Waste Rock Landform (WRL)

Winu Project – Mine Planning

Rio Tinto Winu Pty Limited

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EXECUTIVE SUMMARY

The latest waste rock landform (WRL) design parameters have been used in the design and development of the WRL.

Key objectives met in the design:

- 80 m height limit,
- Allow for encapsulation of potentially acid forming (PAF) material during development and closure inside of the WRL,
- Location adjacent to high sulphur tailings to mitigate the potential of dam break, and
- Consideration of environmental, Closure and Rehabilitation obligations.

The WRL has a capacity of 244 million loose cubic metres (LCM) with a footprint of 567 hectares (Ha). The development of the WRL ensures the PAF can be effectively managed by staying enclosed within the WRL footprint with sufficient rock quantities to provide encapsulation at closure.

The berm-batter design configuration has been updated to 15 degree batter face angle for the 20 metre high lifts, guided by Landloch and feedback from published experience of rehabilitation at Telfer (EarthSystems, pers comms 2023).

The design has been modified to abut the high sulphur tailings cells around the north, east and south as a mitigation for potential of a dam break.

A buffer of 100m has been applied between the rehabilitation toe line of the WRL and the mining lease to prevent a breach of disturbance outside of the lease boundary.

As per Social Surrounds Preliminary Advice 1, RTX_2020_02_Site_001, initial feedback provided is the intent to have a heritage site cleared or relocated to facilitate the construction of the WRL. Additionally, heritage survey for the WRL has been completed with conditional approvals for dune area.

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Abbreviations

Abbreviation	Description
AMD	Acid and Metalliferous Drainage
ATS	Alastri Tactical Scheduler
Ha	Hectares
LCM	Loose cubic metres
LOM	Life of Mine
MCP	Mine Closure Plan
mRL	Meters relative level
Mt	Million tonnes
NAF	Non acid forming
PAF	Potentially acid forming
ROM	Run of Mine
RTLCOT	Rio Tinto Landform Closure Optimisation Tool
SWMP	Surface Water Management Plan
TSF	Tailings Storage Facilities
WRL	Waste Rock Landform

1. DESIGN SUMMARY

A summary of the design characteristics is detailed in Table 1.

Table 1: Design summary

Design details	• Batter-berm configuration modified to 15° batter face angle and 20m berms in the rehabilitation design (as per feedback from Social Surrounds Preliminary Advice 1); • Initial approval was provided to construct the WRL over the heritage site RTX_2020_02_Site_001; • 100m buffer from mining lease boundary; • TSF high sulphur cell bunded to the north, south & east; • Alignment with Mine Plan November 2023 (Schedule 23); • Design capacity for a total 244M LCM, with a final height of 80m and total surface area of 567 Ha; • Alignment of the WRL location to avoid potential sterilisation of the mineralised orebody.

2. MATERIAL CHARACTERISTICS

The waste material from the Winu pit contains both Potential Acid Forming (PAF) and Non-acid Forming (NAF) material types, with the specifics outlined in Section 5.2. Table 2 outlines the approximate split of the PAF/NAF material volumes.

Table 2: Approximate waste rock landform PAF/NAF capacity

Material	%
PAF	30
NAF	70
Total	**100**

The NAF material was further classified by erosion resistance shown in Table 3, based on the Winu Closure Waste Assessment 2023. It was identified sandstone, leach cap, weathered sediments and primary & mafic sulphides as suitable for covering slopes and top surfaces of the WRL.

Table 3: Material by erosion resistance (NAF)

Erosion resistance	Geology domain
very low	Aeolian Sand
low	Mudstones
low-very low	Oxidised Mudstones
moderate-low	Permian Sandstones
moderate	Copper oxide and secondary sulphide
high	Leachcap/Weathered Metasediments
very high	Primary and Mafic

Material quantities are based on Inferred and Indicated Resources hence, the uncertainty with quantities are the same as that associated with planning Inferred material. The volume capacity required for the WRL is determined by applying a swell factor of 30% to the extracted material volume.

3. WRL CONSTRUCTION/OPERATIONAL DESIGN

In operations, a construction/operational design shown in Figure 1 will be applied with the final landform reshaped to the final rehabilitation (rehab) design shown in Figure 3 as part of the Mine Closure Plan. The WRL has a designed capacity of 244M LCM, with a final height of 80m with a total surface disturbance of 567 Ha.

The construction/operational design parameters are presented Table 4 and Table 6. Operational berm widths are required to achieve the 20m "at closure" berm widths after slope reshaping. The WRL shall abut the High Sulphur Tailing cells to the north, south and east of the Tailings Storage Facility (TSF) as a robust mitigation for potential dam breach.

The construction/operational design allows for dozing of the lower berms to allow progressive rehabilitation once the lift is completed.

Table 4: Construction/operational design parameters

Slope angle (degrees)	Lift Height (m)	Berm Width (m)	Inter ramp angle (degrees)
35	20	66	11

The ramp/road design parameters applied are presented in Table 5 and are standard for the planned fleet.

