Appendix 5
Site and Technology Selection Report

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Newcrest Mining Limited

Southern Tailings Storage Facility Site and Technology Selection Process

Cadia Continued Operations Project

August 2023

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Southern Tailings Storage Facility Site and Technology Selection Process
Cadia Continued Operations Project

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WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Abbreviations

CAPEX	Capital expenditure
CCC	Community Consultative Committee
CCOP	Cadia Continued Operations Project
CUO	Cadia Underground Operations
CS	Concept Study
CVO	Cadia Valley Operations
DPE	Department of Planning and Environment (NSW)
EIS	Environmental Impact Statement
FS	Feasibility Study
GFICC	Geotechnical failure impact consequence catastrophic
GISTM	Global Industry Standard on Tailings Management
LGA	Local Government Area
LOM	Life of Mine
MCA	Multi-criteria analysis
NML	Newcrest Mining Limited
NTSF	Northern Tailings Storage Facility
OPEX	Operating expenditure
PAR	Population at risk
PFS	Pre-Feasibility Study
PTSF	In-pit tailings storage facility
RL	Reduced level
SIA	Social Impact Assessment
SISR	Social Impact Scoping Report
STSF	Southern Tailings Storage Facility
STSFX	Southern Tailings Storage Facility Extension
TSF	Tailings Storage Facility
WRD	Waste rock dump
WSD	Water storage dam
w/w	Weight of solids divided by total weight of slurry/paste

Executive Summary

This report has been prepared by WSP on behalf of Newcrest Mining Limited (NML)-owned Cadia Valley Operations (CVO). The intent of this report is to provide a singular summary that documents the history of technical studies that have been undertaken to define the most appropriate location and technology for an additional tailings storage facility that balances long term stability, environmental and community impacts and cost of operation.

Specifically, this report presents:

- An assessment of the TSF studies conducted to date to assess the most appropriate site(s) and the most suitable tailings disposal technology.
- A summary of the technical, environmental and community impacts considered during the selection process.

CVO is a large underground block-caving gold and copper mining operation, with current approval for production of 32 Mtpa and modification to that approval to allow up to 35 Mtpa to be processed is undergoing assessment by regulatory bodies. Those approvals allow CVO to operate until 2031 with tailings deposition into the Pit Tailings Storage Facility (PTSF), Northern Tailings Storage Facility (NTSF) and the Southern Tailings Storage Facility (STSF). Full utilisation of the existing reserves would extend the life of operation beyond 2050.

In 2018, a failure occurred in one section of the southern embankment of the NTSF and deposition ceased in this facility, along with the STSF which was put on care and maintenance to allow for engineering review and limited buttressing. The STSF was subsequently returned to operation with deposition in Stage 6 completed and subsequently the STSF was placed into care and maintenance. At that time Cadia commenced the use of the PTSF whilst the NTSF and STSF underwent engineering review and execution of currently ongoing buttressing works. Engineering studies for the NTSF have identified the required works to repair the failed section of embankment. However, the studies have thus far failed to identify a safe and certain method for re-commissioning the facility for further deposition, and this is unlikely to be identified in the short to medium term. Therefore, the existing PTSF, NTSF and the STSF are likely only sufficient to provide storage capacity until the early 2030s.

Site and technology selection studies for an additional TSF commenced in 2005, with CVO commissioning engineering firm URS to carry out a study to locate and quantify potential TSF sites that could provide the additional tailings storage capacity required to meet the Life of Mine (LOM) requirements, as understood at that time. Further studies were commissioned with Golder in 2012 and in 2016 to 2018, with the intent to search for potential sites and in consideration of different tailings disposal methods. CVO continued progressing such studies with Hatch and Golder, up until 2021, in preparation for the Cadia Continuous Operations Project (CCOP) announcement (refer Community Engagement section below). These studies are further detailed in the following sections.

Community Engagement

In 2020 Umwelt commenced engagement activities with key stakeholders for the purpose of preparing a socio-economic study into existing operations at CVO at that time and gaining stakeholders' perceptions of the company more broadly. In October 2021 the CCOP was announced to the community with the aim of informing and engaging the community on the future of the Cadia operations leading to the submission of an application to extend the license to operate beyond 2031. Whilst detailed internal studies and limited community based discussion for the new TSF had been undertaken since 2005, October 2021 was the first time that detailed and targeted engagement with the community was held on tailings site selection and technology.

Following the announcement of CCOP in October 2021, Cadia held 23 personal meetings with a total of 43 proximal landholders. Cadia engaged with the NSW Government across six project briefings. Briefings were attended by the Department of Planning and Environment (DPE) representatives from the Water and Biodiversity, Conservation and Science divisions. Briefings were also held with Department of Regional NSW representatives from the Resources Regulator, the Mining Exploration and Geoscience division, and the Mine Development Panel of the Mining Concierge.

The NSW Environmental Protection Agency (EPA) and the Natural Resources Access Regulator (NRAR) were also briefed on the project. The Blayney, Cabonne and Orange City Councils were briefed and invited to provide feedback on CCOP concepts, including the proposed construction of a new TSF.

The Cadia community is well-informed, interested and engaged with the existing and future operations of CVO. They have historically been present and actively participated in a range of information sessions and individual meetings with Cadia in relation to CCOP, inclusive of discussions on the site and technology selection for an additional TSF. The primary concern raised by the community relates to dust management of any new TSF at Cadia.

Site selection

The TSF site selection process is based on technical, social and environmental design requirements, as follows:

Technical requirements:

1. Capacity for tailings storage to meet the remaining Life of Mine (LOM);
2. Selection of a suitable site(s), both topographically and geotechnically;
3. Suitable TSF construction methods;
4. Appropriate technical risks associated with these construction methods, execution and long term stability; and
5. Consideration of the capital and operating costs of the TSF construction methods.

Social and environmental requirements:

1. Minimisation of the disturbance areas and biodiversity impacts;
2. Minimisation of noise and dust emissions associated with operation of the TSF;
3. Minimisation of impacts on existing water bodies – both quality and quantity.
4. Minimisation of impacts to the visual amenity of neighbouring landholders.

Several studies have been undertaken to assess suitable locations of the new TSF, since 2005 until 2019. Up to 10 potential TSF sites were initially identified by Golder in 2012 (building on from URS 2005 studies) as candidate locations for the new TSF, as follows (these specific site locations are presented in Figure 3.4 in the main body of the report, and Figure ES.1 provides a general overview of the sites considered in the studies.

1. Ridgeway void and underground
2. Copper Gully
3. Cadia creek (Cadiangullong)
4. Cadia pit
5. Rodd’s Creek dam
6. Cadia East
7. Waste rock dump
8. Bundella Valley (Swallow Creek)
9. Far south Rodds creek
10. NTSF & STSF (i.e. using the existing TSFs).

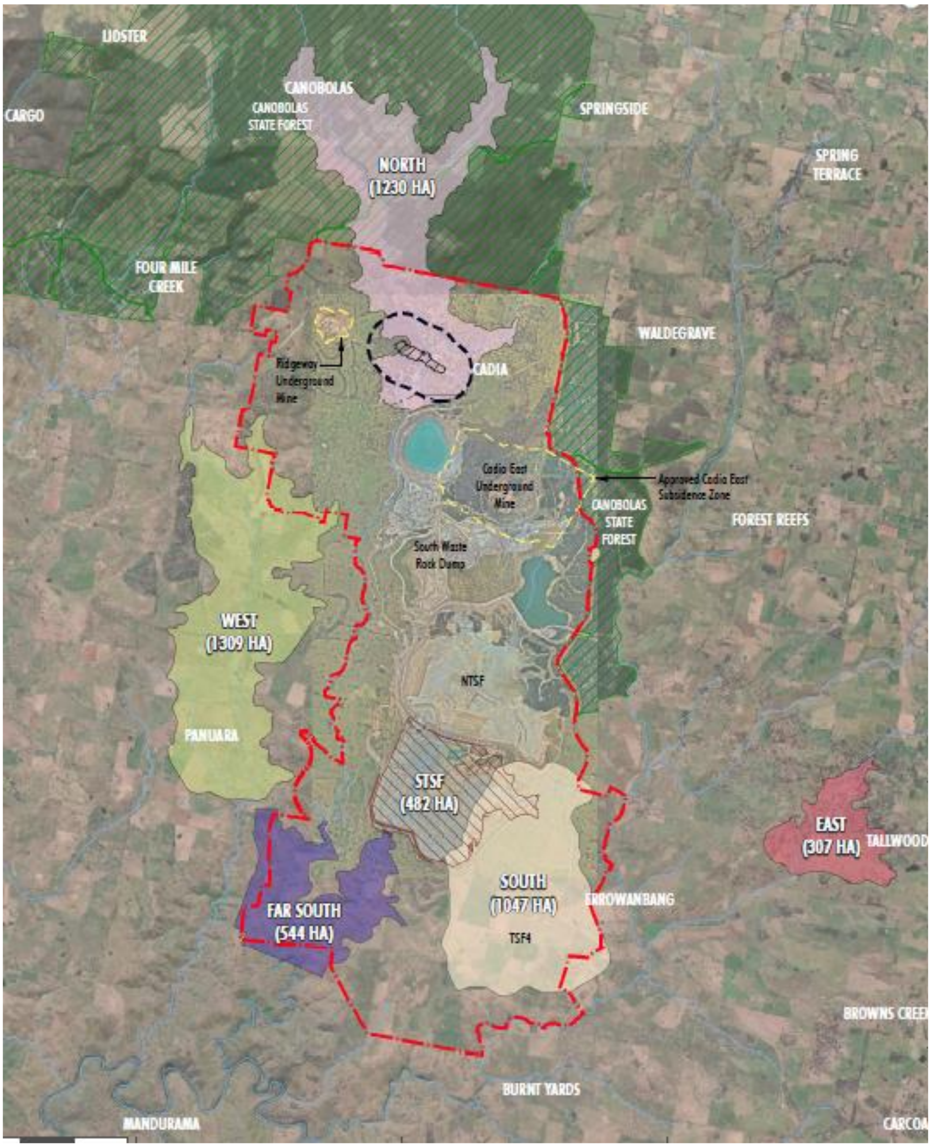

Figure ES.1 TSF sites studied since 2005 (Newcrest Mining Limited, 2023)

In 2017, Golder considered five additional locations, but none were viable:

- TSF1: Swallow Creek, north end
- TSF2: Swallow Creek, middle
- TSF3: Swallow Creek, south
- TSF4: South Rodd's Creek
- TSF5: Gooleys Creek.

In addition to the above studies, wider site searches were undertaken to a 40 km radius around the mine with no credible alternatives identified.

In 2018, Golder examined additional sites, with limitations/issues associated with each site as follows:

- Cadiangullong (located in new catchments unaffected by mining activities), also considered by Golder in 2012.
- Lower Cadiangullong Creek (located in new catchments unaffected by mining activities).

- Belubula River (not credible, unacceptable impact on Belubula and Lachlan River catchment communities and environment).
- Errowanbang (located outside of the mine lease).

Most of the sites considered in the 2005-2018 studies had a limited storage capacity, so a combination of two or more TSFs would have to be operated simultaneously to meet the expected tailings output. In addition, these TSFs had a very limited tailings tonnage they could accept in their early years, due to the narrow valley topography.

Following the above findings, CVO narrowed the site options to the Cadiangullong creek (North site) and the STSF Errowanbang (South site) and assessed different tailings disposal methods for these options. Golder assessed the pros and cons associated with the North and South sites from 2018 to 2019, as follows.

The main advantages associated with the Cadiangullong creek (North site) are:

- The narrow valley results in reduced construction quantities for embankment.
- The site is within 5 km of the process plant.
- The site is located relatively further from neighbouring properties, compared to the South site.

