD</th>
<th>RWD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consequence Category</td>
<td>HIGH</td>
<td>HIGH</td>
<td>Low</td>
</tr>
<tr>
<td>Critical Wet Period</td>
<td>2 months</td>
<td>2 months</td>
<td>N/A</td>
</tr>
<tr>
<td>Runoff from Design Critical Wet Period</td>
<td>1007.8 mm</td>
<td>1007.8 mm</td>
<td>NA</td>
</tr>
<tr>
<td>- Rainfall Total*</td>
<td>28.4 ha</td>
<td>34.8 ha</td>
<td>50.3 ha</td>
</tr>
<tr>
<td>- Catchment Area</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Process Inputs</td>
<td>53.8 ML</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>DSA</td>
<td>340 ML</td>
<td>351 ML</td>
<td>N/A</td>
</tr>
</tbody>
</table>

7.3.3 Mandatory Reporting Level

Mandatory Reporting Levels (MRLs) are also required for regulated storages. MRLs constitute a maximum operational level which if exceeded triggers notification to DEHP and potential fines. MRLs have not been calculated as a component of this assessment, however they will be required as part of detailed design works.

7.4 Water Balance Model

A concept water balance model (WBM) has been developed to assess the performance of the proposed site water management system.

The objectives of the WBM are as follows:

- Confirm sizing and containment requirements for the proposed storages;
- Identify and determine the need for transfer pumping arrangements across the site; and
- Assess the site wide water balance to determine whether the site is in surplus/deficit.

7.4.1 Model Development, Storage and Catchment Characteristics

The water balance model was developed using Goldsim Pro, a dynamic probabilistic simulation program. The model uses a range of parameters to represent the catchment surface water flow system, being routed through a time series of daily rainfall data for an estimate of daily runoff. Proposed site storage characteristics are listed in Table 8.
Table 8
Proposed Configuration of Mt Dromedary Storages

<table>
<thead>
<tr>
<th>Storage Element</th>
<th>Full Supply Level</th>
<th>Maximum Storage Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>IWTL</td>
<td>RL 164.0m</td>
<td>3,831 ML</td>
</tr>
<tr>
<td>MWD</td>
<td>RL 121.0m</td>
<td>188 ML</td>
</tr>
<tr>
<td>RWD</td>
<td>RL 133.0m</td>
<td>280 ML</td>
</tr>
<tr>
<td>Mt Dromedary Pit Sump</td>
<td>NA</td>
<td>5010 ML*</td>
</tr>
</tbody>
</table>

*Storage capacity representing the full pit development. Proposed pit sump comprises a 2m depth at the base of the pit.

7.4.1.1 Climate Data

Climatic input data (Daily Rainfall & Daily Evaporation) derived for the site was obtained from the SILO Data Drill Program specific to the site location, from 1889 to 2017), as outlined in Table 9. The climatic input data informs daily rainfall, runoff and evaporative loss models within the water balance model. Average historical monthly rainfall, ‘A’ class pan evaporation potential and evapotranspiration depths are depicted in Plate 6, as derived from the SILO Data Drill.

Table 9
Site Water Balance - Rainfall and Evaporation Input Data

<table>
<thead>
<tr>
<th>Climate Data</th>
<th>Value</th>
<th>Data Source</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall</td>
<td>Daily Rainfall Rate (mm/day)</td>
<td>Rainfall data obtained from the SILO data drill program for the Mt Dromedary Site Location (1889 - 2017)</td>
<td>Applied as direct rainfall over dam surfaces, and as an input parameter for the estimation of catchment runoff (AWBM).</td>
</tr>
<tr>
<td>Evaporation</td>
<td>Daily Evaporation Rate (mm/day)</td>
<td>Evaporation data from SILO Data Drill obtained formed by conjoining CLIMARC estimates (typically 1889 - 1957) and Class A evaporation pan data interpolated from weather stations within the region.</td>
<td>Evaporation data are adjusted with evaporation factors for each storage to reflect water storage conditions and expected water quality.</td>
</tr>
<tr>
<td>Evapotranspiration</td>
<td>Daily Evapotranspiration (mm)</td>
<td>FAO56 Reference Potential Evapotranspiration Rate</td>
<td>Adopted as a proxy of evapotranspiration rates from surface runoff catchments, for use in the AWBM surface runoff model.</td>
</tr>
</tbody>
</table>
7.4.1.2 Model Flow Chart and Run Duration

The adopted modelling period for the water balance is a horizon of three wet season years from commissioning of the proposed site storages.

A flowchart of the water balance model for the site is depicted in Plate 7.
7.4.2 Catchments and Surface Runoff

Stormwater runoff estimation was undertaken using the Australian Water Balance Model (AWBM) and the catchments identified in Table 10. The catchment types and AWBM model parameters used to simulate these different catchment types and the average yields are summarised in Table 11. Model parameters are uncalibrated and have been selected based on experience with similar water balance model studies, and are considered to be conservative.

Table 10
Mt Dromedary Catchment Characteristics

<table>
<thead>
<tr>
<th>Reporting Destination</th>
<th>Surface Type</th>
<th>Natural</th>
<th>Waste</th>
<th>Hardstand</th>
<th>Open Cut</th>
<th>Full Supply Area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MWD</td>
<td>Natural</td>
<td>7.6 ha</td>
<td>17.2 ha - -</td>
<td>10.1 ha</td>
<td>34.9 ha</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RWD</td>
<td>Waste</td>
<td>39.2 ha</td>
<td>-</td>
<td>-</td>
<td>11.1 ha</td>
<td>50.3 ha</td>
<td></td>
</tr>
<tr>
<td>IWTL</td>
<td>Hardstand</td>
<td>- 9.1 ha</td>
<td>-</td>
<td>-</td>
<td>19.3 ha</td>
<td>28.4 ha</td>
<td></td>
</tr>
<tr>
<td>Pit</td>
<td>Open Cut</td>
<td>11.9 ha</td>
<td>12.1 ha</td>
<td>0.2 ha</td>
<td>12.3 ha</td>
<td>36.6 ha</td>
<td></td>
</tr>
</tbody>
</table>
Table 11
AWBM Model Parameters