Table 5: Haul road design parameters

Parameters	Unit	Value
Road width	m	36
Road gradient	%	10

Figure 1: WRL construction/operational design

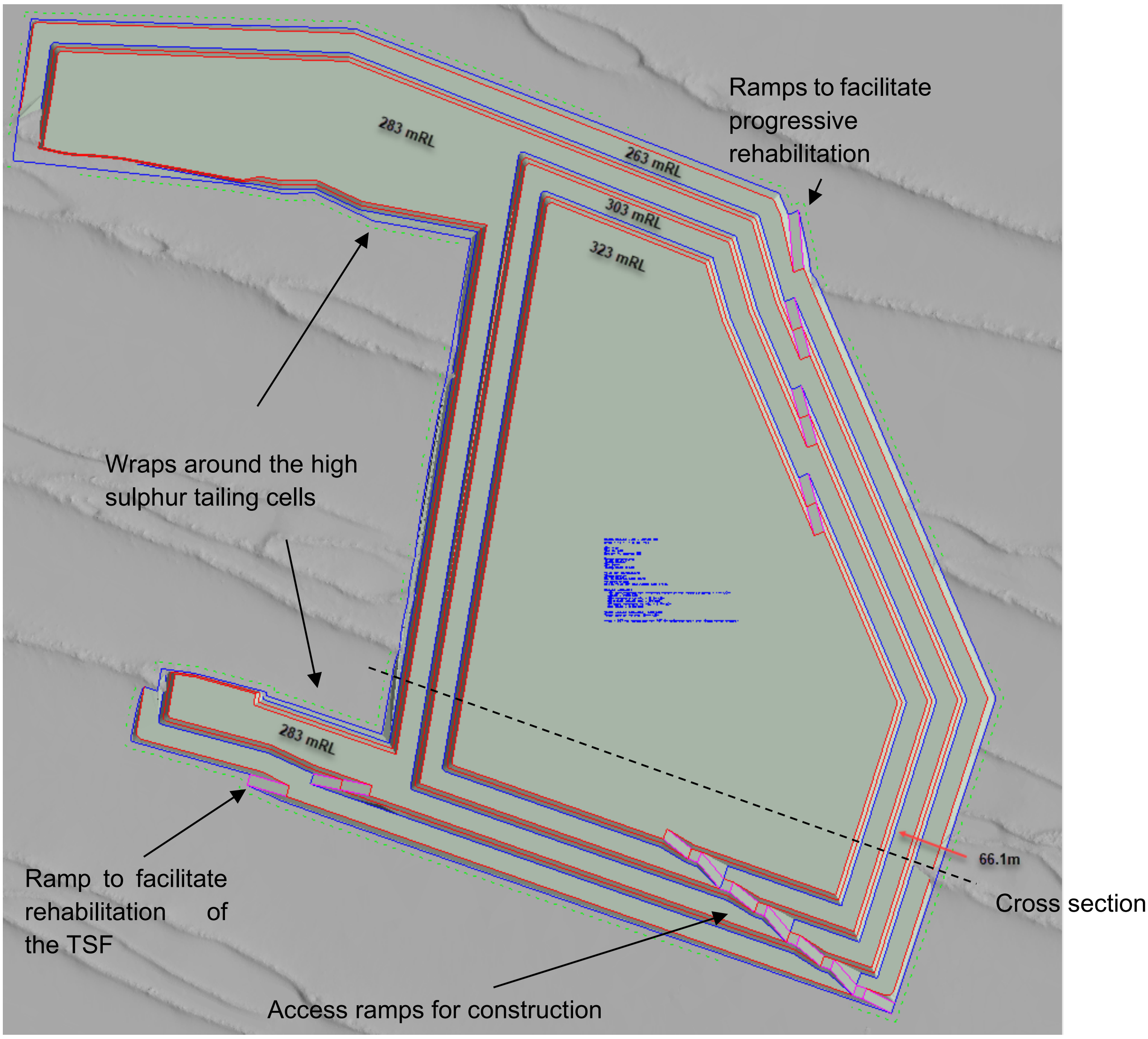
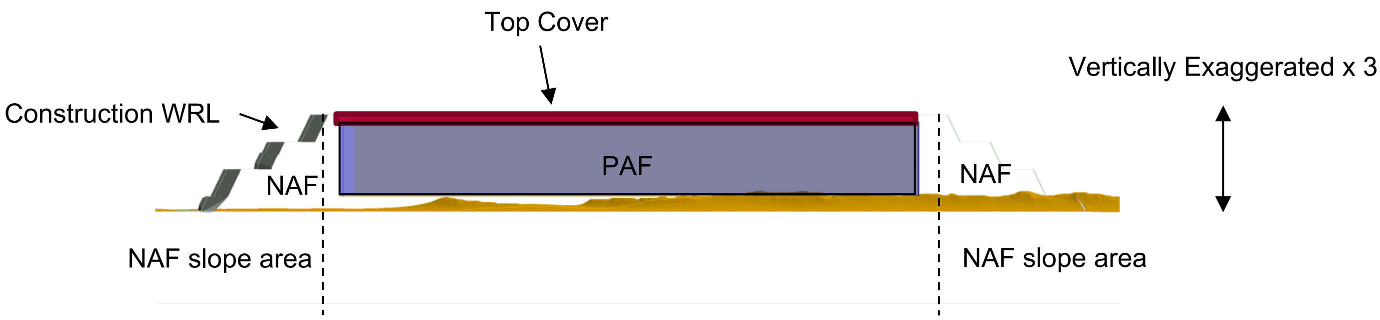


Figure 2: WRL construction/operational design cross section



4. WRL REHABILITATION AND CLOSURE

4.1 WRL Rehabilitation Design

The rehabilitation design is the final landform after the construction/operational design is reshaped as part of the Mine Closure Plan. The parameters are presented in Table 6. The berm-batter design has been guided by feedback from rehabilitation works at Telfer gold mine (EarthSystems, pers comms 2023) incorporating 15° batter face angle and 20m berm. Rehabilitation work can commence once the first lift is completed.

Table 6: WRL rehabilitation design parameters

Batter Face Angle (degrees)	Lift Height (m)	Berm Width (m)	Inter ramp angle (degrees)	Overall Slope Angle (degrees)
15	20	20	11	10.6