The main disadvantages associated with the Cadiangullong creek (North site) are:

- The land is forested area to the north of the site, implementing the TSF at this location would result in significant impacts to biodiversity and plant community species as well as fauna.
- The Four Mile Creek road would need to be relocated.
- High capital cost associated with sediment and runoff control infrastructure.
- Cadiangullong Dam would need to be replaced and a site identified which would increase potential environmental impacts.
- The embankment would be founded on loosely backfilled mine waste over the Cadia north pit and would be extremely technically challenging.
- A major diversion channel and drop-structure would be needed to carry runoff from the 90 km² catchment located upstream of the TSF, divert runoff around the TSF and deliver it to the Cadiangullong diversion channel around the Cadia pit, which would:
    - Require a major excavation into the rock to form the diversion channel.
    - Result in significant environmental impacts.

The main advantages associated with the Errowanbang (South site) are:

- Most of the ground has a low slope of ±2.5%, falling from east to west.
- There is a very limited external catchment (it is within the current TSF catchment area and river system) and this runoff can be diverted relatively easily.
- There is a suitable location for a surface runoff sediment control dam in the lower Rodds Creek valley.
- Lower land disturbance, compared to the North site.
- Waterway impacts are negligible and no new catchment affected.

The main disadvantages associated with the Errowanbang (South site) are:

- All options would be visible, to some extent, to the landholders to the east, south and west.
- The footprint is adjacent to Flyers Creek.
- The Panuara and Meribah roads would need to be relocated.

- The site is about 6.5 km from the process plant.

These studies demonstrated that the Errowanbang (South site) was the most suitable site.

In 2019, Hatch, as part of a consolidated concept study report, prepared a high level Multi Criteria Assessment (MCA) and detailed risk and cost assessments of the TSF options identified in previous studies and associated tailings disposal methods, which confirmed that Errowanbang (South site) was the most suitable option.

The North site option significantly contradicted several of CVO's agreed technical (failure risk, loose embankment foundation, relocation of the water storage dam), environmental and community (relocation of public busy road, disturbance of forested area and impact to biodiversity, major diversion channel and drop structure to divert runoff from catchment area upstream, resulting in major environmental impacts) criteria and was discounted from further examination.

The South site TSF was therefore selected as the most suitable option (most of the ground has flat slope, it is within the current TSF catchment area and river system, it provides the ability to integrate with STSF, resulting in lower land disturbance area compared to the North site, waterway impacts are negligible with no new catchment affected, adequate foundation conditions may be achieved) and later was redesignated as the South TSF eXtension (STSFX).

Tailings deposition technology selection

A range of potential tailings deposition technologies were considered across the identified TSF sites, until one technology was selected as being the most appropriate for the STSFX. The technologies initially considered were:

- Conventional (thickened) slurry – as currently used at Cadia;
- Central thickened discharge;
- Paste;
- Dry stack (filtered tailings);
- Co-disposal of coarse mine waste (cobbles and boulders) with slurry;
- Co-mingling (tailings and coarse waste rock are mixed together within a storage facility or as a single discharge stream); and
- Hydrocyclone sand wall embankment.

It was assessed that the hydrocyclone sand wall embankment tailings deposition system was most suitable to Cadia for the following reasons:

- Marginally lower land disturbance requirements compared to other options (in alignment with previously presented *Social and environmental requirement 1*);
- Significantly reduced quarry rock and borrow requirements (in alignment with previously presented *Social and environmental requirement 1*);
- Hydrocyclone sand wall embankment construction uses less energy than some other tailings technologies (paste, dry stack, rock placement) and is more amenable to Newcrest's zero carbon emissions goals (in alignment with previously presented *Social and environmental requirement 1* and *Technical requirement 5*).
- Noise levels similar to the current NTSF and STSF operations and lower than other options (in alignment with previously presented *Social and environmental requirement 2*);
- Similar dust levels to the dust generated by the NTSF and STSF when operating and lower than other options (in alignment with previously presented *Social and environmental requirement 2*);
- Lower technical risk due to increased embankment stability inherent in the technology (in alignment with previously presented *Technical requirement 4*);

- No increase in water recovery above current requirements (in alignment with previously presented *Technical requirement 5*);

In considering the community's primary concern about dust management (*Social and environmental requirement 2*), the advantages of this technology are as follows:

- It maintains the advantage conventional disposal has, namely the ability to keep the tailings beach wet, provided that tailings deposition is planned accordingly.
- The outer slope of the sand dam is compacted to minimise its propensity to liquefy under earthquake loading and this action assists to control dust generation from the outer slopes.
- To further reduce dust generation from the beach and the slopes, large area water cannons will be used, whilst early development of the final toe and slope of the embankment will allow implementing temporary vegetation and early rehabilitation, further reducing the propensity for dust.

Additional MCA to combine sites and tailings deposition technologies

The MCA undertaken by Hatch in 2019 (refer "Site selection" Section of this Executive Summary) did not consider weighted criteria (it only included 'yes' or 'no' ratings, except for the cost assessment) and did not include hydrocyclone sand wall embankment as a disposal method for the South site.

Therefore, Newcrest and WSP undertook an additional MCA in 2023 with the intent to:

- Consider semi-quantitative criteria (including weightings) for the site and tailings disposal options considered, based on risk assessments completed by Hatch in 2019.
- Align with GISTM's[1] Requirement 3.2, "For new tailings facilities, the Operator shall use the knowledge base and undertake a multi-criteria alternatives analysis of all feasible sites, technologies and strategies for tailings management (…)".

The MCA indicated the following as the top three options, from the highest to the lowest ranking option:

1. Hydrocyclone sand wall embankment disposal method for the South site.
2. Paste tailings discharge with upstream raised embankments at the South site.
3. Slurry tailings discharge at the South site with downstream raised embankments.

Layout optimisation

Once the site location and technology combination was chosen, nine layout options were presented for consideration during the Pre-Feasibility Study (PFS) and put through an MCA, to define the most suitable layout. The MCA determined a preferred option, Option 5A, which was displayed to the community for feedback.

When compared to Option 5A, the final design of STSFX completed during the Feasibility (FS) phase and presented to the DPE and community in May 2023 has taken into account the feedback from the community and has the benefits:

- Reduced footprint reducing disturbance and biodiversity impacts;
- Reduced impacts from dust and noise on local community stakeholders;
- Creates an integrated single facility with the existing STSFX and NTSFX reducing visual amenity for neighbouring landholders;

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[1] Global Industry Standard on Tailings Management

- Adjusts the facility to match the 25-year approval extension timeframes allowing all stakeholders to assess any future request for another facility at a time closer to the approval date. This includes the opportunity to utilise currently excluded locations (e.g.: Ridgeway and/or Cadia East subsidence zones) or currently underdeveloped technologies, to further reduce impacts.
- The potential for temporary or progressive closure and rehabilitation in areas where construction and tailings placement is complete.

The layout progression from before the MCA, up until Option 5A and the final STSFX design based on community feedback is illustrated in Figure ES.2 to Figure ES.4.

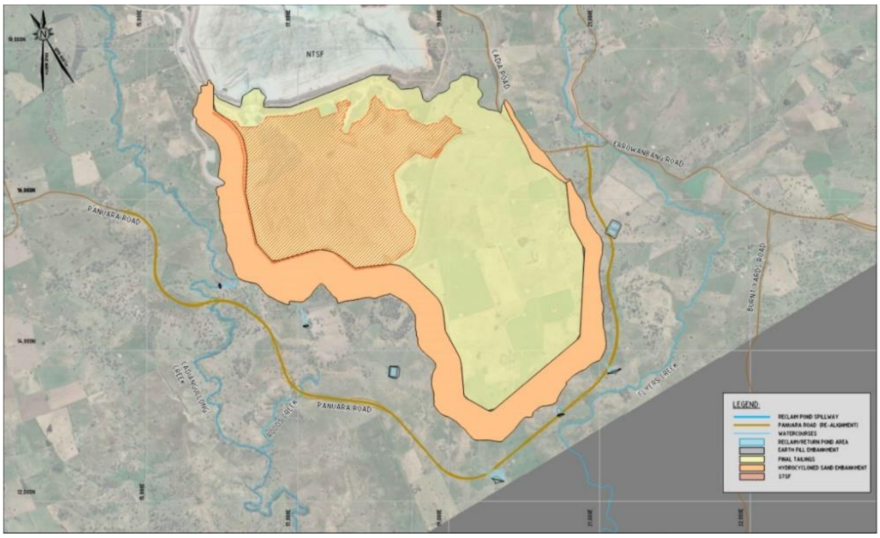

Figure ES.2 STSFX configuration prior to MCA

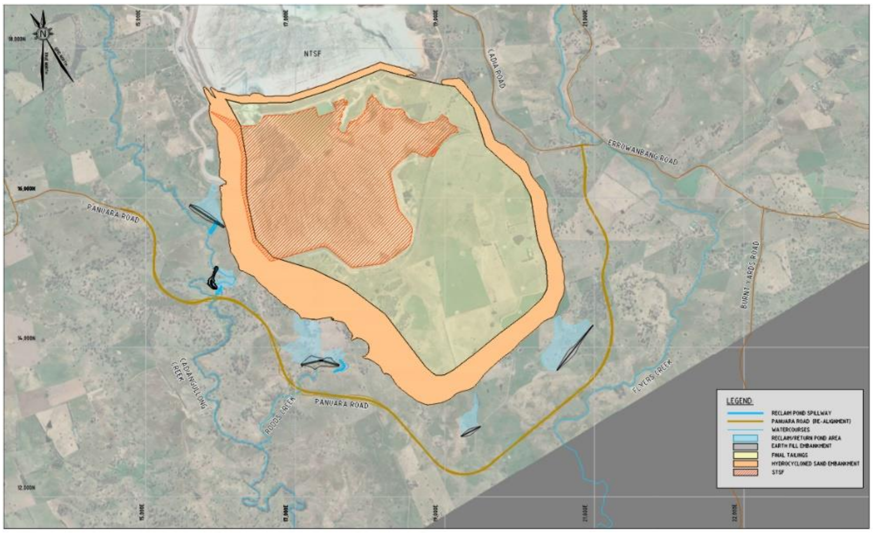

Figure ES.3 Option 5A selected as a result of the MCA

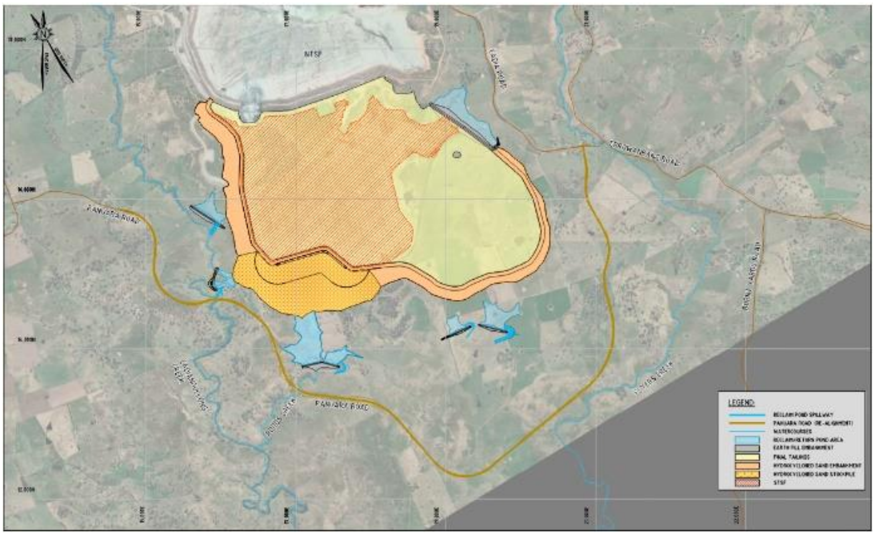

Figure ES.4 STSFX

1 Introduction

1.1 Overview

The Newcrest Mining Limited (NML) owned Cadia Valley Operations (CVO) is a large underground block-caving gold, copper and molybdenum mining operation. The mining operations result in the generation of saleable metal products (gold dore, gold rich copper concentrate and molybdenum concentrate), and mine waste which becomes tailings with no economic value. Mining tailings cannot be directly disposed into the environment, as they have a potential for pollution of ecosystems and negative impact to flora and fauna. Tailings are therefore disposed of and stored at tailings storage facilities (TSFs).