<table>
<thead>
<tr>
<th>AWBM Parameters</th>
<th>Split Areas (sum=1.0)</th>
<th>Storage Capacities (mm)</th>
<th>Ks (day⁻¹)</th>
<th>BFI</th>
<th>Kb (day⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>Natural</td>
<td>0.134</td>
<td>0.433</td>
<td>0.433</td>
<td>12</td>
<td>120</td>
</tr>
<tr>
<td>Hardstand</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Waste</td>
<td>0.2</td>
<td>0.8</td>
<td>-</td>
<td>10</td>
<td>300</td>
</tr>
<tr>
<td>Open Cut</td>
<td>0.1</td>
<td>0.9</td>
<td>-</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Rehab waste</td>
<td>0.1</td>
<td>0.3</td>
<td>0.6</td>
<td>20</td>
<td>55</td>
</tr>
<tr>
<td>Stockpiles</td>
<td>0.1</td>
<td>0.9</td>
<td>-</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Tailings</td>
<td>0.2</td>
<td>0.8</td>
<td>-</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Trimmed Waste</td>
<td>0.1</td>
<td>0.3</td>
<td>0.6</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Embankment</td>
<td>0.2</td>
<td>0.8</td>
<td>-</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

7.4.2.1 Operating Conditions

7.4.2.1.1 Make-Up Water Supply

Available water sources on-site are limited (RLA, 2016). Accordingly, make-up water supply has been modelled based on secured allocation of water from the Northwest Queensland Pipeline. Make-up water has been modelled as follows:

- Supply Rate 1.0 ML/day
- Supply Condition RWD Water Surface Elevation is below RL130m

7.4.2.1.2 Groundwater Ingress to Pit

Groundwater ingress to the Mt Dromedary Pit has been based upon hydrogeological calculations undertaken by Rob Lait & Associates (as per Email communication dated 16/1/2018). Daily inflow rates have been modelled as follows:

- Groundwater Ingress Rate to Pit 0.01 ML/day

7.4.2.1.3 Process Sourcing

Process sourcing has been calculated based upon available tailings parameters for the site, as follows:

- Slurry Solids Content (by weight) 46.5%
- Max Density Achieved 1.6 t/m³
- Tailings Particle Specific Gravity 2.7 t/m³
7.4.2.1.4 Dust Suppression

Dust Suppression supply rates have been modelled as follows:

- Daily Dust Suppression Rate: 0.05 ML/day
- Dust Suppression Condition: Occurs on Days with <5mm of rainfall
- Water Source: RWD

7.4.2.1.5 Site Transfer Contingency

Site transfer capacity requirements was assessed iteratively, as needed to achieve containment requirements. This transfer capacity was developed in order to a) minimise disruption to open cut pit activities and b) to minimise spill risks associated with the proposed storages. Proposed transfer pumping rates are listed in Table 12:

<table>
<thead>
<tr>
<th>Pump From</th>
<th>Pump To</th>
<th>Activates When Water Level Exceeds</th>
<th>Transfer Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pit Sump</td>
<td>MWD</td>
<td>57m*</td>
<td>10 L/s*</td>
</tr>
</tbody>
</table>

*The above transfer line ceases when the MWD water surface elevation exceeds RL120m, to minimise the potential for uncontrolled release from the MWD.

7.4.2.1.6 Seepage Losses

Seepage losses were modelled for the RWD only, recognising the following:

- Seepage recovery measures are proposed for the MWD and IWTL;
- The Mt Dromedary Pit is unlikely to seep beyond the groundwater inflow rate; and

Seepage was modelled at a rate of 5mm/day for the RWD, based on the dynamic water surface area of the storage.
7.4.3 Water Balance Results

7.4.3.1 Spill Probability

The estimated spill risks for the current pumping arrangement at Mt Dromedary are summarised in Table 13.

Table 13
Summary Results for Water Balance Model

<table>
<thead>
<tr>
<th>Spill Probability</th>
<th>MWD</th>
<th>IWTL</th>
<th>RWD</th>
<th>Mt Dromedary Pit Sump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Annual Spill Probability</td>
<td>&lt;1.0%*</td>
<td>&lt;1.0%*</td>
<td>&lt;2.5%</td>
<td>&lt;1.0%*</td>
</tr>
<tr>
<td>over Modelling Period (3 Years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* No Spills Modelled

7.4.3.2 Modelled Storage Volume & Elevation Results

Plate X below provides a graphical explanation of GoldSim chart output. It is noted that the charts provide probability outcomes, derived from 127 individual model ‘runs’ utilising historical climate data.

Plate 1
Modelled Storage Volume Result Example
7.4.3.2.1 Modelled IWTL Outcomes

Plate 2
Modelled Storage Volume - IWTL (DECANT WATER ONLY)

Plate 3
Modelled Storage Volume - IWTL (DECANT WATER & TAILINGS)
7.4.3.2.2 Modelled MWD Outcomes

Plate 4
Modelled Storage Elevation - IWTL

Plate 5
Modelled Storage Volume - MWD
7.4.3.2.3 Modelled RWD Outcomes
7.4.3.2.4 Modelled Pit Sump Outcomes
7.4.4 Conclusions and Discussion

The modelled water balance outcomes indicate the following:

- On an overall net basis - the site wide water balance is considered to be in deficit, reflecting the arid climatic conditions. Site processing of Graphite is therefore dependent on the make-up water supply.

- No regulated site storages are modelled to spill, confirming containment requirements as per the Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (DEHP, 2016)

- The Concept IWTL Starter Embankment provides sufficient containment for tailings and PAF for 3 years, with a raise required prior to the commencement of the wet season proceeding.

- Accumulation of water within the Pit Sump is generally minor, except in extreme rainfall years - where some accumulation of water in the base of the pit would be expected.