Figure 3: WRL rehabilitation design

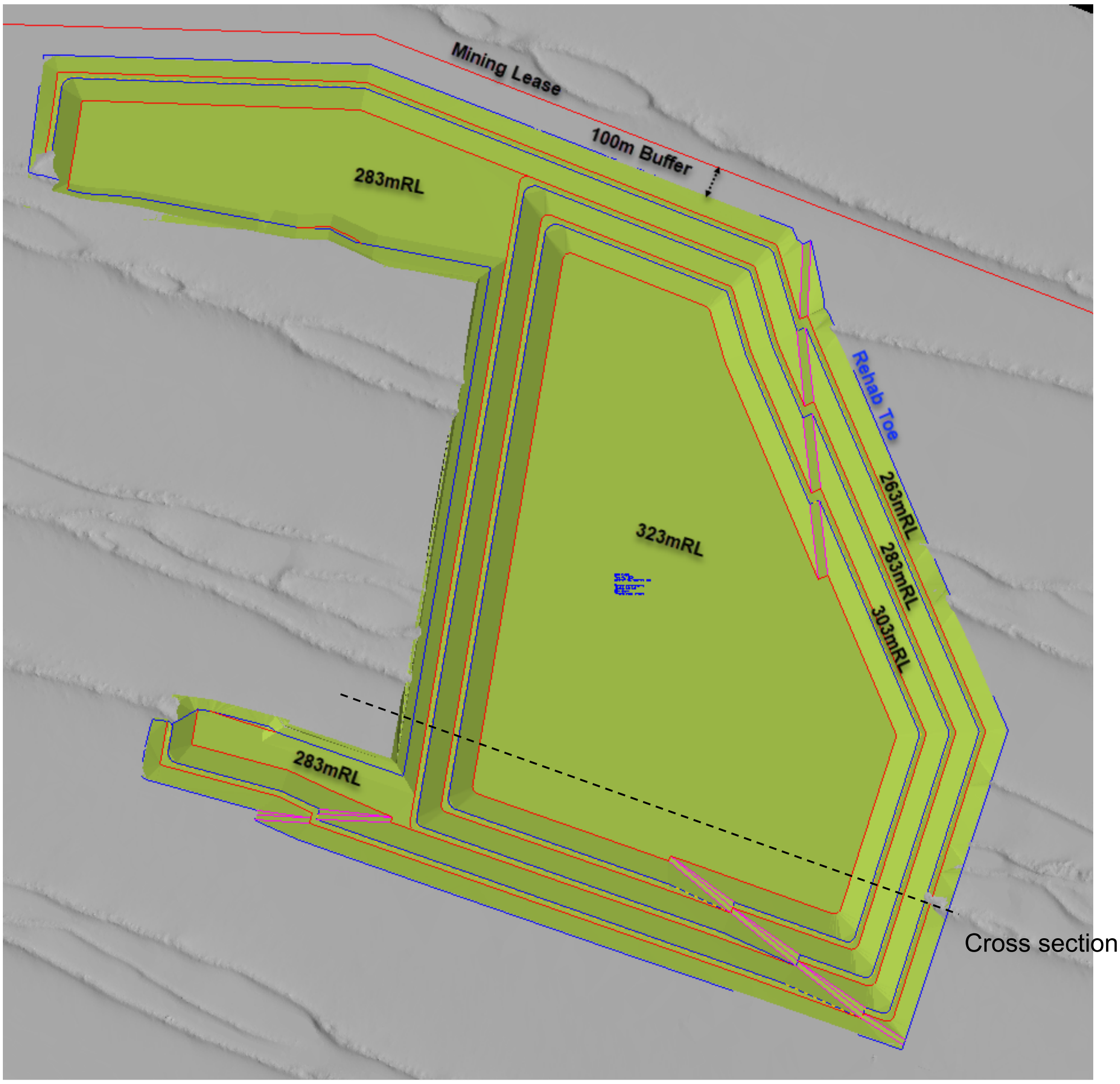
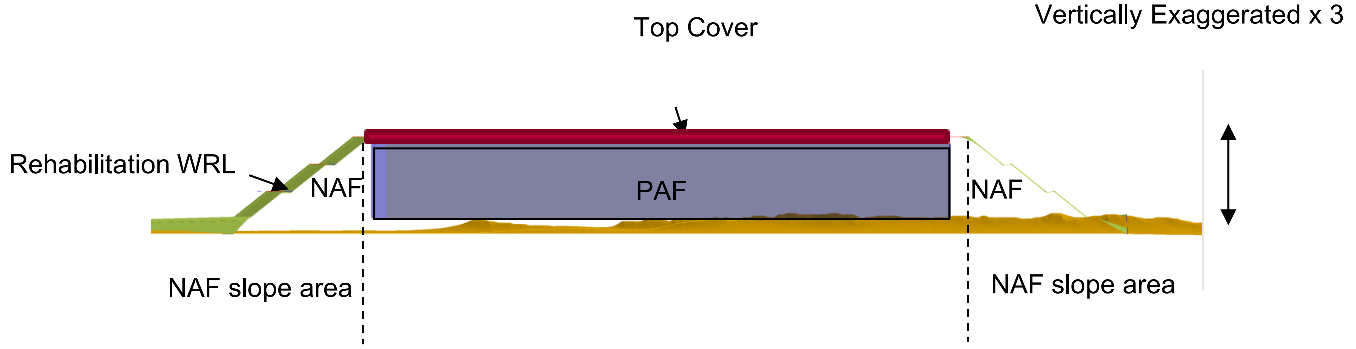


Figure 4: WRL rehabilitation design cross section

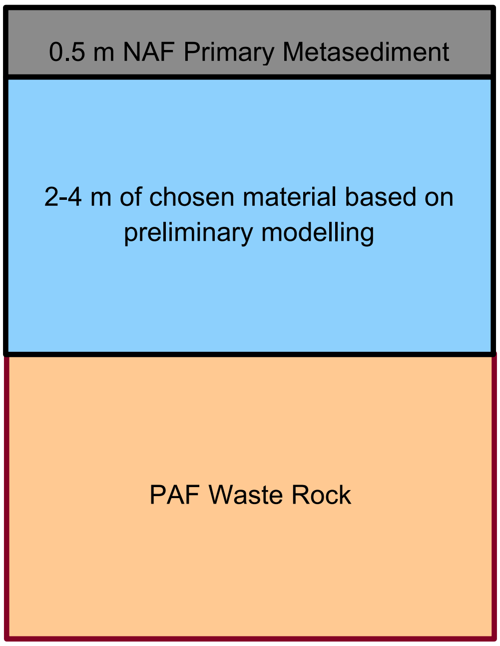


The outer exposed surface will be constructed with durable, NAF waste rock such that erosion losses are less than 10t/ha/year. Sandstone, leachcap, primary sulphides and mafic sulphides were considered suitable material for the outer cover of the WRL. At completion of mining and processing, material from the Run of Mine (ROM) pad, base of stockpiles and any other remaining waste or stockpile material will be re-handled into the WRL.

Once the store and release cover is installed, topsoil or growth media (nominally 200mm thick) will be placed on the cover, ripped and seeded with local provenance flora. Allowance for fauna habitats will be incorporated into the final landform designs. Bunding will be installed at crests to minimise the potential for water to flow from the top surface of the WRL during flood events.
Revegetation of outer surfaces will be encouraged through the application of contour ripping, topsoil application and revegetation using appropriate native species that promote stability.