The CVO has an approved annual production of 32Mt with plans to process up to 35 Mt of ore once approval is granted by regulatory authorities. This ore is crushed and milled to allow the copper and gold, to be recovered in three process plants, with the resulting tailings being pumped as a thickened slurry.

The first TSF, the Northern TSF (NTSF), was designed to accommodate the tailings from the Cadia hill open pit and originally accommodated the tailings produced by Concentrator 1. The Southern Tailings Storage Facility (STSF) was originally designed to accommodate the tailings from the Ridgeway underground mine via Concentrator 2. The NTSF was designed in 1997 by engineering firm Knight Piesold as a conventional slurry tailings facility with a zoned earth rockfill containment embankment, with plans to raise the embankment over time using the upstream2 method, supported by a downstream buttress only. The STSF was developed in 2001 by engineering consulting firm URS, following the same design concept used for the NTSF. Later in the operational life the STSF was modified to accommodate concentrator 1 feed and the NTSF was modified to take previous feed to the STSF.

CVO is licensed to mine until 2031 and current storage facilities (NTSF, STSF and PTSF) have storage capacity that will exceed this timeframe however the known reserves at Cadia exceed the capacity of these facilities. CVO commissioned URS in 2005 (URS, 2005) to carry out a study to locate and quantify potential TSF sites that could provide the additional tailings storage capacity required to meet the Life of Mine (LOM) requirement. These studies were further developed in 2006 (URS, 2006) to Pre-Feasibility Study level (PFS). More studies were commissioned by CVO following the completion of the URS study in 2005/2006 and are discussed in more detail throughout this report.

More recently, the failure of the NTSF in 2018 has required Cadia to utilise the Cadia pit for tailings disposal (PTSF) until the NTSF is repaired and the STSF is lifted to its next stage, Stage 7. However, these TSFs provide limited storage capacity, and at this time it is likely that only the STSF will be recommissioned in the short to medium term. CVO therefore requires a new TSF to support continued operations for its known reserves. CVO has since undertaken studies to define the new TSF under the Cadia Continued Operations Project (CCOP).

Stakeholder and community engagement relevant to this work commenced in 2020 and has continued up until and following the announcement of CCOP in October 2021, discussed further in Section 2.1.2. Various engagement activities have been undertaken with a range of stakeholders including the NSW Government, local councils and landholders to seek feedback on CCOP concepts, including the proposed construction of a new TSF. The Cadia community is well-informed, interested and engaged with the existing and future operations of CVO. They have historically been present and actively participated in a range of information sessions and individual meetings with Cadia in relation to CCOP, inclusive of

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2 Upstream construction method: embankment raises are constructed over the existing embankment crest and over tailings.
Downstream construction method: embankment raises are constructed over the existing embankment crest and over existing ground located outside of the TSF.
Centreline construction method: embankment raises are constructed over the existing embankment crest and partially over tailings, partially over existing ground located outside of the TSF.

discussions on the site and technology selection for an additional TSF. The primary concern raised by the community relates to dust management of any new TSF at Cadia.

This report summarises several studies that assessed multiple options for a suitable site against an agreed set of environmental, community and technical considerations.

1.2 Overview of Cadia Continued Operations Project

Cadia commenced the Cadia Continued Operations Project (CCOP) to secure the long-term mining future of Cadia, with direct and indirect employment of over 3,000 people and the economic benefit this brings to the Orange City, Cabonne and Blayney Shires, as well as the state of NSW and the Commonwealth.

The Cadia East mine has reserves in excess of 30 years of production and will be seeking approval from the NSW Department of Planning and Environment (DPE) for an extension to the current approvals of 25 years under the CCOP. During this period, CVO requires additional tailings storage capacity of approximately 600 Mt. Security of tailings storage for this time horizon is important to allow the continued development of the operation and to create the certainty required for future investments.

1.3 Future tailings disposal

1.3.1 Life of Mine Tailings Management Strategy

During the proposal 25-year approval term under the CCOP. This LOM tailings strategy will include:

- An integrated tailings deposition plan for NTSF, STSF and PTSF.
- Closure plans for each of the NTSF and PTSF, both of which are likely to have their useful life exhausted by 2030.
- The development of the STSFX, which incorporates a new area to the east of the STSF and its integration with the STSF, to provide LOM tailings storage for the period 2028-2048.
- A closure plan for the STSFX, which incorporates the current STSF.

1.3.2 Study history and timeline

Several tailings disposal site identification studies have been completed since 2005, as illustrated in Figure 1.1. Starting with a study carried out by URS in 2005 and finishing with the (Golder, 2018c) study that identified the STSFX site.

This report forms part of the CCOP and the LOM tailings Feasibility Study currently in preparation in 2023.

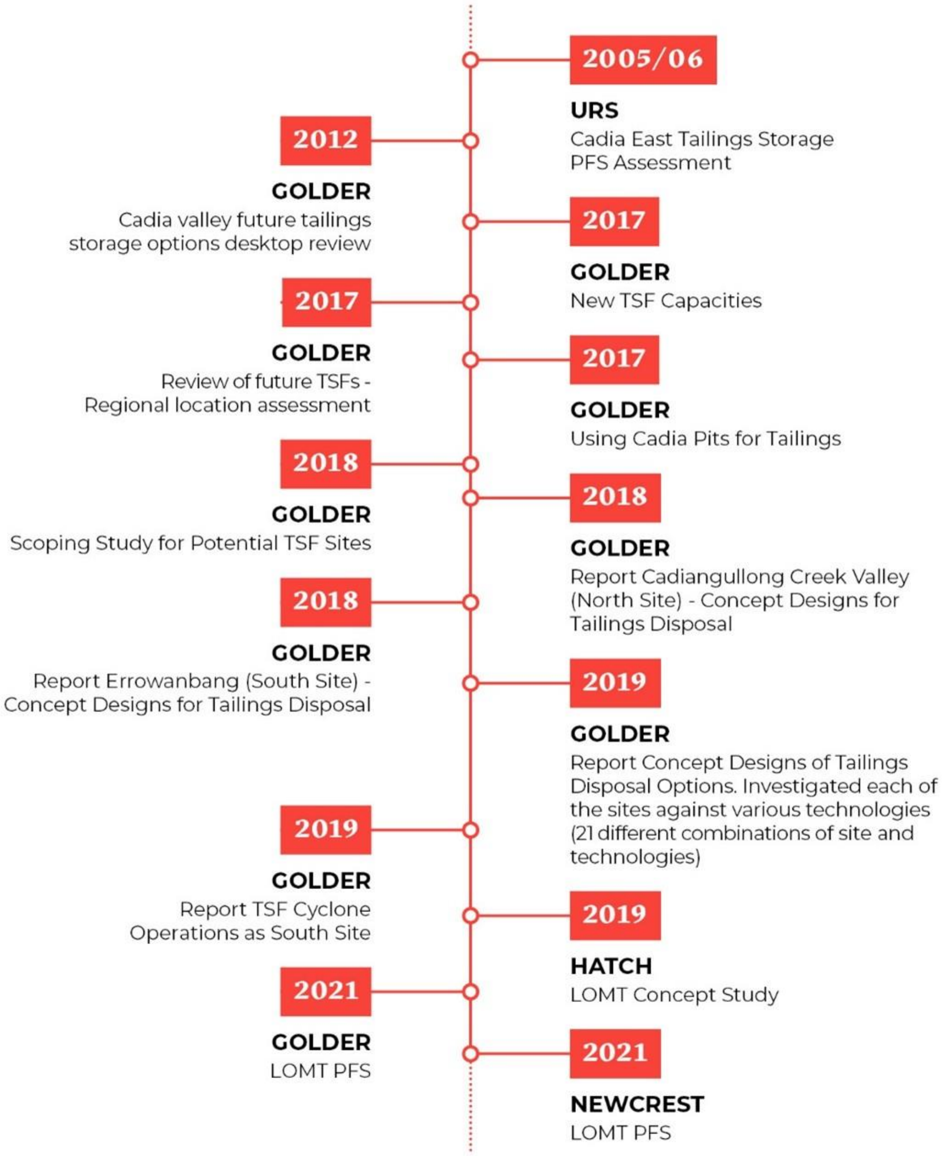

Figure 1.1 Study history and timeline

1.4 Purpose of this report

This report has been prepared by WSP on behalf of Newcrest to provide a singular summary that documents the history of technical studies that have been undertaken. Specifically, this report presents:

- An assessment of the TSF studies conducted to date to identify the most appropriate tailings deposition system and site.
- The site selection process undertaken progressively through the years and how it selected the STSFX site.
- Details on the justification for the selection of the STSFX site.
- A summary of the technical, environmental and community impacts considered during the selection process.

2 Engagement

2.1 Overview of engagement

Newcrest and CVO have engaged with stakeholders for CCOP (inclusive of TSF location and tailings deposition system assessments), and during the PFS, MCA and FS processes. Newcrest further captures community sentiment toward its activities via quarterly Community Consultative Committee (CCC) meetings and Cadia District Residents Meetings.

2.1.1 Preliminary stakeholder identification

The following stakeholders have been identified for the CCOP as part of the Social Impact Scoping Report (SISR) being prepared by environmental and social consultancy Umwelt (Umwelt, 2022). The SISR forms part of the Social Impact Assessment (SIA), a formal requirement of the CCOP environmental impact statement (EIS). As Newcrest and CVO have been present in the region for a long time and have a long history of engagement with stakeholders, previous assessments and existing stakeholder databases were used in the identification process. Umwelt and Newcrest representatives then identified future stakeholders in CCOP and their engagement preferences. Thirteen separate stakeholder groups were identified, see Figure 2.1.

Figure 2.1 Preliminary stakeholder identification (Source: (Umwelt, 2022))

2.1.2 Historical engagement activities at Cadia

In 2020 Umwelt commenced engagement activities with key stakeholders for the purpose of preparing a socio-economic study into existing operations at CVO at that time and gaining stakeholders' perceptions of the company more broadly. This engagement program included consultation with over 500 community members and 37 key stakeholders and neighbouring landholders. While this consultation program engaged with over 1,000 people across five stakeholder groups, this engagement program was not specifically targeted at the site and technology selection for an additional TSF, rather the broader existing Cadia operations at the time (Umwelt, 2020).

Detailed studies for the new TSF had been undertaken since 2005, however, Newcrest acknowledges that targeted engagement with the community on tailings site selection and technology was limited in nature, prior to the announcement of CCOP in 2021.

Following the announcement of CCOP in October 2021, Cadia held 23 personal meetings with a total of 43 proximal landholders. Cadia engaged with the NSW Government across six project briefings. Briefings were attended by the DPE representatives from the Water and the Biodiversity, Conservation and Science divisions. Briefings were also held with Department of Regional NSW representatives from the Resources Regulator, the Mining Exploration and Geoscience division, and the Mine Development Panel of the Mining Concierge. The NSW Environmental Protection Agency (EPA) and the Natural Resources Access Regulator (NRAR) were also briefed on the project. The Blayney, Cabonne and Orange City Councils were briefed and invited to provide feedback on CCOP concepts, including this time the proposed construction of a new TSF. Three community drop-in sessions were also held in November 2021 where project information was provided to interested community members. Since November 2021 Newcrest has held ongoing Cadia District Resident Meetings as well as individual discussions with landholders as required (Umwelt, 2022).

During March 2022, Newcrest distributed a project sheet that summarised stakeholder and community feedback received during the October to December 2021 period. At this time Umwelt were engaged to prepare a SISR as part of the CCOP as per EIS requirements for an extractive industry project in NSW. This led to consultation with over 50 neighbouring landholders and close to 40 other community representatives (see Table 2.1).

Stakeholders were asked a range of questions in relation to CCOP's three aspects:

- Proposed additional water storage to maintain security of water supply to the mine;
- Options for realignment of public roads; and
- The proposed construction of a new TSF to the south of the existing STSF to allow capacity for storage of tailings produced beyond the existing approved mine life (Umwelt, 2022).