- Over dry seasons, site storages are modelled to be empty in most climatic sequences, with the exception of the RWD (which is filled via make-up water).
8 CONSTRUCTION ASPECTS

8.1 Typical Construction Approach

8.1.1 Preparation Works

8.1.1.1 Installation of erosion and sediment control Measures

Erosion and sediment control measures shall be implemented to minimise the offsite release of sediment within surface water runoff. Particular attention shall be paid to surface runoff from areas of construction/filling and Clay Fill borrow areas. Sediment control provisions would comprise, as a minimum, silt fences and hay bales, with initial construction of Sediment Dams prior to the remaining works.

Erosion and Sediment control works are described in Section 8.3.

8.1.1.2 Decommissioning of bores within the IWTL area

Prior to site clearing and stripping, all investigation and monitoring bores would need to be located and grouted using 8 parts sand to 1 part cement grout for the fill depth of each well.

8.1.1.3 Site clearing and topsoil stripping

Clearing and stripping would be carried out within the embankment footprint area, emergency spillway and storage area of the IWTL and water management infrastructure.

Clearing would generally include the complete removal of all debris, trees, stumps, scrub and fallen timber. Clearing in areas to be excavated or filled shall also include the grubbing of stumps and roots in excess of 25mm diameter. Materials removed in clearing operations would be stockpiled in windrows outside of the storage area.

Topsoil stripping would be undertaken within the all areas to be excavated or filled and within the storage area. Nominal topsoil stripping thickness is 0.1m. Stripped topsoils would be stockpiled and profiled as nominated by Emerald for reuse in rehabilitation works.

8.1.2 Foundation Works

8.1.2.1 General Subexcavation

General subexcavation below the cleared and topsoil stripped surface would be carried out beneath the entire width of the embankment foundations to remove weak, compressible or over-saturated soils.

8.1.2.2 Cut-Off Key Excavation

A cut-off key would be excavated beneath the cleared, stripped, and sub-excavated foundation surfaces over which embankment construction is to be undertaken, and would be excavated to refusal of a 20t excavator or equivalent such that the cut-off key excavation extends through weak to very weak rock. Localised grouting of seepage areas and irregular surfaces may also be required to allow placement of the clay fill.
8.1.2.3 IWTL Foundation Treatment

IWTL Foundation Treatment shall be undertaken following the stripping/removal of topsoils and unsuitable materials from the WRD footprint area. The works will comprise general profiling, ripping of insitu materials, conditioning and compaction to form a foundation of low permeability and shaped to direct seepage/contact water towards the IWTL seepage collection system.

8.1.3 Earthworks

The material types proposed in the construction of the IWTL embankment, and the relevant application of these materials, are listed in Table 14.

<table>
<thead>
<tr>
<th>Table 14</th>
<th>Construction Material Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material Type</strong></td>
<td><strong>Application</strong></td>
</tr>
</tbody>
</table>
| Clay Fill | • Construction of the low permeability core zone and backfilling cut-off keys  
• Construction of storage blanketing within the former drainage areas |
| Rock Fill | • Construction of embankment buttressing  
• Erosion protection for batter surfaces, spillways, drains etc. |

The following outlines typical specifications for the construction materials proposed, and identifies the locations for sourcing of these materials.

8.1.3.1 Clay Fill

Clay fill materials can be selectively sourced from borrows located within the storage area and the general surrounds of IWTL. These materials have typically comprised residual soils. The following geotechnical properties are applicable to available materials, which would represent the minimum selection criteria for these materials.

| Plasticity | Liquid Limit  > 20% |
| Particle Size Distribution | Linear Shrinkage  < 5% |
| Permeability* | Minimum percent less than 0.075 mm size  30% |
|             | Not greater than  5x10^{-9} m/s |

* Recompacted to specified compaction

The key issues related to selection of clay fill are the achievable permeabilities, strength and the serviceability of the compacted material. These issues are related directly to the adopted compaction specification - both dry density ratio and compaction moisture content.

In assessing an appropriate compaction specification to achieve desired clay fill permeability, it is recognised that the control on permeability is based on soil structure, such that soil grains are mostly in contact and the void space or micro-pores are minimised. To reduce void space, a “kneading” type compaction is recommended, with the compacted moisture content greater than the optimum for that material to overcome the dry clod strength of the clay material. Based on this philosophy, the following earthworks construction standards are considered appropriate:

(i) Compacted Clay Fill densities (at the selected compaction moisture content) should be maximised to increase shear strength and minimise settlement potential.
(ii) The Clay Fill zone forming remaining cut off key zones, placed against the foundation and abutment surfaces, should be constructed to achieve as low a permeability as is possible as a primary seepage control measure, with fill strength being of lesser significance. A compaction moisture content within this zone, ranging from 0 to +4% of optimum, is therefore considered appropriate.

(iii) Within the core of each embankment section, the key compacted fill properties include low permeability and high strength. This combination would be achievable with compaction moisture contents being close to optimum, with a moisture range of -2 to +3% being considered appropriate.

In summary, the recommended compaction standards for Clay Fill zones associated with the IWTL works are as follows:

<table>
<thead>
<tr>
<th>Clay Fill Zone</th>
<th>Location</th>
<th>Compaction Specification*</th>
<th>Moisture Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Cut-Off Key (against foundation and</td>
<td>98%</td>
<td>0 to +4% of optimum moisture</td>
</tr>
<tr>
<td></td>
<td>abutment surfaces)</td>
<td></td>
<td>content</td>
</tr>
<tr>
<td>II</td>
<td>Embankment Lift</td>
<td>98%</td>
<td>-2 to +3% of optimum moisture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>content</td>
</tr>
</tbody>
</table>

* Based on standard compaction, as determined by AS1289.5.1.1

8.1.3.2 Rock Fill

It is expected that Rock Fill for use in the IWTL works would be sourced predominantly from the mining activities. Based on the nature of mining and the variable structure of the geology within the pit, the grading of the run-of-mine waste rock would likely be variable. Notwithstanding, the properties of the Rock Fill used in embankment construction would ideally include:

- high compacted strength;
- stable with respect to vertical settlement and volume instability
- high permeability compared with clay fill material
- suitable grading to reduce the migration of fines from adjacent filter zones; and
- durable and non-acid producing for the PAF Waste Rock zone.