The top surface of the WRL will be rehabilitated with a store and release cover as per the concept design in Figure 5. The primary objective of the plateau cover is to limit water ingress (net percolation) to the PAF waste rock. The modelling results indicate that increasing the closure cover system thickness to greater than 2.5 m had little effect on simulated net percolation (3-6% net percolation predicted). The flat top store and release cover over the WRL should be built with 2m of cemented sandstone, leached cap or sand followed by a 0.5m NAF metasediment cap. The purpose of the metasediment is erosion control. Prioritising the use of topsoil for the cover will further improve performance.
The cover design will continue to be evaluated during the life of mine (LoM) as identified waste material is mined and can be tested to confirm suitability.

Figure 5: WRL closure top cover requirements



4.2 Geotechnical Assessment

Based on geotechnical assessment by Golder (2021), the WRL is considered stable.

Key recommendations from the report were:

- Maximum dump height < 100 m
- Tip-head lift height < 30 m
- Overall slope angle closure ~ 12 degrees

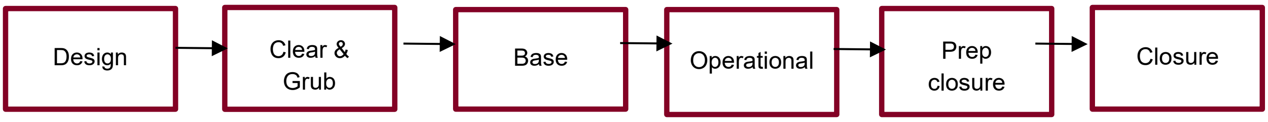
Current design parameters are within the specifications provided by Golder (2021).

5. DEVELOPMENT STRATEGY

5.1 Operational Development of the WRL

The development of the WRL operationally will follow the steps as per Figure 6.

Figure 6: Operational development of the WRL



Clear and grub involves clearing, collecting and storage of topsoil for closure requirements.

Base involves the placement of NAF material to delineate the boundaries of the WRL and the laying of the basal clay layer prior to the placement of PAF waste rock.

Operational will involve establishing the tip heads to ensure PAF and NAF can be sequentially deposited and the placement of waste material as per the WRL design. Monthly surveys as a minimum will be undertaken to ensure that the design complies with execution. At this point, operational data will be gathered to the suitability of material for closure and designs amended accordingly. This presents an opportunity in progressive rehabilitation in the progress construction of the WRL.

At prep closure the base material from stockpiles and the ROM pad will be re-handled into the WRL.

At closure the final stage of rehabilitation will occur where the WRL will be re-shaped and topsoil deposited as per Section 4.

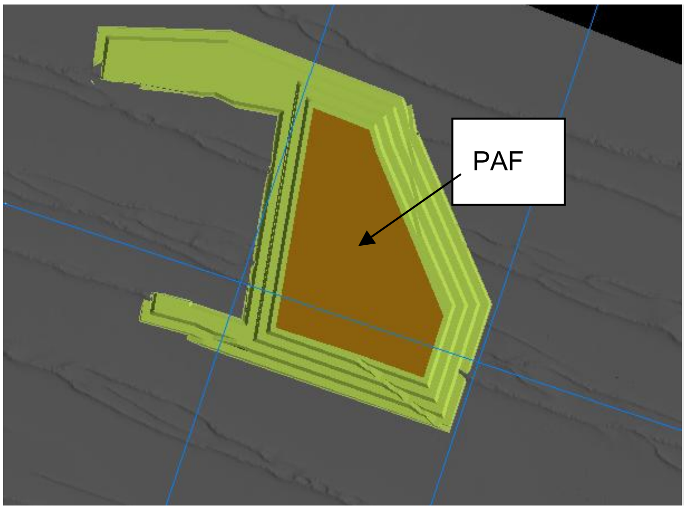
5.2 PAF encapsulation and AMD management

The PAF shall be managed as per the Winu Acid and Metalliferous Drainage (AMD) Management plan. The location, volumes and sulphur concentration of all PAF material will be recorded so that a three-dimensional plan of PAF material distribution within the WRL is maintained.

The construction of the WRL will be executed gradually through multiple 10m tip-heads to effectively encapsulate PAF material. This will establish compacted layers within the WRL to minimise seepage and restrict oxygen movement. The WRL will be restricted to four lifts, each reaching a height of 20m to a total height of 80m.

The PAF material will be placed away from the batters to reduce the risk of exposure of these materials to oxygen supply by advection. The more distant PAF material is from the batters, the lower the risk of advective oxygen transport. This is shown in Figure 7 where the PAF (and erodible material) are restricted in placement away from the batters. To prevent seepage into the underlying groundwater table, a minimum of 2 m basal clay layer will be laid before the placement of PAF.

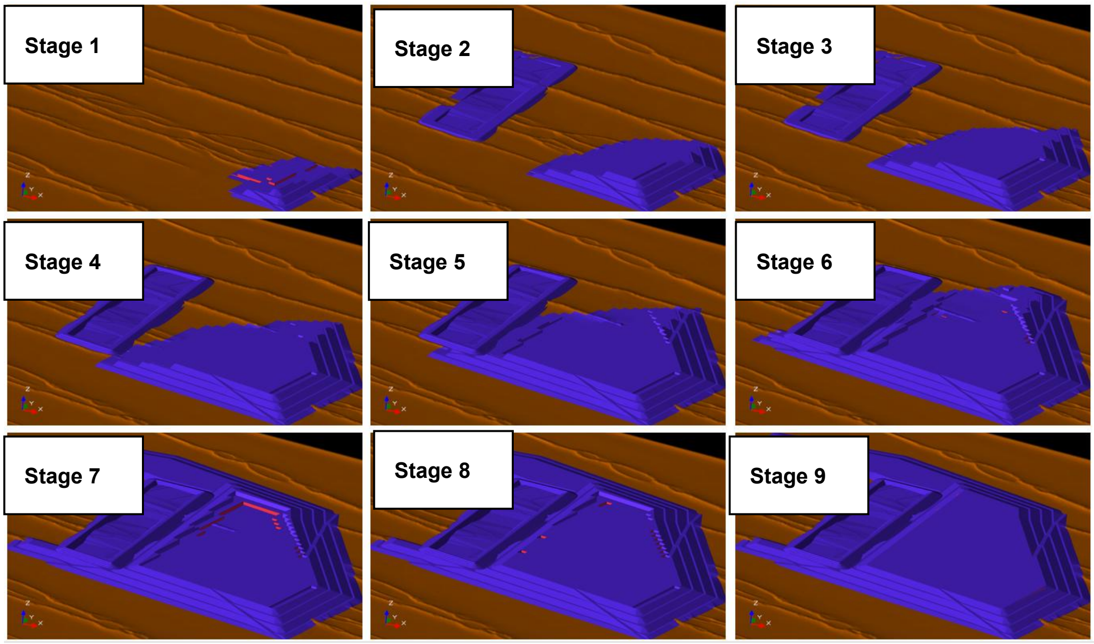
Figure 7: PAF Encapsulation



Before the final closure, impermeable NAF clay material layer at the base of stockpiles will be retrieved and stored within the WRL to cap the PAF material.