Table 2.1 details the number of stakeholders consulted by Umwelt for the SISR on the above-mentioned aspects of CCOP, including the proposed South option for STSFX during March and April 2022.

Table 2.1 Stakeholder consulted and informed of CCOP during EIS scoping phase

Stakeholder group	Mechanism	Number of surveys/meetings conducted	Number of participants
Proximal Landholders	Personal interview with Umwelt / Completion of SIA online survey	53	53 (may have been engaged by both Umwelt and Cadia at various consultation phases)
	Personal meetings with Cadia	23	43
Local Community	Cadia District Residents Meetings	2	11

Stakeholder group	Mechanism	Number of surveys/meetings conducted	Number of participants
	CCOP Meeting	1	17
	Maildrop of Project Information Sheet	134	NA
	Email of Project Information Sheet	~300	NA
Aboriginal Representative Groups	Personal meeting	1	1
Local Government	Project briefing	2	12
State Government	Project briefing	6	~24
Community and Special Interest Groups	Project briefing to the CDPG and subsequent interviews with members	1	6
	Personal interview with Umwelt / Completion of online survey	2	2
Broader Community	Local newspaper media with invitation to Community Information Session	3	NA

Source: (Umwelt, 2022)

Figure 2.2 illustrates the timeline of community and stakeholder engagement since the commencement of the socio-economic study (Umwelt, 2020). Engagement activities will continue during the preparation of the EIS for CCOP, both for the purpose of the SIA as well as the broader EIS engagement scope. Stakeholders will be consulted on all aspects of CCOP, including the site and tailings deposition system technology preferred option for STSFX (hydrocyclone sand wall embankment, refer to Section 4 for more information).

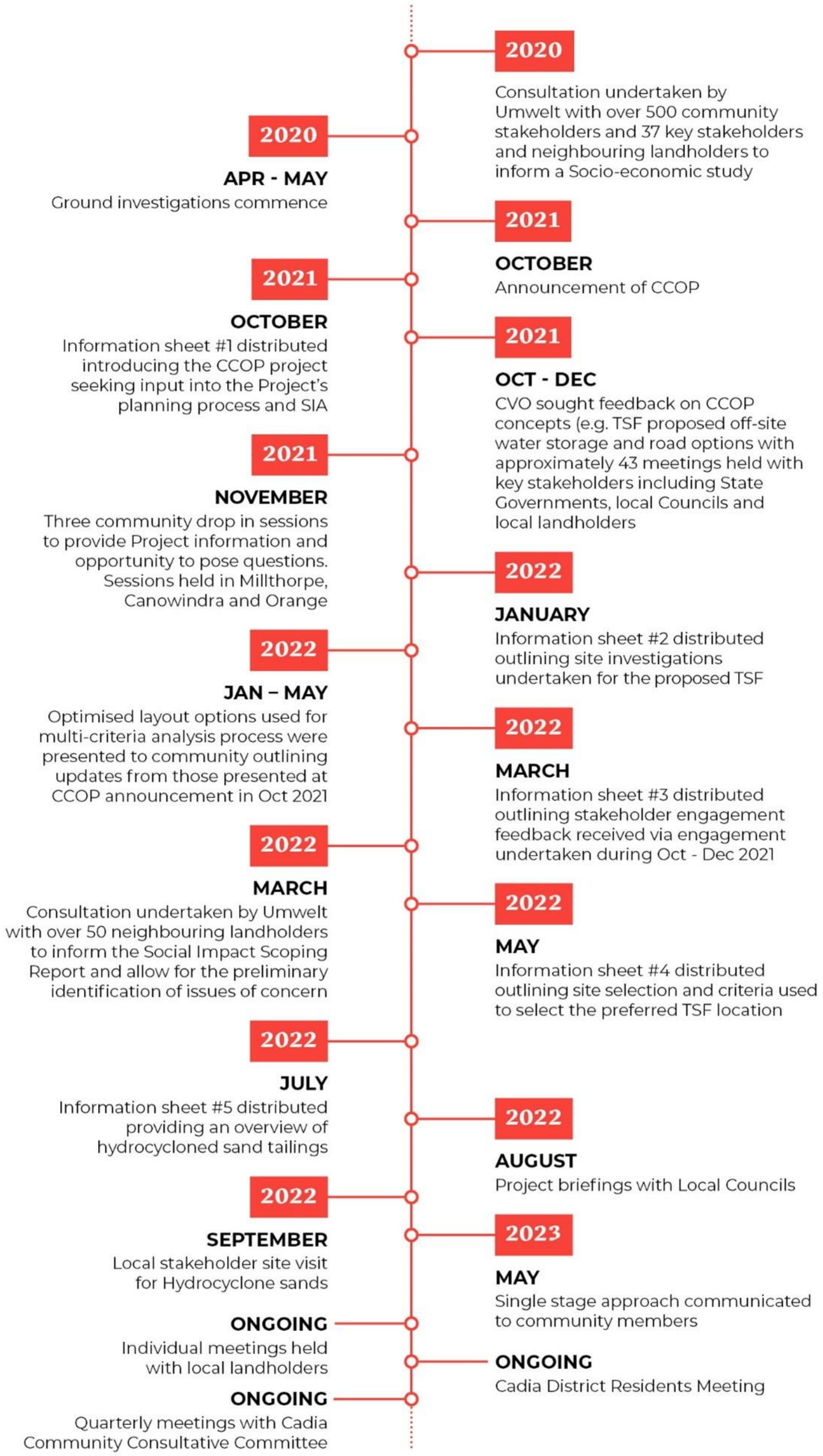

Figure 2.2 Community engagement timeline (Source: (Umwelt, 2022))

2.2 Key issues raised by stakeholders

Prior to 2016 the issue of most concern to the community was traffic impacts and a desire for infrastructure improvements to accommodate increasing traffic associated with CVO. Umwelt's 2020 socio-economic study notes that, since the 2018 NTSF dam wall breach at Cadia, the number of complaints relating to dust has increased significantly. Between July 2013 and December 2021, 51.7% of complaints related to dust. The vast majority of these complaints were made in the 12 months following the dam wall breach (Umwelt, 2020).

The top five environmental and social concerns raised by community members, via survey in March and April 2022, during preparation for the CCOP Social Impact Scoping Report included:

- Dust disturbance
- Increased traffic and travel times
- Conflicting land use and/or reduced land for agricultural use
- Noise disturbance
- Access and use of groundwater.

The most positive perceived benefit of the project related to employment opportunities followed by the expected subsequent economic contribution to the broader region (Umwelt, 2022)

2.2.1 Dust from tailings

The Cadia District Protection Group (CDPG) was formed following the emergence of public concern over environmental and health impacts of tailings storage at Cadia. The 2018 dam wall breach was reported in local media in 2019 and set off a series of complaints being made to Newcrest on the topic of dust emissions. Of particular concern is the community's perception of the severity of potential health impacts caused by ingesting dust particles from tailings (Logan, 2021). Media articles indicate that the uncertainty around the composition of the dust is the underlying issue. Figure 2.3 presents a photograph of the site showing tailings dust above a TSF.

Figure 2.3 Tailings dust above a TSF at Cadia. Photo: Sally Green

3 Site selection process

Newcrest recognises that tailings deposition technologies and site selection are directly linked. Numerous factors were considered during the siting and design phases for the new TSF.

Figure 3.1 sets out the interrelationship between three most critical site selection considerations for a new TSF.

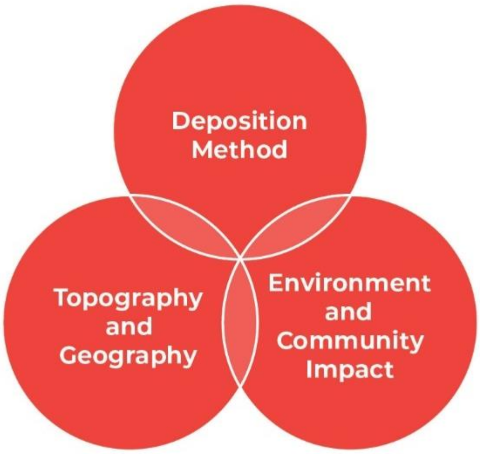

Figure 3.1 Interrelated TSF siting considerations

- Topography and geography inform the possible foundation issues and limitations to embankment and TSF construction.
- Deposition method is often a continuation of the previously used method or a change, brought about by technological improvements or industry demands.
- Environment and community impact affect site and tailings deposition method selection, it is preferrable to select sites and deposition methods that limit impacts to the environment and community.

3.1 TSF location requirements

The site selection process for a new TSF typically starts with the following design requirements:

3.1.1 Technical requirements

The technical requirements for a new TSF typically are:

- Capacity for tailings storage to meet the remaining LOM;
- Selection of a suitable site(s), both topographically and geotechnically;
- Suitable TSF construction methods;
- Appropriate technical risks associated with these construction methods, execution and long term stability; and
- Consideration of the capital and operating costs of the TSF construction methods.

3.1.2 Social and environmental

The social and environmental requirements seek to limit:

- Minimisation of the disturbance areas and biodiversity impacts;
- Minimisation of noise and dust emissions associated with operation of the TSF;
- Minimisation of impacts on existing water bodies – both quality and quantity.
- Minimisation of impacts to the visual amenity of neighbouring landholders.

3.2 Earlier studies

The following sections provide a brief overview of the earlier TSF location studies, the considered locations are shown in Figure 3.2 (the red dotted boundary indicates the proposed CCOP boundary). The intent was to identify alternative sites within Cadia mining lease, mindful of the productive farming land surrounding Cadia and the impact a new TSF would have on the community, though sites located outside of the lease were also considered, predominately in the interests of due diligence.

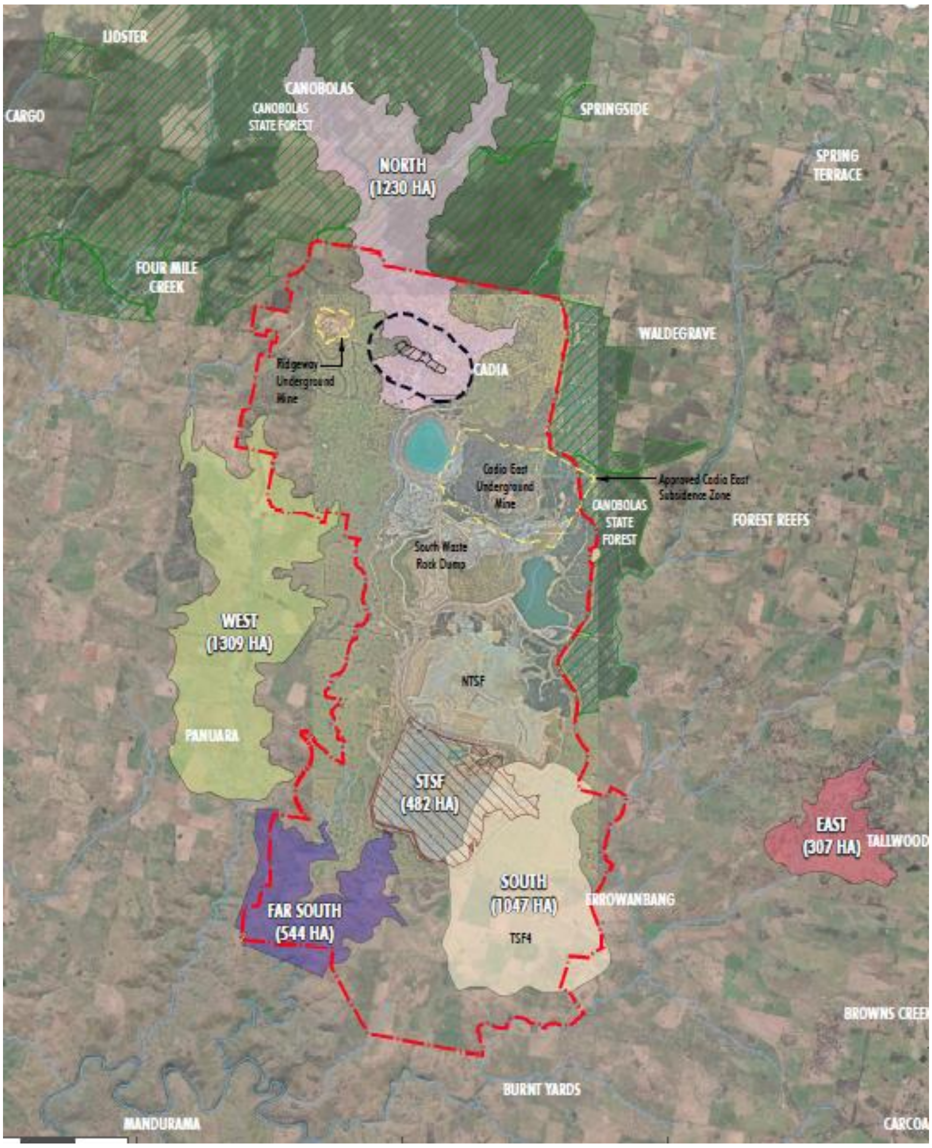

Figure 3.2 TSF sites studied since 2005 (Newcrest Mining Limited, 2023)

3.3 URS 2005-2006

The first study commissioned by CVO in 2005 by URS was based on a tailings production rate of 25 Mtpa[3], looking at all or part of this output going to the new TSFs, with the balance to be sent to the NTSF and STSF (URS, 2005). The 2005 study was subsequently further refined to develop some of the preliminary concepts to PFS level in 2006 (URS, 2006).