It would be appropriate that the Rock Fill is coarsest towards the exposed downstream face of the embankment to provide erosion resistance, with finer materials to be placed against the core to enhance the performance of the filter zone.

It is considered that the suitability of materials selected as Rock Fill for different zones within the embankment would be assessed visually. The suitability of these materials would be confirmed by monitoring the performance of the Rock Fill under compaction and visual assessment of the integrity of the formed layer. The Rock Fill material would therefore be subject to a defined method specification.
8.2 Construction Materials Schedule - Bill of Quantities

A bill of construction material quantities Stages 1 and 2 of the IWTL development is provided in Table 7.
Table 15
Construction Bill of Quantities

<table>
<thead>
<tr>
<th>Item</th>
<th>Scheduled Item</th>
<th>Unit</th>
<th>Starter Embankment</th>
<th>Ultimate Embankment*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>SITE PREPARATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Remove debris, trees, stumps, scrub and fallen timber 3 m beyond work area, push into windrows, as specified.</td>
<td>ha</td>
<td>33.0</td>
<td>13.8</td>
</tr>
<tr>
<td>1.3</td>
<td>Strip topsoil from IWTL footprint and stockpile at designated locations</td>
<td>ha</td>
<td>33.0</td>
<td>13.8</td>
</tr>
<tr>
<td>2</td>
<td><strong>EXCAVATIONS</strong></td>
<td>m²</td>
<td>71,000</td>
<td>63,000</td>
</tr>
<tr>
<td>3</td>
<td><strong>SEEPAGE COLLECTION WORKS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Foundation Treatment</td>
<td>m²</td>
<td>71,000</td>
<td>63,000</td>
</tr>
<tr>
<td>3.2</td>
<td>Excavate trenches, supply and install piping and drainage aggregate</td>
<td>m</td>
<td>1,400</td>
<td>NA</td>
</tr>
<tr>
<td>3.3</td>
<td>Supply and install precast 1.5m diam. concrete seepage sump and concrete base</td>
<td>No.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td><strong>IWTL EMBANKMENT CONSTRUCTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Clay Fill - Supply, condition, place &amp; compact</td>
<td>m³</td>
<td>74,000</td>
<td>536,000</td>
</tr>
<tr>
<td>4.2</td>
<td>PAF Rock Fill - Supply, condition, place &amp; compact</td>
<td>m³</td>
<td>225,000</td>
<td>7,955,000</td>
</tr>
<tr>
<td>4.3</td>
<td>NAF Rock Fill</td>
<td>m³</td>
<td>71,000</td>
<td>1,327,000</td>
</tr>
<tr>
<td>5</td>
<td><strong>MWD EMBANKMENT CONSTRUCTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>Clay Fill - Supply, condition, place &amp; compact</td>
<td>m³</td>
<td>23,000</td>
<td>NA</td>
</tr>
<tr>
<td>5.2</td>
<td>NAF Rock Fill</td>
<td>m³</td>
<td>23,000</td>
<td>NA</td>
</tr>
<tr>
<td>6</td>
<td><strong>MISCELLANEOUS WORKS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>IWTL Emergency Spillway</td>
<td>No</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6.3</td>
<td>Clean Water Diversion drains</td>
<td>m</td>
<td>2,200</td>
<td>500</td>
</tr>
<tr>
<td>6.4</td>
<td>IWTL Embankment Instrumentation (piezometers and Survey Monuments)</td>
<td>No</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.5</td>
<td>Decant Causeway Rock Fill (Pumping and piping by Operations)</td>
<td>m³</td>
<td>NA**</td>
<td>NA**</td>
</tr>
<tr>
<td>6.6</td>
<td>Tailings delivery pipeline and spigots at a maximum 100m centres</td>
<td>m</td>
<td>4,568</td>
<td>NA</td>
</tr>
</tbody>
</table>

*It is envisioned that the construction of the IWTL will occur in multiple stages, to be confirmed in detailed design. The ultimate embankment BOQ numbers do not therefore consider staging beyond the starter embankment.

**Decant Causeway to be formed out of PAF waste stored within the IWTL.
With respect to the volumes described above, and the projected production schedule for the proposed development, the following is noted:

- Initial production (Year 1) of tailings and PAF waste rock material is minimal, as initial pit development predominantly comprises excavation of overburden and weathered waste rock lithologies;
- It is assumed that clay fill materials will be sourced from within the footprint of proposed site elements;
- Required waste rock construction materials for the IWTL Starter Embankment, MWD and RWD are expected to be accommodated by the materials generated in the first year of pit development;
- The required volume of PAF rock fill utilised in the IWTL Ultimate embankment is expected to reduce significantly upon detailed design and staging of lifts, with additional capacity available for tailings containment as a result.
- It is noted that subject to detailed design and staging, utilisation of Low Grade Ore material for construction works may be required; and
- Overall, the required volumes for the IWTL Ultimate Embankment are expected to be met by pit development activities, over the life of the project, with the structure providing sufficient containment volume for projected combined LoM tailings and PAF waste rock volume.

8.3  Erosion and Sediment Control Planning

The detailed soil and erosion control plan would be developed as part of the IWTL Stage 1 construction documentation, notwithstanding, the general approach proposed for the development is presented below.

8.3.1  Aims

The aim of an Erosion and Sediment Control Plan (ESCP) is to take all reasonable and practicable measures to minimise short and long-term soil erosion and the adverse effects of sediment transport.

Specifically, measures for the protection of impacts caused by construction sites fall into two categories:

- **Erosion Control** - the prevention of sediment and particle loss from earth surfaces, typically by the action of external forces such as running water, rainfall, and wind; and
- **Sediment Control** - measures to prevent the occurrence of un-natural levels of sediment transfer. Typically, the transfer of clay (fine sediments) are of concern.