A development sequence of stages was developed through the Rio Tinto Landform Closure Optimisation Tool (RTLCOT) to determine the effective PAF/NAF/Erodible NAF deposition sequence (Figure 8). The results confirmed an optimal encapsulation is achievable at the closure of WRL, as required through AMD and Mine Closure Plan (MCP).

Figure 8: WRL based on the RTLCOT results[1]



[1] Stage 1 – red color represents erodible material.

Subsequently, the results of the WRL optimisation have been tested and progressed through mine scheduling software Alastri Tactical Scheduler (ATS) to confirm the practical implementation of the PAF/NAF deposition sequence. The output from the schedule confirmed there is sufficient NAF waste to ensure the base layer can be created and the PAF is covered.

The cover is obtained from remaining NAF metasediments and early commencement of the cover 7 years prior to completing the WRL.

Sufficient capacity has been left for the rehandle of the waste material used to form the ROM pad and for contingency.

Figure 9: Cross-section of WRL and mRL

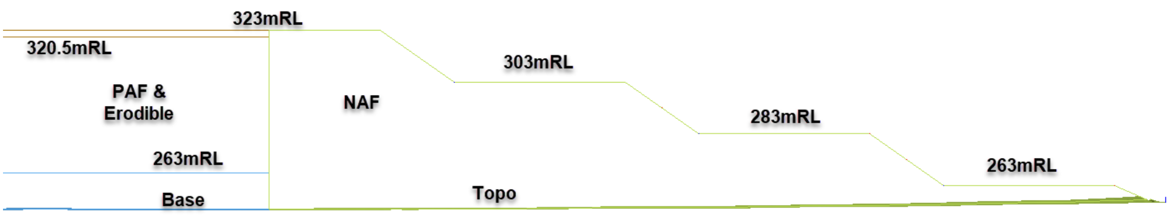
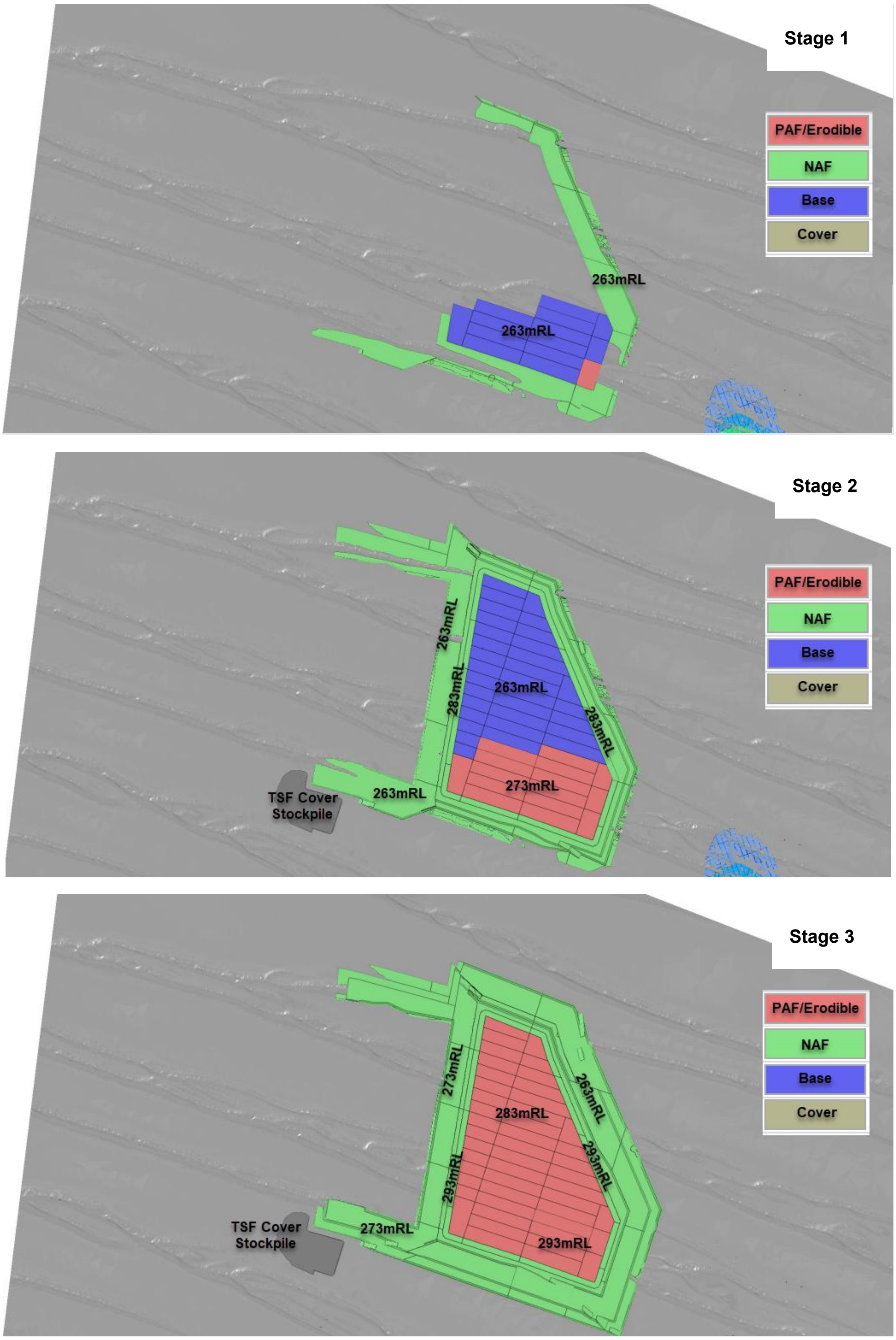
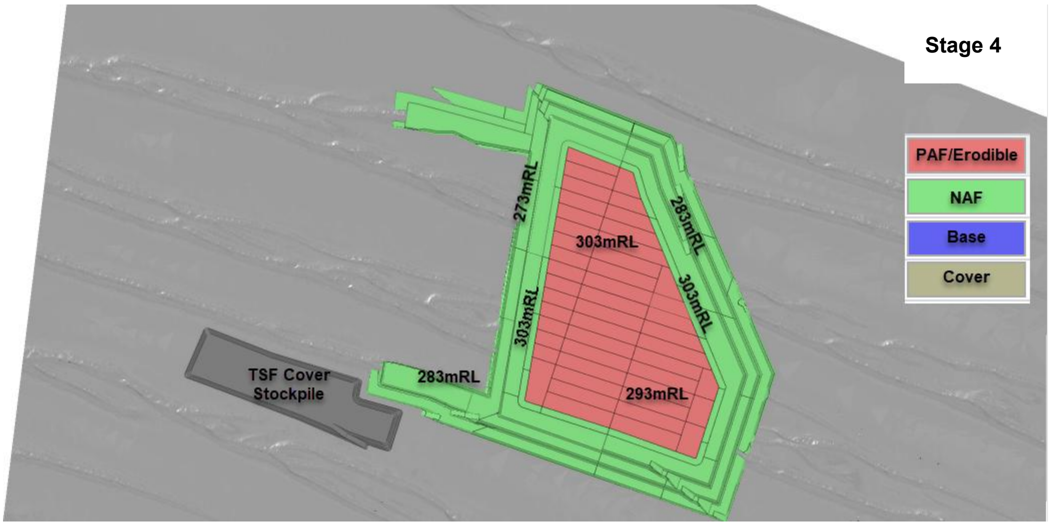
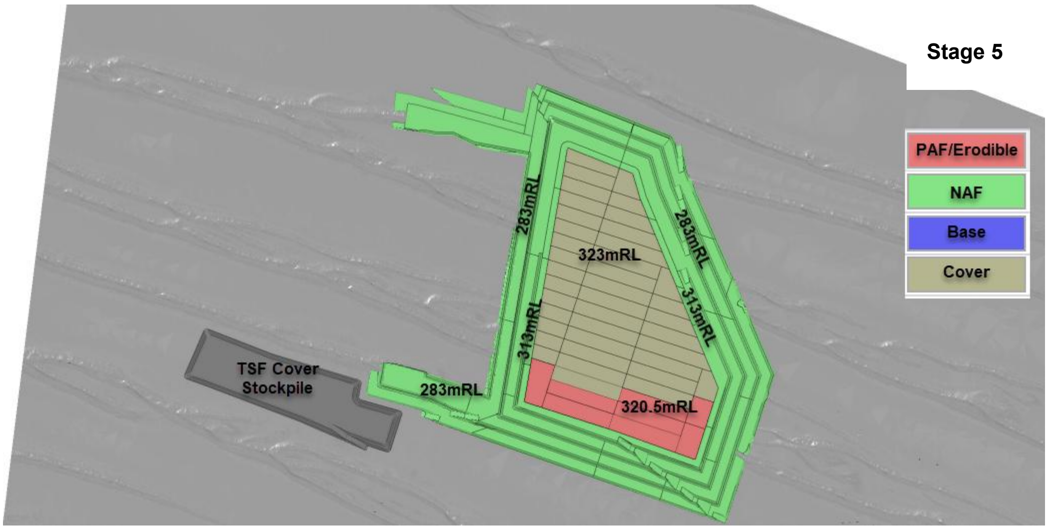
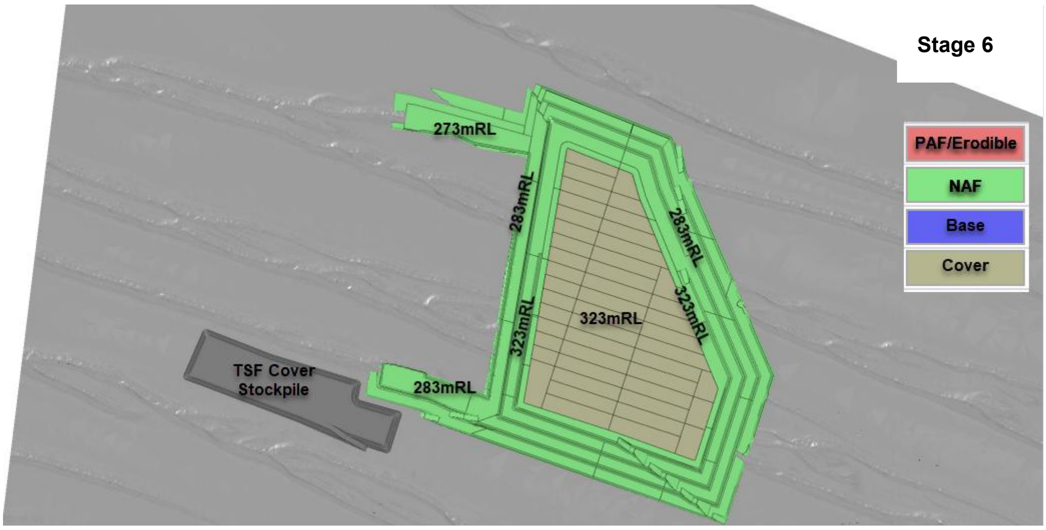


Figure 10: ATS WRL development across the life of WRL




Stage 4
PAF/Erodible
NAF
Base
Cover
273mRL
303mRL
283mRL
303mRL
303mRL
283mRL
293mRL
TSF Cover
Stockpile


Stage 5
PAF/Erodible
NAF
Base
Cover
283mRL
323mRL
283mRL
313mRL
313mRL
283mRL
320.5mRL
TSF Cover
Stockpile