3.3.1 Study scope

URS sought to identify potential locations for future tailings storage facilities to accommodate the predicted tailings generated by the processing of Cadia East ore, approximately 830 Mt of dry tailings. URS provided indicative costings for the locations identified and listed alternative tailings storage locations. The study quantified the predicted maximum capacity of the NTSF and the STSF in operation at the time.

3.3.2 Tailings disposal methods

The methods considered were:

- Conventional (thickened) slurry – as operated for NTSF and STSF: tailings leave the process plant in a slurry with a slurry solids concentration of at about 25% w/w. Conventional or high-rate thickeners are used to thicken the slurry to a 55% solids concentration and this is then pumped to the TSF using conventional centrifugal pumps for transport and deposition. Processing was considered to be straightforward, as it would be as per the existing system in place for NTSF and STSF. The conceptual study was focussed on this option.

- Central thickened discharge: thickening the tailings (with reference to conventional slurry) to typically 60% to 65% solids concentration and depositing from a central deposition point within the basin, towards the perimeter embankments, resulting in a cone-shaped deposit of tailings. The main constraint which led to exclusion of this option is the lack of space for tailings disposal as central thickened discharge. This option was therefore not further explored.

- Paste: for the purpose of URS studies, 'paste' system referred to relatively dense tailings streams with a 'paste' consistency (i.e. increased solids concentration, minimum of 65%). The report indicated that paste systems are often associated with relatively low tailings generation and high capital and operating costs. The estimated tailings generation rate of 3 000 tonnes per hour (at the time of the report) at Cadia East was one order of magnitude higher than what was indicated in the available literature. Combined with the anticipated relatively high costs, paste was not considered a feasible option and was not elaborated further.

- Underground disposal: this option comprises disposal of tailings into existing underground voids. The report stated that there was no existing underground void at Ridgeway which could provide sufficient storage volume for the 800 Mt of dry tailings to be generated. This option was therefore not further explored.

- Subsidence void disposal: similar to the underground disposal, this option considers tailings discharge into underground voids formed by mining operations. The anticipated underground extraction was in the order of 17 Mm^3[4], which would be equivalent to less than 25 Mt of dry tailings, being much less than the anticipated 800 Mt of dry tailings to be generated. This option was therefore not further explored.

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3 Megatons (1 000 000 t) per annum

4 Mega m^3 (1 000 000 m^3)

- Co-disposal with waste rock: this system consists of disposal of coarse mine waste (cobbles and boulders) similar to a landfill operation, with concurrent disposal of tailings slurry. The report indicated a much larger anticipated volume of tailings, in comparison to that of waste rock, making it unfeasible to implement a co-disposal operation. However, the report indicated that waste rock and tailings storage concepts should be discussed in conjunction, in order to identify possible synergies.
- In pit disposal: this option consists of discharging the tailings into excavated pits at which mining activities were undertaken (i.e. 'store the tailings where they came from'). The report considers which Cadia Hill void a candidate for this option, as Cadia Eat open cut pit cannot be used simultaneously for mining and tailings disposal. Nevertheless, Cadia East pit could be used for future developments at Cadia Valley.

3.3.3 Potential TSF sites

The 2005/2006 URS study found six potential locations as shown in Figure 3.3 and listed as follows.

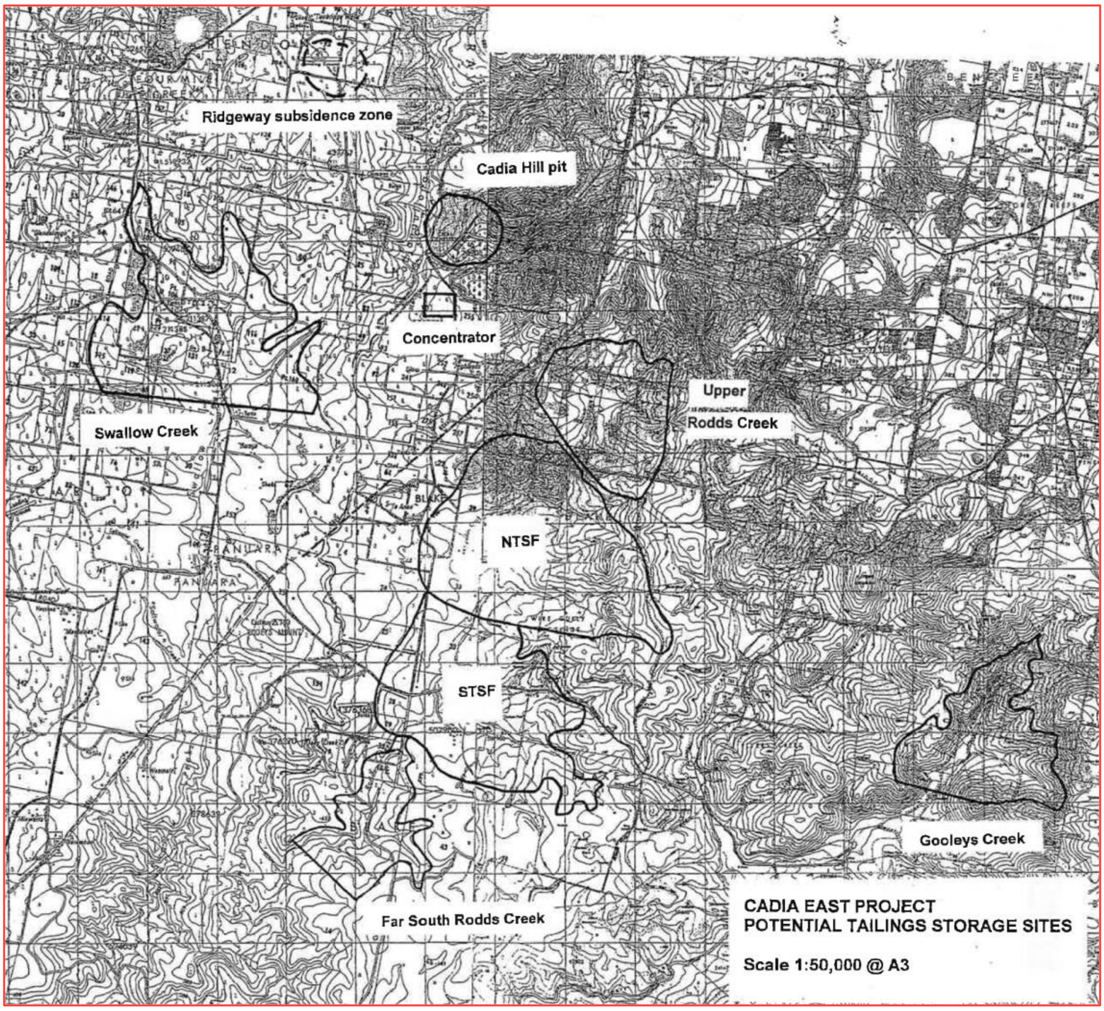

Figure 3.3 Early site location study (URS, 2005)

1. Ridgway subsidence zone
2. Swallow Creek
3. Far South Rodds Creek
4. Upper Rodds Creek
5. Gooleys Creek
6. Cadia Hill open cut.

In addition to the sites noted above, potential additional TSF sites were identified in the Cadiangullong and Flyers creek valleys. These sites were not further assessed, due to the presence of large upstream catchments, which would need diversion of flood runoff through or around the TSF, which would be expensive and difficult to implement.

3.3.4 Storage capacity outcomes

The storage capacity of the above-listed TSFs is presented in Table 3.1, where URS adopted an average dry density of 1.5 t/m³ when converting the storage volume to tonnage.

Table 3.1 URS study TSF capacities

TSF	CAPACITY (Mt)
NTSF	190
STSF	135
Ridgway subsidence zone	25
Swallow creek	285
Far South Rodds Creek	100
Upper Rodds Creek	150
Gooleys creek	360
Cadia Hill open cut	260
POTENTIAL COMBINED CAPACITY	**1,505**

3.3.5 Study outcome

The combined storage capacity of the TSFs presented in the URS study would have been more than sufficient to meet the then LOM requirement, based on the following assumptions:

- The NTSF and STSF could be raised safely to the heights suggested by URS.
- The establishment of multiple TSFs would be acceptable, requiring a significant volume of rock for each of the TSF embankments.

However, the URS study further notes that:

- The efficiency of these TSFs would be generally poor, where efficiency is the ratio between the tailings storage volume and the embankment material volume.
- Some of the TSFs are located in new stream catchments, for which there would be potential environmental and regulatory hurdles associated.

It was considered that given the poor efficiency outcome, it was unsuitable to use multiple TSF sites. CVO concluded that the URS study did not yield a suitable site and technology solution to support future tailings requirements and that further options studies were required to select a site that met environmental, resource potential and community criteria.

3.4 Golder 2012

Engineering and consulting firm Golder Associates (Golder) was engaged by CVO in 2012 to carry out a TSF location study review.

3.4.1 Study scope

Golder was engaged to assess alternative sites for additional storage capacity for approximately 100 Mt of dry tailings, which would be required by 2030 (the date for which tailings operations at the mine were licensed) (Golder, 2012). This storage capacity was required in addition to the available capacities of NTSF and STSF when raised to their expected full heights (URS, 2005).

This arose from the increased tailings generation rate of 35 Mtpa, compared to the initially assumed generation rate of 27 Mtpa. The 100 Mt capacity was required over a period of approximately 12 years, resulting in a tailings generation rate of approximately 8 Mtpa (equivalent to the ramp up in production).

Though the additional 730 Mt (resulting in the total required storage capacity of 830 Mt of dry tailings to the LOM, refer Section 3.3.1) of dry tailings were not the main focus of the assessment, they were considered for potential longer-term requirements.

3.4.2 Tailings disposal methods

The studies considered the following deposition methods:

- Paste: thickened tailings to a 'paste' consistency, similarly to the method described in Section 3.3.2, but proposing a solids concentration of 68% to 70% w/w (or higher).
- Dry stack (filtered tailings): this method consists of a further step from tailings thickening undertaken for paste system and can dewater tailings to a solids concentration of more than 75% solids w/w, resulting in a filter cake that has to be moved on a conveyor belt or by truck.
- Hydrocyclone sand wall embankment: this system uses hydrocyclones which split the tailings into two fractions, being a coarser (underflow) fraction used to construct the confining embankments and a finer overflow fraction (sometimes referred to as 'slimes') that is stored behind the embankments. The hydrocyclone sands construction method allows for relatively steeper more stable outer slopes.
- Co-disposal with waste rock: similarly to the method described in Section 3.3.2, but considering tailings disposal into existing waste rock dumps.
- Central thickened discharge: as described in Section 3.3.2.
- Conventional (thickened) slurry: as described in Section 3.3.2.