The Erosion and Sediment Control Plan will combine both erosion control and sediment control measures to manage construction impacts associated with the IWTL construction works.

8.3.2  Construction Activities and Sequencing

Construction activities considered relevant to erosion and sediment control planning for IWTL are as follows:
- Stripping and excavation of topsoil, subsoil and earth fill borrow;
- Stripping of unsuitable materials from embankment footprints;
- Stockpiling; and
- Embankment earthworks.

8.3.3 Erosion Control

Minimisation of clean water ingress into the construction site is the principal method of minimising erosion on construction sites. For the IWTL construction works, the construction of check dams upstream of embankment works, and associated bypass pumps achieves a similar aim.

Erosion of the construction works would be expected to occur under the following scenarios:

- Erosion from the incomplete embankment construction works (downstream side) caused by rainfall impact;
- Erosion as a result of ponding against incomplete embankment works (upstream and downstream side);
- Erosion from stockpiling activities; and
- Erosion as a result of construction vehicular movement.

Mitigation of this erosion is to occur as described in Table 21.

<table>
<thead>
<tr>
<th>Erosion Pathway</th>
<th>Mitigation Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall Erosion on incomplete embankments batter</td>
<td>• Embankment works to drain to sediment basins where practicable.</td>
</tr>
<tr>
<td></td>
<td>• General fill / clay fill to be compacted, trimmed and finished to a generally smooth surface on same day of placement.</td>
</tr>
<tr>
<td></td>
<td>• Silt fencing to be employed as required in locations directed by the drawings.</td>
</tr>
<tr>
<td>Ponding against incomplete embankment works</td>
<td>• Local infilling as required to prevent ponding.</td>
</tr>
<tr>
<td>Ponding against stockpiles</td>
<td>• Inspection of stockpile footprints prior to placement to identify ponding areas.</td>
</tr>
<tr>
<td></td>
<td>• Infilling of potential ponding areas with topsoil, mulching and seeding.</td>
</tr>
<tr>
<td></td>
<td>• Stockpile inverts to be kept free of trash / debris.</td>
</tr>
<tr>
<td>Vehicle Erosion</td>
<td>• Vehicles to use site roads where practicable.</td>
</tr>
<tr>
<td></td>
<td>• Vehicles leaving the construction area to be washed down.</td>
</tr>
</tbody>
</table>

8.3.4 Sediment Control

Sediment capture at areas of downstream runoff generation is necessary to prevent excessive sediment transport occurring from disturbed areas (embankment footprint) and associated
construction roads. Sediment basins are to be located down-gradient of the IWTL, process plant site area and pit area.

8.4 Construction Quality Assurance (QA)

Recommended QA/QC provisions related to the construction of the IWTL embankment are summarised below. These requirements will be addressed in detail in the specification, subject to the detailed design.

8.4.1 Foundation Preparations

Foundation preparations for the lift embankment construction works would comprise a combination (as required) of clearing/surface stripping and subexcavation. QA/QC requirements for this phase of construction would include full-time superintendence of the foundation preparation works, to provide advice on surface stripping thicknesses and to delineate the extent of foundation subexcavations, as required. The most important aspects of foundation preparations is to achieve an effective foundation surface on which the embankment could be constructed and the excavation of the cut-off key to a depth that intersects moderate to low permeability foundations.

8.4.2 Embankment Earthworks

The QA/QC objectives for embankment earthworks would be to confirm compliance of fill construction with specified compaction standards.

Specific QA/QC requirements for construction of the embankments would involve ongoing technical supervision, particularly during the initial stages of earthworks, to correlate construction methods against achievable fill compaction standards. The suitability of construction materials would also be assessed as part of this supervision, with provision included in the specification for fill material compliance testwork. Direction and supervision of QA testing of the fill materials, as placed, would also be undertaken. The basis for this QA program is in-situ density and moisture content determinations, carried out on earth fill.

Observation of the response of the Clay Fill to compaction and loading would also be carried out as part of supervision of the works. Particular note of the occurrence of heaving and displacement of the completed surface would be made.

In addition to the above, observation of the embankment (in conjunction with review of survey data in relation to the temporary survey marks) would be carried out to support the interpretation of current geotechnical stability of the section.
9 SURVEILLANCE AND MONITORING

The minimum suggested frequency of site surveillance and monitoring, broadly adopted from the *Guidelines on Dam Safety Management* (ANCOLD, 2003), if site water management dams are assessed to be “Significant” in the detailed design phase, is as follows:

Significant Consequence Dam

- Routine Visual inspection (by site personnel) to be performed on a weekly basis.
- Monitoring of rainfall, storage level and seepage to be performed on a monthly basis.
- Inspection by certified dam engineer to be performed on an annual basis.

10 OPERATIONS

The structures should be operated in the following manner:

- Minimise water stored in the MWD.
- Maximise reuse of water for the process plant.
- Maintain the diversion system.

A number of operational and closure issues apply to the ultimate IWTL to maintain consistency with the concept design philosophies adopted. These issues are outlined below and provide a summary description of the deposition, water and seepage management, and rehabilitation requirements for the IWTL and WRD.

10.1 IWTL Facility

10.1.1 Tailings Deposition Practices

As outlined in *Section 5.4*, the general design philosophy adopted for the IWTL development is based on the use of sub-aerial techniques for tailings deposition. Such techniques involve discharge of thickened tailings from multiple locations on the perimeter of the IWTL. Water liberated in conjunction with the deposition phase is recovered for return to the process plant via the Process Dam.

The significance of sub-aerial deposition techniques in the context of the proposed IWTL development concept is such that:

- tailings storage efficiencies are maximised; and
- a tailings surface is developed, possessing characteristics suitable for external embankment upstream lift construction and final rehabilitation works;
- tailings permeabilities are reduced, minimising the rate of seepage.