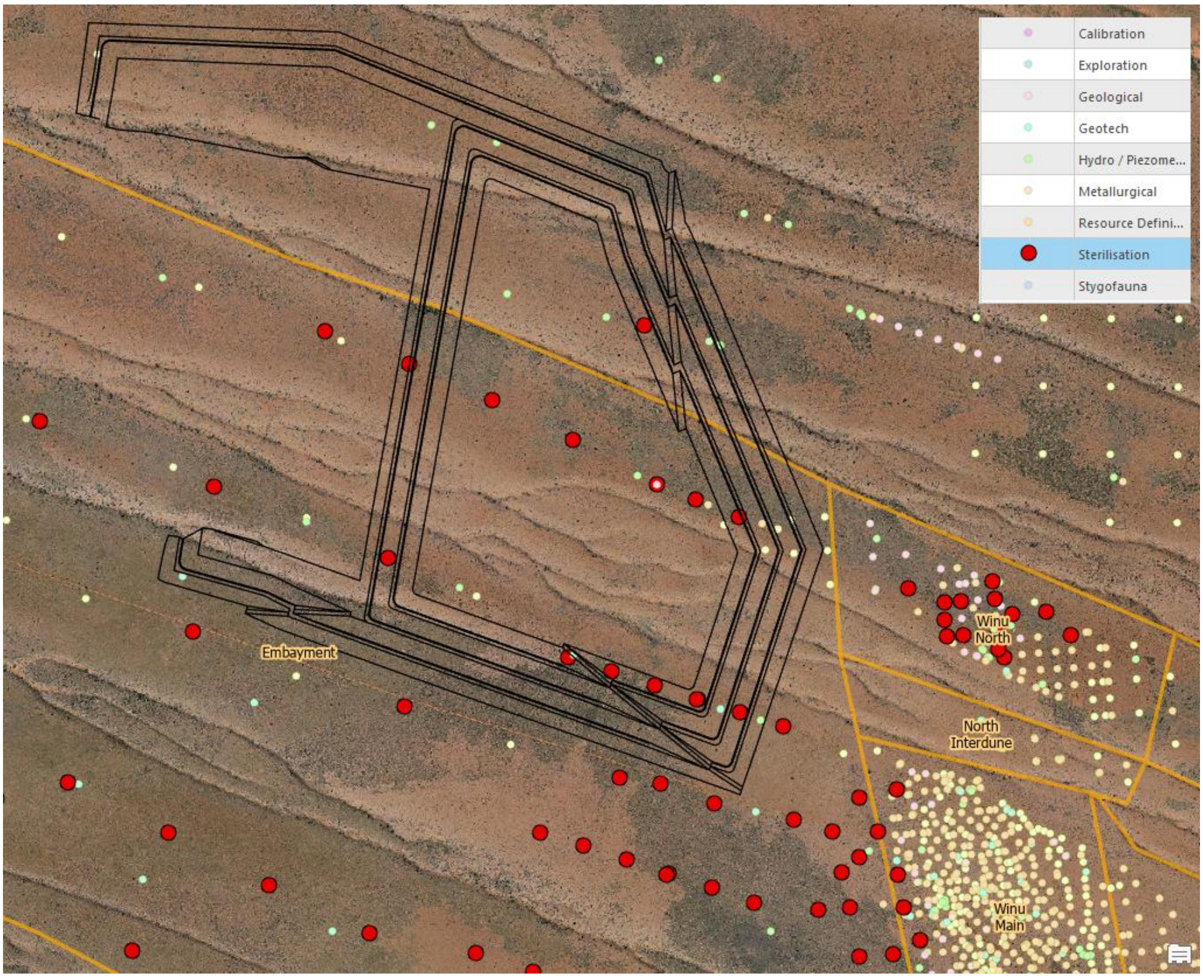

Stage 6
PAF/Erodible
NAF
Base
Cover
273mRL
283mRL
283mRL
323mRL
323mRL
323mRL
283mRL
TSF Cover
Stockpile

6. WRL LOCATION

6.1 WRL Footprint Sterilisation

The WRL location has considered the future potential orebody and is outside the Winu prospect boundaries. Sterilisation drilling has been completed within the footprint, as shown in Figure 11 and confirmed that there is no economic ore under the WRL.

Figure 11: WRL footprint and sterilisation drilling



6.2 Pit zone of instability for closure

Based on Guidelines on Safety Bund Walls Around Abandoned Open Pit Mines (DoIR,1997) a review was undertaken to ensure that the proposed WRL does not lie inside the potential "zone of instability" of any nearby potential pits. The boundary has been generated using the methodology detailed in Figure 12 as per the guidelines. Figure 13 shows the potential zone of instability in relation to the potential resource pitshells. The toe of the WRL lies outside the zone of instability.