3.4.3 Potential TSF sites

The potential TSF sites identified by URS (URS, 2006) were reassessed by Golder in 2012 (Golder, 2012). The TSF sites considered are shown in Figure 3.4 and are as follows:

1. Ridgeway void and underground
2. Copper Gully
3. Cadia creek (Cadiangullong)
4. Cadia Open Cut Pit
5. Rodd's Creek dam
6. Cadia East
7. Waste rock dump
8. Bundella Valley (Swallow Creek)
9. Far South Rodds creek
10. NTSF and STSF.

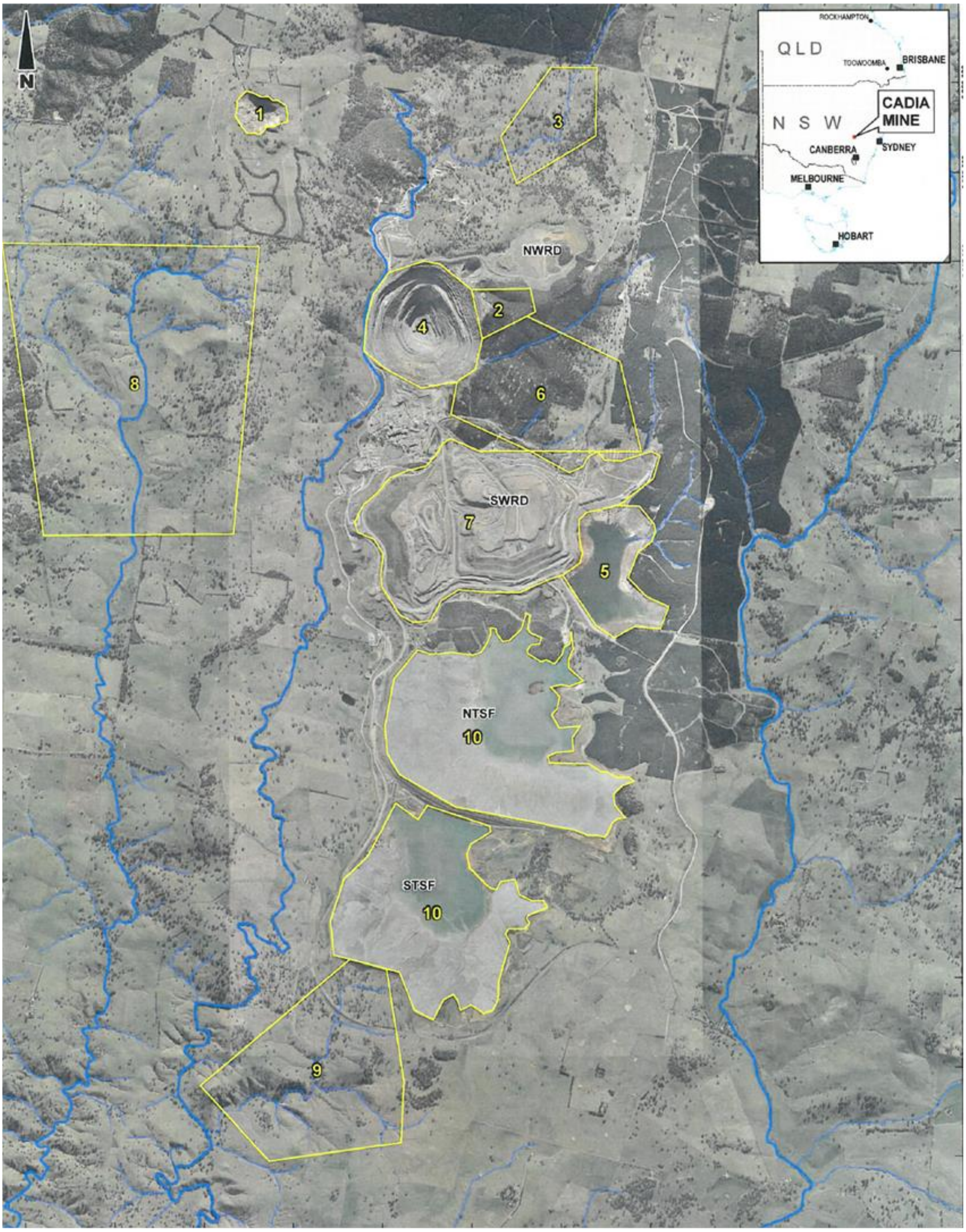

Figure 3.4 Potential TSF sites considered

3.4.4 TSF option ranking

The TSF options were ranked using a weighted semi-quantitative method, which allowed for the identification of a shortlist of the following options:

1. Use the existing NTSF and STSF by converting to thickened tailings (high density with central discharge or paste).
2. Place tailings into the Cadia Pit as a paste.
3. Place tailings as a paste into the subsidence zone above the Cadia East workings.
4. Convert Upper Rodd's Creek Dam into a supplementary TSF, establish a new process water storage dam and continue deposition into all three facilities with tailings as a thickened slurry.
5. Convert the existing TSFs into facilities with hydrocyclone sand wall embankment, potentially accommodating a higher volume of material within the same footprint area.
6. Construct a new TSF to the south of the STSF – the "Far South Rodd's Creek TSF" and operate in tandem with the NTSF and STSF, assuming slurry tailings deposition (58% to 62% by mass).
7. Discharge of tailings into existing waste rock dump (WRD) Pit 1 and Pit 2.

3.4.5 Storage capacity outcomes

The tailing storage capacities of the options studied by Golder as of 2012, all for a conventional thickened tailings slurry, are shown in Table 3.2, based on a 1.5 t/m³ average stored dry density for the tailings.

Table 3.2 Golder TSF ranking outcomes

OPTION	CAPACITY (Mt)
1 – NTSF & STSF	497
2 – Cadia pit (PTSF)	237
3 – Cadia East subsidence	320
4 – Upper Rodd's Creek Dam – raised	120
5 – Existing TSFs with hydrocyclone sand wall embankments	~497
6 – Far South Rodd's Creek	264
7 – Waste rock dumps	75
POTENTIAL COMBINED CAPACITY	**2,010**

The caveats for the TSFs presented in Table 3.2 from this assessment are:

- Assumed NTSF and STSF can be raised safely to their full heights.
- A tailings slurry could be pumped into the Cadia East subsidence without causing life-threatening mud-rushes underground – though this was later proven not to be correct, mud rushes/flows into pits were a critical risk.
- An alternative water dam could be constructed to replace the Upper Rodd's Creek Dam and it could be successfully raised – previous studies undertaken identified that the two preferred locations for construction of additional water dams at the site were the Lower Cadiangullong Creek and the Lower Rodd's Creek sites.

3.4.6 Study outcome

Despite most alternatives providing sufficient storage capacity for the additional 100 Mt (except for Option 7), not one single tailings facility would be able to accommodate the total additional tailings of 830 Mt to the LOM. A combination of options would need to be considered. As such, it was concluded that the options presented in the 2012 Golder report did not adequately meet CVO's technical requirements.

3.5 Golder 2016 to 2018 studies

3.5.1 Initial study scope

In 2016 Golder investigated storage capacity options for an increased total tailings output of 960 Mt delivered at a rate of 32 Mtpa for 30 years. This study re-considered the sites identified in previous studies and extended the study area, in view of considerations of the previous study outcomes.

3.5.2 Tailings disposal methods

Only conventional thickened and dry stack tailings disposal methods were considered in the Golder 2016 study. Hydrocyclone sand wall embankment was not considered as it had not been previously used in Australia for the construction and operation of TSFs.

3.5.3 Potential TSF sites

The following sites were considered for conventional thickened tailings (Golder, 2017a). These locations are shown in Figure 3.5.

- TSF1: Swallow Creek, north end
- TSF2: Swallow Creek, middle
- TSF3: Swallow Creek, south
- TSF4: South Rodd's Creek
- TSF5: Gooleys Creek.

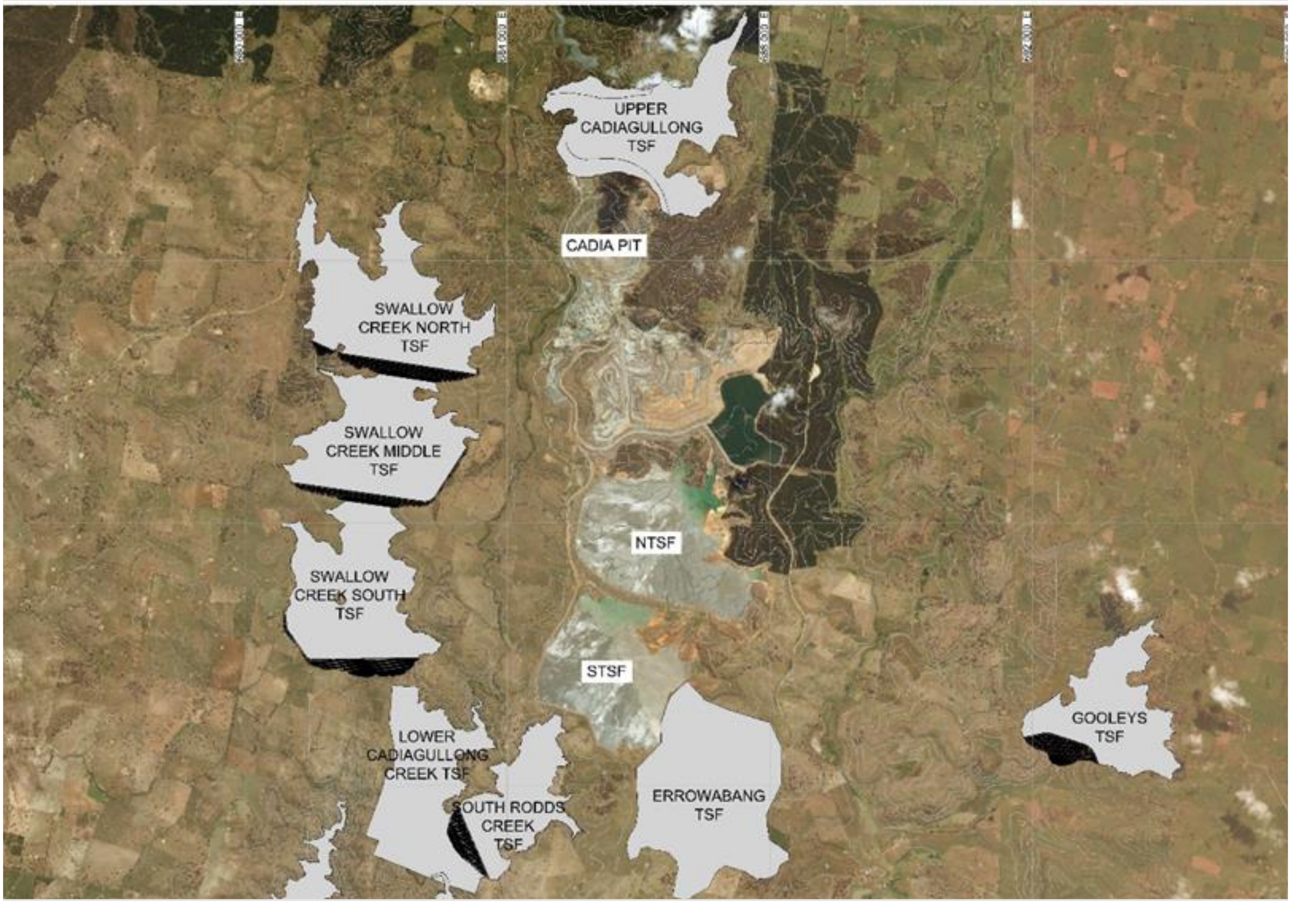

Figure 3.5 TSF sites considered in Golder 2017 studies

3.5.4 *Storage capacity outcomes*

The tailing storage capacities of the options studied by (Golder, 2017a), all for a conventional thickened tailings slurry, are shown in Table 3.3.