Appropriate sequencing of tailings deposition is also suggested to ensure that over-drying of exposed tailings surface is avoided to minimise the potential for dusting of the tailings surface. A management process is therefore recommended, subject to dusting potential/issues, in relation to the IWTL to avoid the implications of over-drying. Such a process may include periodic irrigation of the beach, primarily for disposal of excess water as a means of improving the site water balance (as required). Alternatively, application of an appropriate surface treatment to limit dusting may be undertaken.
10.1.2 Tailings Water Management

Tailings water recovery from the IWTL surface is integral to sub-aerial deposition techniques. During the operation of the system, transferring decant water from the IWTL to the process water dam shall be a priority to minimise the risk of spill from the IWTL, recognising that spill from the system should only occur in the event of an extreme rainfall period, and should cease generally within 24 hours of cessation of the event. Attention during operation should also be made to avoid surcharging the system with excess water volumes from alternative sources.

10.1.3 Seepage Fate and Control

For the purpose of describing seepage path and fate, assuming limited seepage mitigation measures are implemented, seepage from the storage during the operation of the IWTL and into the post closure phase would occur by development of a seepage plume, initially migrating slowly downwards into the foundation sequences. A local groundwater mound would form beneath the storage, either directly connected with the underlying groundwater system, or perched above a horizon of lower permeability. This mound will eventually move hydraulically down gradient, likely towards the west. The time taken for such seepage to migrate would depend on the hydraulic capacity of the seepage pathways that may exist, either through the basement or beneath the cut-off key.

Based on the above potential seepage path, it is likely that the fate of seepage from the storage would be to concentrate through the drainage line to the west of the storage. Evidence of seepage from the storage is likely to be observed as follows:

- Expression of seepage at ground surface directly downstream from the embankment.
- Depending on the continuity of surface soils, some seepage springs may appear in depressions/hollows or intersecting drainages further downstream.

To address the above seepage potential, a number of feasible measures, focussing on the above seepage mechanisms, which can reduce the magnitude of seepage from the storage. The seepage control measures that have been incorporated into the proposed concept design are as follows:

- A foundation cut-off key to intersect the basement sequences.
- A low permeability embankment core zone.
- Foundation Lining System
- Seepage recovery system.
- Tailings dewatering system.

In addition to the proposed seepage control measures, monitoring and if necessary, subsequent implementation of additional seepage controls is a fundamental component of the IWTL development. Groundwater monitoring, particularly down gradient from the IWTL should be implemented. Where additional controls are considered necessary, such controls may comprise one or a combination of the following:

- Installation of pumps in the groundwater monitoring bores, or construction of dedicated groundwater recovery wells;
- Refinement of the water recovery practices adopted to reduce the volume of water retained within the system.
It is emphasised that these are contingency measures and that the above primary management measures working effectively should negate the need for these additional measures.

11 CLOSURE / REHABILITATION

The final landforms will be subject to investigation works and detailed assessment in the years prior to closure and would typically include assessment of the water chemistry and the surrounding environment and consideration of infrastructure to remain post closure (subject to relevant agreements).

The typical objectives to be adopted for rehabilitation of the IWTL, RWD and MWD would be to create landforms that are:

- Stable and sustainable;
- Safe to humans and wildlife;
- Of minimum long-term environmental impact (i.e. non-polluting); and
- Able to sustain an appropriate land use after rehabilitation.

11.1.1 IWTL Rehabilitation

IWTL closure, decommissioning and rehabilitation plan for the IWTL will be prepared as part of detailed design to inform the proposed landform and capping development for the IWTL, notwithstanding, the following conceptual closure strategy will inform this process. The typical objectives to be adopted for rehabilitation of the IWTL would be to create a landform that is:

(i) stable and sustainable;
(ii) compatible with the surrounding landform; and
(iii) of minimum long term environmental impact (i.e. non-polluting).

Based on these objectives, a concept for the IWTL rehabilitation is detailed below.

11.1.1.1 Closure Water Management

Undertake progressive capping and utilisation of the MWD to maintain the rainfall runoff capacity to comply with regulatory requirements for the IWTL and MWD area, until such a time that it is demonstrated that the runoff is of suitable quality to allow discharge from the site. Following demonstrated maintenance with release criteria, the final ponded area would be breached/filled to facilitate drainage of the area.

11.1.1.2 Landform Development

It is envisaged that the final IWTL landform would comprise long-term stable external batters with an upper surface formed such that ponding is substantially avoided. This would therefore necessitate a final campaign of tailings deposition within the IWTL to infill any significant depression. The conceptual formation of the final tailings beach is to grade the beach generally from west to east with an overflow channel incorporated on the northern perimeter to discharge runoff into the MWD. Interim water management would include discharge into the downstream MWD storage.
11.1.1.3 Tailings Surface Capping

11.1.1.3.1 Background

A tailings surface cap would serve the following purposes:

(a) facilitate ongoing surface water drainage and prevent ponding;
(b) stabilise the surface to mitigate against potential ongoing erosion; and
(c) reduce potential rainfall infiltration into the tailings as recharge to seepage.

To address the above, tailings capping options should be undertaken and trialed prior to closure of the IWTL.

11.1.1.3.2 Conceptual Capping Arrangement

To meet these performance standards, the cap would comprise the following components. This configuration assumes that the tailings would remain geochemically benign.

- **Tailings Surface Stabilisation Layer (Capillary Break)**
  
  To provide a geotechnically competent surface over the surface of the tailings, a stabilization layer may be necessary. The purpose of the stabilisation layer would be to provide a competent subgrade or bridging layer, which would evenly distribute the surcharge onto the tailings surface and thereby limit potential settlements. The area most likely to require stabilisation would be the decant pond surface, due to the likely extent of saturated slimes materials.

  The stabilisation layer would typically comprise rock mattress (the rock comprising competent and durable material).

- **Sealing Layer**
  
  A sealing layer may be required to reduce the downward infiltration of surface water, which would act as a recharge to seepage, as well as oxygen. The sealing layer would be constructed using a clay fill material, which would possess similar characteristics to the clay fill proposed for use in the embankment construction. The sealing layer would extend over the full surface area of the storage.