Figure 12: Determination of Zone of Instability

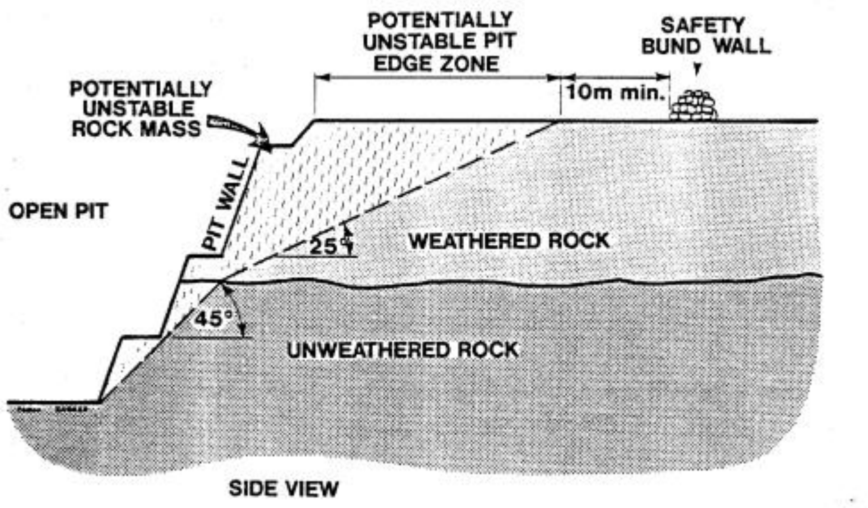
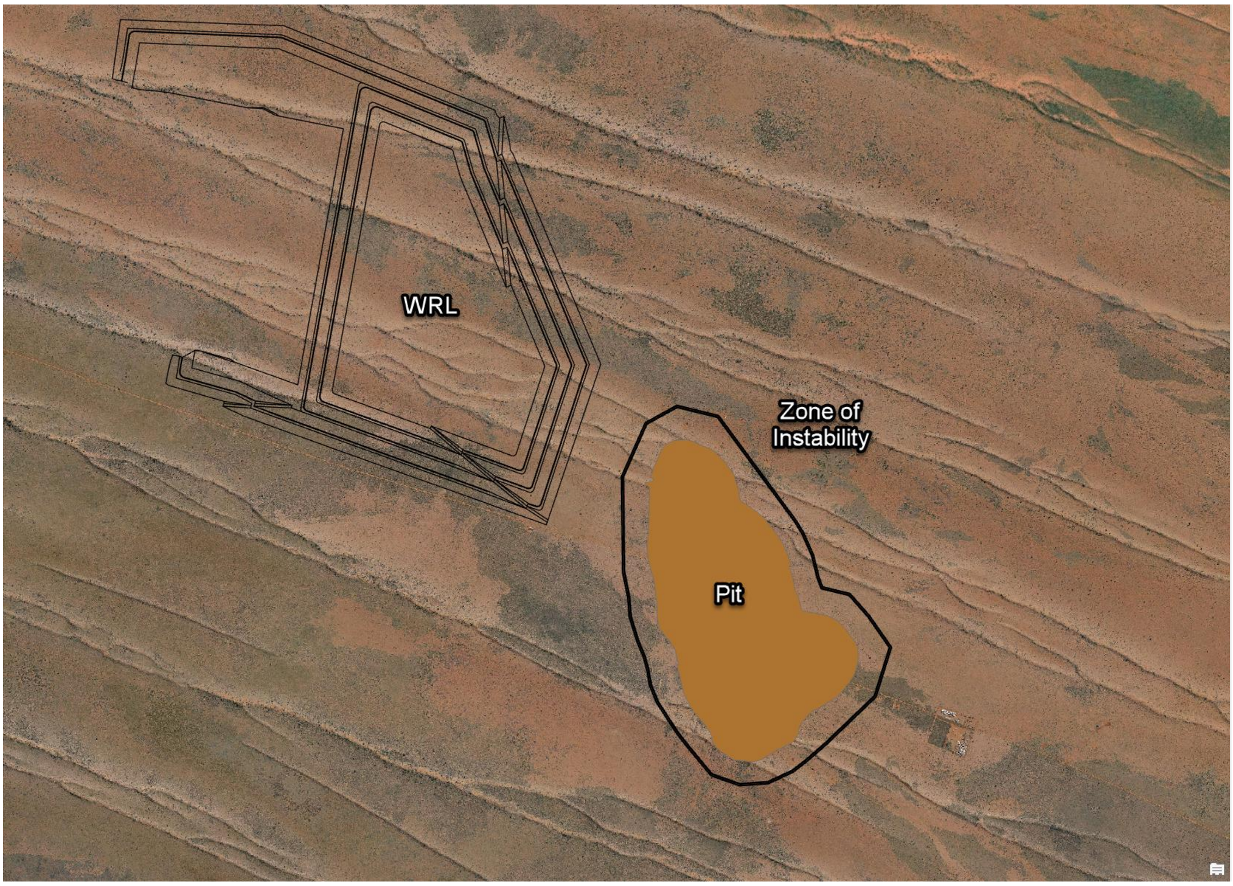


Figure 13: Potential zone of instability for proposed pit design



7.0 LAND CLEARING AND TOPSOIL MANAGEMENT

Topsoil clearing (minimum 0.1m where possible) will be required and cleared as outlined in the Winu Closure Planning – Topsoil Considerations. The topsoil shall be paddock dumped and stockpiled in a cleared designated area with clearing estimated in Table 7.

The topsoil shall be vegetated where possible with native species to increase evapotranspiration, seed bank viability, biotic function and minimise loss due to erosion and weed infestation.

The area shall be surveyed prior to paddock dumping to ensure successful reclamation and post paddock dumping to record quantities.

Table 7: Topsoil Quantities

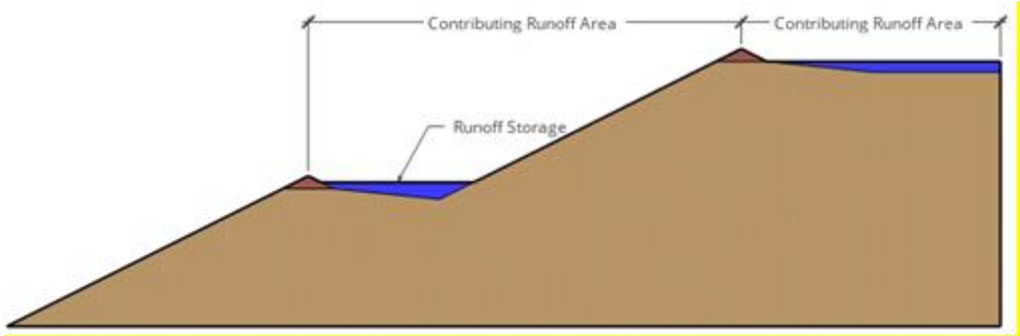
	Units	
Area cleared	Ha	567
Estimated topsoil collected at 0.1m	M LCM	0.6

The WRL footprint extends over the dunes and guidance will be sought as to whether the preference is to clear the dunes of topsoil or due to the sensitivity associated with the dunes, to avoid clearing and commence placement of waste rock directly over the top without clearing. In the case of the latter, guidance would be required to designate the areas and limitations required for topsoil clearance. This will be required prior to commencing mining.

8.0 SURFACE WATER MANAGEMENT

Perimeter bunds are proposed to be constructed along the perimeter of the upper surface and benches of the WRL to retain surface water where it will then infiltrate into the WRL or evaporate into the environment as per Figure 14 This will be applied at operations and closure.

Figure 14: Conceptual cross-section of the WRL landform and bund arrangement



The design shall be reviewed on completion of the Surface Water Management Plan (SWMP).

REFERENCES

- Department of Industry and Resources (DoIR), 1997, Safety bund walls around abandoned open pit mines – Guideline
- Golder Associates Pty Ltd (Golder), 2021, Winu Waste Dump Design, 19135779-007-R-Rev0
- Rio Tinto, 2023, Winu Closure Waste Assessment 2023, 230330
- Rio Tinto, 2023, Winu AMD Management Plan, Rev 1