Table 3.3 TSF capacities

TSF	CAPACITY (Mt)	CAPACITY (M3)
Swallow Creek north	214.1	158.6
Swallow Creek middle	229.2	169.8
Swallow Creek south	133.6	98.9
South Rodd's Creek	94.3	69.9
Gooleys Creek	88.7	65.7
POTENTIAL COMBINED CAPACITY	**759.8**	**562.8**

The combined storage capacity of the proposed TSFs did not meet the LOM tailings requirement.

The option of dry stacking the tailings in the Swallow creek TSFs was also investigated and this provided about 167 Mt of capacity. However, the technical challenges constructing a dry stack across a valley counted against this option.

3.6 Wider site search

A decision was made by Cadia to carry out further site assessments to attempt to locate a LOM site for a TSF in the vicinity of Cadia (Golder, 2017b), outside and adjacent to its mining lease area. The search was extended to a 40 km radius around the mine, as shown in Figure 3.6.

The criteria used for this search included:

- Relatively flat ground area.
- Site not located on intensive agriculture land.

A single site was identified about 35 km to the west of CVO, in broad farmland. This site could only be regarded as suitable in theory and was not credible for a range of reasons, not the least of which was the cost and complexity associated with mitigating risk to the environment and rural enterprises at both the site and along the transport pipe corridor.

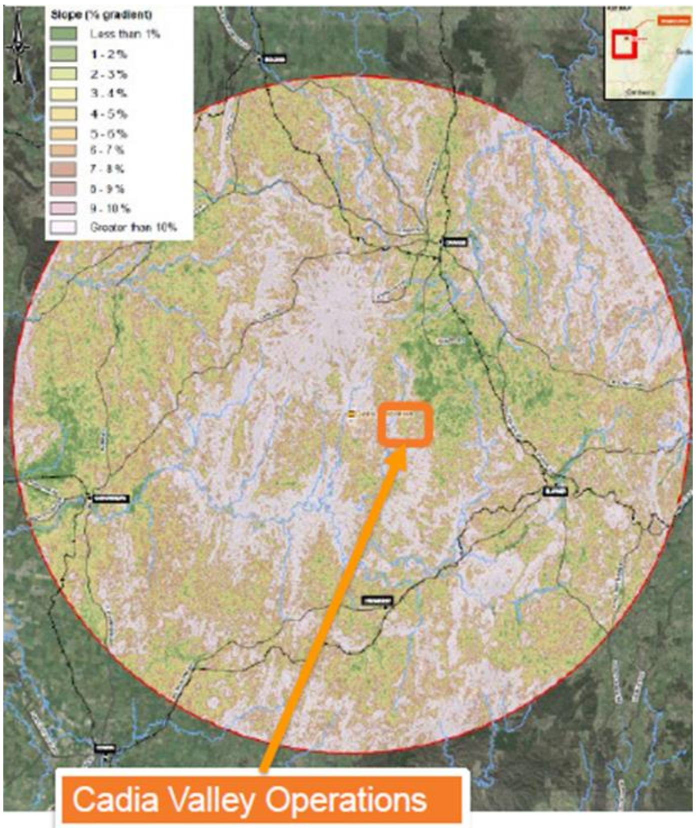

Figure 3.6 40 km radius TSF site search area

3.7 Alternative TSF site options

CVO then received a request from the Environmental Protection Agency (EPA) to assess feasibility of using existing pits/mine voids for tailings disposal. This conceptual study was carried out by Golder (2017c).

3.7.1 Ridgeway subsidence zone

The Ridgeway mine is some 8 km to the north-west of the two process concentrators and has a void volume of about 23.8 Mm^3, which would potentially store some 35.7 Mt of tailings, assuming an average placed dry density of 1.5 t/m^3. The life of this storage would be 1.1 years at the current full mine tailings output rate of 32 Mtpa.

The Ridgeway subsidence zone was not inspected, but it was assumed that it was intact and would be able to store wet tailings without a risk of flooding the underground mine or causing significant environmental harm, such as negative impacts on the local groundwater regime. These are significant assumptions and would need to be verified during any studies leading to a modification or approval. Note that, at the time of these studies, Ridgeway was not being mined and therefore was considered a siting option. Newcrest currently intends to recommence mining activities at Ridgeway and therefore it is no longer considered an option for tailings storage.

The following works would be required in order to use the Ridgeway mine for storing tailings:

- Installation of a new slurry pumping and delivery pipeline system.
- Installation of a return water pipeline.
- Installation of a power line to the pit to power the return water pumps.

This option was not considered further due to its very limited storage capacity and the high cost of providing the required infrastructure.

3.7.2 Ridgeway underground

The storage volume available in the Ridgeway underground workings is reported to be 1.8 Mm^3, which would store just 2.6 Mt of tailings at the same average dry density assumed above. Not only is the storage volume underground very small, the challenges with using this storage are:

- Obtaining safe access underground to install the required equipment and to manage the tailings deposition operation.
- Installation of a new slurry pumping and delivery pipeline system.
- Installation of a return water pipeline.
- Installation of a power line to power the return water pumps.

This option was not considered further due to its extremely limited storage capacity and the high cost of providing the required infrastructure.

3.7.3 Cadia Hill pit

The Cadia Hill pit, located close to the two concentrators, had a potential tailings storage volume of 185 Mm^3, about 278 Mt of tailings at an average stored dry density of 1.5 t/m^3. While the Cadia Hill pit is close to the Cadia East underground mine, the underground workings plan indicates that neither the pit nor underground mine is likely to be compromised. This pit would thus be suitable to receive tailings in a slurry form and is currently receiving the full tailings output until the STSF is recommissioned. The pit has a remaining life of about 4.3 years (as at June 2023) at a rate of 32 Mtpa tailings output rate.

3.7.4 Cadia East underground mine

The Cadia East block-caving underground mine has a substantial subsidence zone that is continually increasing and would seem to be an ideal repository for tailings. However, there is a substantial risk that any tailings placed into the void, whether as a slurry or filtered, would either flow down or be washed down by rainfall into the mine and cause a serious mud-rush that could lead to fatalities. The only way tailings could be safely stored in this void would be to form cemented briquettes, so that they would not disintegrate and cause a mud flow.

In view of this risk, the Cadia East underground mine was discarded as a viable tailings disposal option at this time.

3.8 Additional TSF sites and storage capacity

Following liaison with CVO, Golder (2018a) updated the capacity modelling undertaken for the sites identified in 2017 (refer Section 3.5), to consider revised embankment heights and more accurate survey, and considered additional locations.

The updated modelling indicated that only Swallow Creek North and Swallow Creek Middle satisfied the annual tailings generation, but the combined storage capacity still did not meet the LOM tailings requirement.

The additional locations considered are as follows:

- Cadiangullong
- Lower Cadiangullong Creek
- Belubula River
- Errowanbang

The estimated capacities of the additional sites are listed in Table 3.4.

Table 3.4 Additional TSF capacities

TSF	CAPACITY (Mt)
Cadiangullong	489
Lower Cadiangullong Creek	210
Belubula River	766
Errowanbang	234
POTENTIAL COMBINED CAPACITY	**1,699**

3.8.1 Study outcome

The combined storage capacity of these TSFs met the LOM tailings requirement, considering that:

- Cadiangullong and Lower Cadiangullong Creek TSFs would be located in new catchments, largely unaffected by mining activities at the time of the study.
- Errowanbang TSF was unlikely to affect any new catchments but was outside the mining lease.
- Belubula River TSF could only be regarded as an option in theory given the critical role the river plays in supporting local and downstream agricultural industries.

Most of the sites considered in the 2005-2018 studies had a limited storage capacity, so a combination of two or more TSFs would have to be operated simultaneously to meet the expected tailings output. In addition, these TSFs had a very limited tailings tonnage they could accept in their early years, due to the narrow valley topography and technical limits on rate of rise.

The TSF site options studies undertaken between 2005 and 2018 provided valuable insights (as described above) that led to CVO narrowing the list of final options to the Cadiangullong creek (North site, referred to as “Upper Cadiangullong TSF” in Figure 3.5) and the STSF Errowanbang (South site, referred to as “Errowanbang TSF” in Figure 3.5).

Additional studies were commissioned by CVO to test a range of disposal methods for each of the two chosen locations.

Further detail on this analysis process is provided in Section 3.9.

3.9 Golder 2018 to 2019 studies

In 2018, Golder investigated the Cadiangullong Creek site, known as the North site, and the Errowanbong site, known as the South site. These studies were provided in separate reports (Golder, 2018b) (Golder, 2018c).

In 2019, Golder prepared a single report (Golder, 2019), which included:

- A compilation of the findings from the 2018 reports.
- A range of geometries and combinations of disposal methods for the new TSF (both North and South sites).
- Options for extending the existing STSF.
- Information on the preparation and construction works required, as well as high level quantities associated with the works.

The tailings disposal methods considered in the Golder (2019) report were as follows:

- Conventional (thickened) slurry: similar to the method described in previous sections of this report.
- Paste: similar to the method described in previous sections of this report.
- Dry stack (filtered tailings): similar to the method described in previous sections of this report.
- Hydrocyclone sand wall embankment: similar to the method described in Section 3.4.2.

The only use of hydrocyclones for construction to date, in Australia, had been in the mineral sand dredge mining operations, where hydrocyclones were used to dewater the sands to re-construct sand embankments upstream of the dredge path. Hydrocyclone sand wall embankment is used widely in South and North America, a system dictated by law, to prevent liquefaction failures triggered by earthquakes. Hydrocyclone sand wall embankment TSF construction and operation was considered in subsequent studies in 2018, after Newcrest acquired a hydrocyclone sand wall embankment TSF in Canada. This acquisition provided CVO with a link to in-house operating experience and confidence in the method.

In total, 22 options are considered in the Golder (2019) report. A summary of the findings for the North and South sites are presented in Sections 3.9.1 and 3.9.2, respectively.

3.9.1 Cadiangullong Creek (North site)

3.9.1.1 Study scope

Golder investigated the Cadiangullong Creek site, known as the North site, as a potential TSF location and tested a range of tailings disposal methods for suitability.

The Cadiangullong creek site (North) is located immediately upstream of the Cadia Hill pit. Cadiangullong Creek flows around the pit in a diversion channel, flowing down from the water storage dam used to supply the Cadia mine, in a channel cut into the rock through the lower part of this valley. An earlier pit was excavated in this valley and was backfilled with random mine waste rock, there are also numerous mine infrastructure buildings and a disused farmhouse through the valley.

The valley is quite narrow in the lower elevations and only widens out at a height of about 80 m above the elevation at the outlet of the valley, north of the Cadia Hill pit. The creek rises further to the north, in land not held by Cadia, to the north of the Four Mile Creek road. A zoomed-in view of the site location is presented in Figure 3.7.

Figure 3.7 Cadiangullanong creek - North site (circled) (Golder, 2018b)

3.9.1.2 TSF configurations considered

The following configurations were investigated in the study:

1. Option N1 – Upstream, slurry: embankment constructed across the Cadiangullong Valley, just upstream of the Cadia Hill pit and located partly over a backfilled pit. This option has a 40 m high starter embankment and tailings slurry would be deposited from the embankment, with 3 m upstream raises to a final 110 m height (vertical height between lowest point on the downstream toe of the embankment and the crest).
2. Option N2 - Downstream, upstream slurry: 109 m high embankment constructed downstream across the Cadiangullanon valley, located raised over the backfilled pit. Tailings slurry would be deposited upstream from the embankment.
3. Option N3 - Upstream, central discharged paste: 42 m high starter embankment and then uses 3 m upstream raises to contain the paste tailings, raised to a final height of 112 m.
4. Option N4 – dewatered tailings, stack: dry stack constructed in two 50 m raises, the outer faces would be dozed to a 4H:1V slope (approximately 14° with the horizontal plan) and covered with a 1 m thick erosion and dust suppression rock-mulch layer.
5. Option N5 - Cadia Hill pit, downstream, slurry: the embankment is located downstream of the Cadia Hill pit and upstream of the Process Plant. The height of the embankment is restricted by the need to maintain a 15 m offset from the embankment toe to the Cadia Hill pit and the Process Plant. The embankment would be constructed downstream raised to a height of 66 m through the life of the facility.
6. Option N6A – North of old pit, downstream, slurry: located north of the backfilled pit in the Cadiangullong valley. This option utilises downstream raises of the embankment through life of the facility to 100 m final height.
7. Option N6B – North of old pit, downstream, slurry: similar to Option N6A, but with the embankment crest raised to a height of 129 m, to take advantage of the topography.