- **Surface Protection Layer**
  
  To protect the tailings surface from erosion and exposure deterioration (through wetting and drying), a surface protection layer would be required. This layer could also be utilized as a rooting zone for vegetation depending on the proposed end land use.

  This layer would be formed typically using select mine waste rock from the existing waste rock dump areas. Geochemically, the waste should be non-acid producing. From a geotechnical perspective, the material should be non-erosive/dispersive.

  The thickness of this layer would be selected to not only maintain drainage, but also to compensate for settlement within the underlying tailings. A hummocky final land surface may also have some benefit with respect to maintaining moisture within the surface layers to support vegetation growth and to reduce erosion potential. The final surface landform would be subject to further, ongoing assessment through the life of the facility.
A conceptual detail of the proposed IWTL capping arrangement is provided in Plate 8.

Plate 9
Conceptual IWTL Capping Arrangement

A more detailed assessment of a suitable capping configuration would need to be completed, subject to more data being available with respect to the physical and geochemical characteristics of the tailings. In particular, geochemical compatibility between the tailings and capping materials must be confirmed to ensure the integrity of the capping horizon is not compromised.
REFERENCES


Particle Size Distribution Results

TEST IN ACCORDANCE WITH AS 1289

☐ Method 3.6.1  ☐ Method 3.6.3  □ Oven Drying Method 2.1.1

Client: Graphitecorp Operations Pty Ltd

Address: Level 12 144 Edward St, Brisbane Qld 4000

Project: Mt Dromedary Project - Tailings Laboratory Testing

NATA Report No.: R38417

Job No.: 116195.02

Register No.: 31817

Location: QLD

Sample Description: GSP - Primary Ore - Filter Cake

Borehole No.:  

Test Pit Depth:

Dispersion Method used: Mechanical Stirrer for 1 minute

Hydrometer Type Used: ASTM 1521

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1 Clause 6.5.4

☐ Sampled by the Client

Note 1: The sample was oven-dried during sample preparation and not air-dried as stated in AS 1289.3.6.3.

Note 2: The sample was mixed with a propeller type stirrer rather than inverting the cylinder as described in AS 1289.3.6.3.

The test result relates only to the item tested.

Australian Standard Sieve Apertures (mm)

<table>
<thead>
<tr>
<th>Aperture (mm)</th>
<th>Percentage Passing</th>
</tr>
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<tbody>
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NATA ACCREDITED LABORATORY NUMBER: 3372

Accredited for compliance with ISO/IEC 17025

Approved Signatory: [Signature]

Date: 8/12/2017

Form RSN 004.15 (PSD)

Date of Issue: June 2013
Particle Size Distribution Results

TEST IN ACCORDANCE WITH AS 1289
☐ Method 3.6.1  ☐ Method 3.6.3
☐ Oven Drying Method 2.1.1

Client: Graphitecorp Operations Pty Ltd.
Address: Level 12 144 Edward St, Brisbane QLD 4000

Project: Mt Dromedary Project - Tailings Laboratory Testing

NATA Report No.: R38517
Job No.: 116195.02
Register No.: 31917
Location: QLD

Sample Description: GSW - Weathered Ore - Filter Cake

Dispersion Method used: Mechanical Stirrer for 1 minute
Hydrometer Type Used: ASTM 152H

☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1 Clause 6.5.4
☐ Sample provided by the Client

Note 1: The sample was oven-dried during sample preparation and not air-dried as stated in AS 1289.3.6.3
Note 2: The sample was mixed with a propeller type stirrer rather than inverting the cylinder as described in AS 1289.3.6.3.
The test result relates only to the item tested.

Australian Standard Sieve Apertures (mm)

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
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<tr>
<td>1.25</td>
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<td>0.75</td>
<td>0.645</td>
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<td>0.63</td>
<td>0.520</td>
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<tr>
<td>0.425</td>
<td>0.050</td>
</tr>
<tr>
<td>0.030</td>
<td>0.010</td>
</tr>
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</table>

Silverson Analyser Data

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<tr>
<th>Size (mm)</th>
<th>CLAY</th>
<th>SILT</th>
<th>SAND</th>
<th>GRAVEL</th>
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<tr>
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<td>Medium</td>
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</table>

NATA ACCREDITED LABORATORY NUMBER: 3372

 Accredited for compliance with ISO/IEC 17025

Approved Signatory: [Signature]
Name of Signatory: John Walker

Date: 8/12/2017

NATA

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Form RSN 004.15 (PSD)
Date of Issue: June 2013
### Classification (Atterberg Limits)

**TEST IN ACCORDANCE WITH AS 1289 - CONE PENETROMETER**

**Client:** Graphitecorp Operations Pty Ltd  
**Address:** Level 12, 144 Edward St, Brisbane  
**NATA Report No.:** R38017  
**Job No.:** 116195.02  
**QLD 4000:**  
**Project:** Mt Dromedary Project - Tailings Laboratory Testing  
**Location:** Queensland

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<th>Linear Shrinkage (%)</th>
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<th>Sample Crumbled (CR)</th>
<th>Sample Cracked (CK)</th>
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<td>31917</td>
<td>GSW Tailings</td>
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<td>30</td>
<td>18</td>
<td>-</td>
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</tbody>
</table>

- Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1
- Sample provided by the client

The test results relate only to the items tested.

**Test Methods:**

- Liquid Limit: AS 1289.3.9.1 (Standard - Penetrometer Method)
- Liquid Limit: AS 1289.3.9.2 (One Point - Penetrometer Method)
- Plastic Limit: AS 1289.3.2.1
- Plasticity Index: AS 1289.3.3.2 (Cone Plasticity Index)
- Linear Shrinkage: AS 1289.3.4.1
- Moisture Content: AS 1289.2.1.1

**Sample Preparation:**

- Natural Moisture: ☒ Air Dried: ☐ Oven Dried: ☐ Unknown: ☐
- Wet, Sieved: ☐ Dry Sieved: ☒ Unsieved: ☐

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**NATA ACCREDITED LABORATORY NUMBER: 3372**

Accredited for compliance with ISO/IEC 17025

Approved Signatory: John Walker  
Date: 5th December 2017

Name of Signatory: John Walker

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Form RSN 002.8 (Atterbergs-Solids)  
Date of Issue: May 2017
Determination of Conductivity
Soil chemical test

TEST IN ACCORDANCE WITH IN-HOUSE TEST METHOD IHM 11.0

Client: Graphitecorp Operations Pty Ltd
Address: Level 12, 144 Edward St, Brisbane
QLD 4000

Project: Mt Dromedary Project - Tailings Laboratory Testing
Location: Queensland

<table>
<thead>
<tr>
<th>Register Number</th>
<th>Sample Description</th>
<th>Soil - Suspension / Groundwater</th>
<th>Electrical Conductivity (µS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31817</td>
<td>GSP Primary Tailings</td>
<td>Slurry</td>
<td>2560</td>
</tr>
<tr>
<td>31917</td>
<td>GSW Tailings</td>
<td>Slurry</td>
<td>389</td>
</tr>
<tr>
<td>33017</td>
<td>GSW Tailings</td>
<td>Decant Water</td>
<td>705</td>
</tr>
<tr>
<td>33117</td>
<td>GSP Primary Tailings</td>
<td>Decant Water</td>
<td>5960</td>
</tr>
</tbody>
</table>

Notes:
- Sample provided by the client
- The test specimen was prepared from Melbourne tap water used to create a slurry mix from the "as received filter cake" and decanted off after settling for several days.

The test results relate only to the items tested.
Moisture Content of a Soil

TEST IN ACCORDANCE WITH AS 1289.2.1.1

Client: Graphitecorp Operations Pty Ltd.................................
Address: Level 12, 144 Edwards St, Brisbane ..............................
          QLD 4000..........................................................
Project: Mt Dromedary Project - Tailings Laboratory Testing
Location: Queensland..................

<table>
<thead>
<tr>
<th>Register Number</th>
<th>Description</th>
<th>Sample Condition</th>
<th>Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31817</td>
<td>GSP Primary Tailings</td>
<td>As Received Filter Cake</td>
<td>21.4</td>
</tr>
<tr>
<td>31917</td>
<td>GSW Tailings</td>
<td>As Received Filter Cake</td>
<td>28.7</td>
</tr>
</tbody>
</table>

Notes:
☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1
☒ Sample provided by the client

The test results relate only to the items tested.

NATA ACCREDITED LABORATORY NUMBER: 3372
Accredited for compliance with ISO/IEC 17025
Approved Signatory: John Walker
Date: 5th December 2017

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Form RSN 001.8
Date of Issue: July 2016
## Determination of the Soil Particle Density of a Soil

**TEST IN ACCORDANCE WITH AS 1289.3.5.1**

**Client:** Graphitecorp Operations Pty Ltd  
**Address:** Level 12, 144 Edward St, Brisbane  
**NATA Report No.:** R37917  
**Job No.:** 116195.02  
**Project:** Mt Dromedary Project - Tailings Laboratory Testing  
**Location:** Queensland

<table>
<thead>
<tr>
<th>Register Number</th>
<th>Sample Description</th>
<th>Sample Condition</th>
<th>% of Sample &gt;2.36 mm</th>
<th>Particle Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31817</td>
<td>GSP Primary Tailings</td>
<td>As Received</td>
<td>None</td>
<td>2.72 #</td>
</tr>
<tr>
<td>31917</td>
<td>GSW Tailings</td>
<td>As Received</td>
<td>None</td>
<td>2.60 #</td>
</tr>
</tbody>
</table>

**Notes:**
- Sample provided by the client
- ‘*’ = apparent average soil particle density - particle size less than 2.36 mm
- ‘X’ = apparent average soil particle density - particle size greater than 2.36 mm
- ‘#’ = soil particle density of the total sample

The test results relate only to the items tested.

**NATA ACCREDITED LABORATORY NUMBER: 3372**

Accredited for compliance with ISO/IEC 17025

Approved Signatory: [Signature]  
**Date:** 5th December 2017

**Name of Signatory:** John Walker

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**Determination of the pH value**  
**Soil chemical test**

**TEST IN ACCORDANCE WITH AS 1289.4.3.1 ELECTROMETRIC METHOD**

**Client:** Graphitecorp Operations Pty Ltd ..........................................................  
**NATA Report No.:** R38717 ..............

**Address:** Level 12, 144 Edward St, Brisbane  .............................................  
**Job No.:** 116195.02 .............

**QLD 4000 .................................................................**

**Project:** Mt Dromedary Project - Tailings Laboratory Testing  
**Location:** Queensland.................

<table>
<thead>
<tr>
<th>Register Number</th>
<th>Sample Description</th>
<th>Soil - Suspension / Groundwater</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>31817</td>
<td>GSP Primary Tailings</td>
<td>Slurry</td>
<td>2.8</td>
</tr>
<tr>
<td>31917</td>
<td>GSW Tailings</td>
<td>Slurry</td>
<td>7.7</td>
</tr>
<tr>
<td>33017</td>
<td>GSW Tailings</td>
<td>Decant Water</td>
<td>7.9</td>
</tr>
<tr>
<td>33117</td>
<td>GSP Primary Tailings</td>
<td>Decant Water</td>
<td>2.7</td>
</tr>
</tbody>
</table>

**Notes:**  
☐ Sampled by ATC Williams Pty Ltd in accordance with AS 1289.1.2.1  
☒ Sample provided by the client

# The test specimen was prepared from Melbourne tap water used to create a slurry mix from the “as received filter cake” and decanted off after settling for several days.  
Date Tested: 07/12/2017  
The test results relate only to the items tested.

**NATA ACCREDITED LABORATORY NUMBER: 3372**

Accredited for compliance with ISO/IEC 17025  
Approved Signatory: [Signature]  
Date: 08/12/2017  
Name of Signatory: John Walker

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Form RSN 017.1  
Date of issue: April, 2014