8 Option N7A – South of water dam, downstream, slurry: located immediately south of the water storage dam. This option has a 100 m high downstream raised embankment, tailings slurry would be deposited from the embankment.

9 Option N7B – South of water dam, downstream, slurry: similar to Option N7A, but with the embankment raised downstream to a height of 130 m.

10 Option N8 – North of water dam, downstream, slurry: located north of the water storage dam. This option has the embankment constructed downstream raised to 97 m through the life of the facility. Tailings slurry would be deposited from the embankment, with the decant pond located at the upstream end of the tailings beach.

11 Option N9 – South of water storage dam (WSD), Downstream, paste: located south of the water storage dam. This option has the embankment constructed downstream raised to 100 m through the life of the facility. Paste tailings would be deposited into the TSF from 3 discharge locations, creating an essentially down-valley beach slope, to increase its tailings storage capacity.

12 Option N10A – South of water dam, downstream, slurry: located south of the water storage dam. This option raises the embankment downstream to 100 m through the life of the facility. Slurry tailings would be deposited into the TSF from three discharge locations, creating a beach slope towards the embankment, to increase tailings storage. The decant pond would be located against the embankment.

13 Option N10B – South of water dam, downstream, slurry: south of the water storage dam. This option raises the embankment downstream to 120 m through the life of the facility. Tailings slurry would be deposited from two discharge locations up the valley, creating down-valley beach slope, to maximise tailings storage, with the decant pond held against the embankment.

14 Option N11 – South of water dam, downstream, slurry, 0.4% beach slope: located south of the water storage dam. This option raises the embankment to 100 m through the life of the facility with downstream raise. Tailings slurry would be deposited from the upstream of the facility with three spigot points, creating a down valley discharge structure, to increase tailings storage, using a 0.4% (the NTSF and STSF beach slope at Cadia, at the time of the study).

3.9.1.3 Advantages of North site

The main advantages associated with the North site were:

- The narrow valley results in reduced construction quantities for embankment.
- The site is within 5 km of the process plant.
- The site is located relatively further from neighbouring properties, compared to the South site.

3.9.1.4 Impacts associated with North site

There were many issues associated with the north site that eliminated it from further consideration, including:

- The land is forested area to the north of the site, implementing the TSF at this location would result in significant impacts to biodiversity and plant community species as well as fauna.
- The Four Mile Creek road would need to be relocated.
- Increases failure risk profile when compared with the South site, due to process plant downstream.
- High capital cost associated with sediment and runoff control infrastructure.
- Cadiangullong Dam WSD would need to be replaced.
- The embankment would be founded on loosely backfilled mine waste over the Cadia north pit.
- TSF footprint extended over the existing Cadiangullong Dam.

- A major diversion channel and drop-structure would be needed to carry runoff from the 90 km² catchment located upstream of the TSF, divert runoff around the TSF and deliver it to the Cadiangullong diversion channel around the Cadia pit, which would:
    - Require a major excavation into the rock to form the diversion channel.
    - Result in significant environmental impacts.

3.9.1.5 Study outcome

The early site layouts provided in the Golder concept design report (2019) indicated storage capacities varying between 76 and 937 Mt of capacity, as a function of the TSF configuration.

The North site option significantly contradicted several of CVO's agreed technical (failure risk, loose embankment foundation, relocation of Cadiangullong Dam), environmental and community (relocation of public road, disturbance of forested area and impact to biodiversity and plant community species, major diversion channel and drop structure to divert runoff from catchment area upstream, resulting in major environmental impacts) criteria and was discounted from further examination.

3.9.2 Errowanbang (South site)

3.9.2.1 Study scope

This study looks at the tailings disposal options on the Errowanbong (South) site valley, to the south of the Southern Tailings Storage Facility (STSF), a site that covers an area of about 1 000 Ha.

The South site is located immediately south of the STSF and is bounded to the east and south by Flyers Creek, with the lower Rodds Creek valley at the western end of this area. An overview of the site location is presented in Figure 3.8.

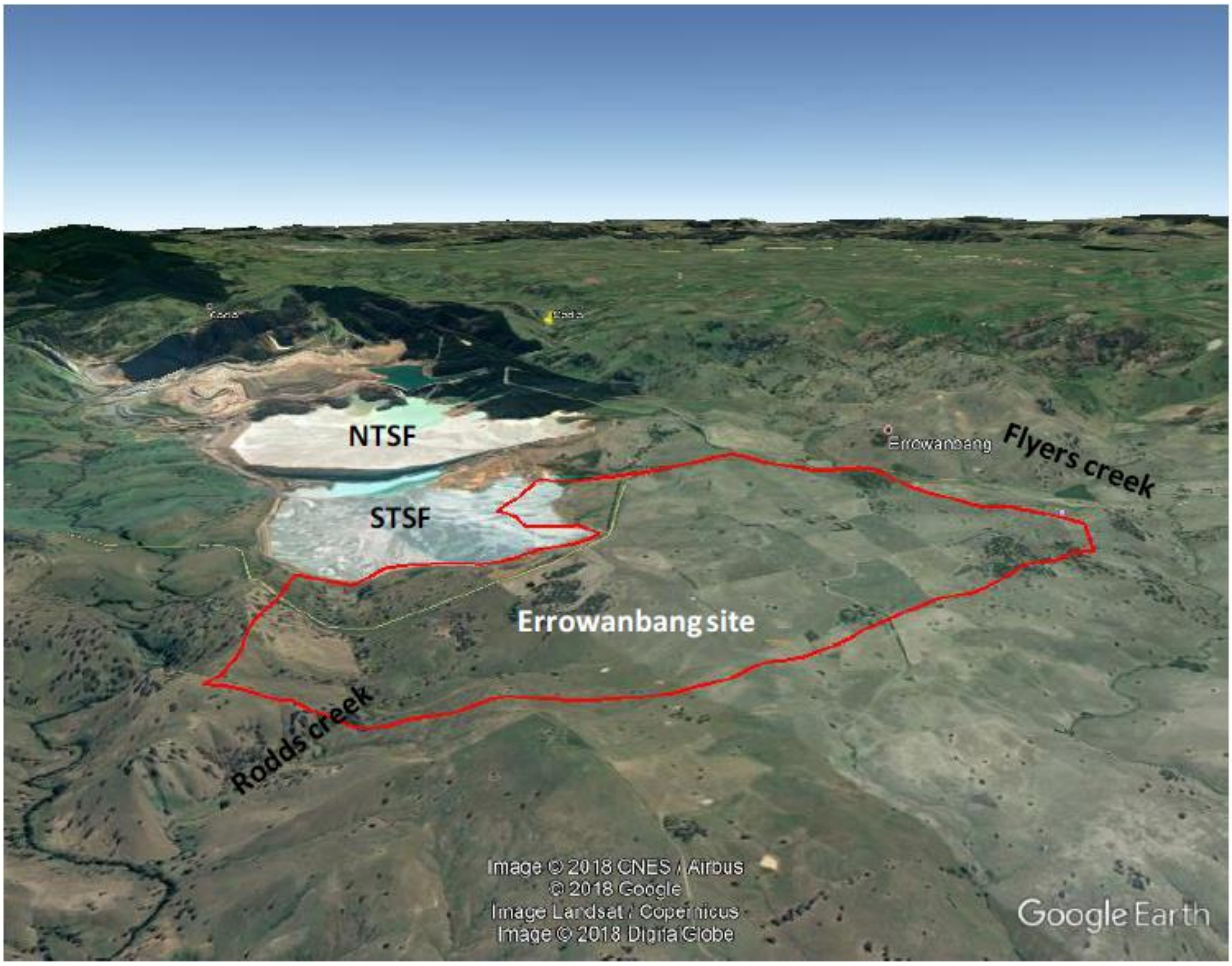

Figure 3.8 Errowanbang (South) site (Golder, 2018c)

3.9.2.2 TSF configurations considered

The following disposal methods were investigated in the study:

1. Option S1 – downstream, slurry: spigot slurry discharge from a 110 m high downstream constructed embankment, allowing the full 32 Mtpa tailings output to be deposited through the life of this TSF.
2. Option S2 – upstream, slurry: a 30 m high starter embankment with a series of 3 m high upstream raises to the maximum height of 100 m.
3. Option S3 – upstream, paste, southern embankment discharge: a 30 m high starter embankment with a series of 3 m high upstream raises to the maximum height of 100 m. Paste tailings are deposited from a single discharge location at the high point of the site on the north side of the TSF.
4. Option S4 – upstream, paste, central discharge location: centrally discharged paste, with a 30 m high starter embankment and 3 m high upstream raised embankments.
5. Option S5 – dewatered tailings, stack: Similar to Options S1, S2, S3 and S4, Option S5 is located in the Errowanbang Valley east of the STSF.
6. Option S6 – cyclone tailings, stack: located in the Errowanbang Valley east of the STSF, as are Options S1, S2, S3, S4 and S5.
7. Option ST1 – East extension, downstream, slurry: extension of the STSF to the east of the STSF, to fill a valley up to the crest of the ridge, to the same final elevation of the STSF (RL 702 m).

8 Option ST2 – East extension and raise, upstream, slurry: comprises six 3 m upstream raise of the STSF to RL720 m and includes the eastern extension presented in Option ST1.

We note that during this study, in 2018, the failure of the NTSF occurred and, as a result, TSF upstream raising was discontinued at Cadia.

3.9.2.3 Advantages of South site

Some advantages of the South site are:

- Adequate foundation conditions may be achieved.
- Most of the ground has a low slope of ±2.5%, falling from east to west.
- There is a very limited external catchment (it is within the current TSF catchment area and river system) and this runoff can be diverted relatively easily.
- There is a suitable location for a surface runoff sediment control dam in the lower Rodds Creek valley.
- Lower land disturbance, compared to the North site.
- Waterway impacts are negligible and no new catchment affected.

3.9.2.4 Impacts associated with South site

The main impacts identified to be associated with the South site were:

- All options would be visible, to some extent, to the landholders to the east, south and west.
- The footprint is adjacent to Flyers Creek.
- The Panuara and Meribah roads would need to be relocated.
- The site is about 6.5 km from the process plant.

3.9.2.5 Study outcome

The early site layouts provided in the Golder concept design report (2019) indicated storage capacities varying between 21 and 843 Mt of capacity, as a function of the TSF configuration.

The assessments undertaken indicated that the South site was the preferred option for expansion of tailings storage capacity.

3.10 Hatch 2019

3.10.1 Study scope

The objective of the 2019 Hatch Concept Study (CS) (Hatch, 2019) was to prepare a multi criteria assessment and detailed risk and cost assessments of the TSFs options identified during the previous studies undertaken, in order to confirm that the South site was the most suitable option.

3.10.2 Tailings disposal methods

The assessment considered the following tailings disposal methods:

- Conventional (thickened) slurry.
- Paste.
- Dry stack (filtered tailings).

- Co-mingling (tailings and coarse waste rock are mixed together within a storage facility or as a single discharge stream). Note that CVO no longer produces waste rock so this is no longer consider a viable option.
- Hydrocyclone sand wall embankment.

3.10.3 Potential TSF sites

The potential TSF sites considered were North, South, Far South, Far Far South, West Upper, West Middle, West Lower and STSF extension, as presented in Figure 3.9. These sites were later grouped as North, South, West and East.

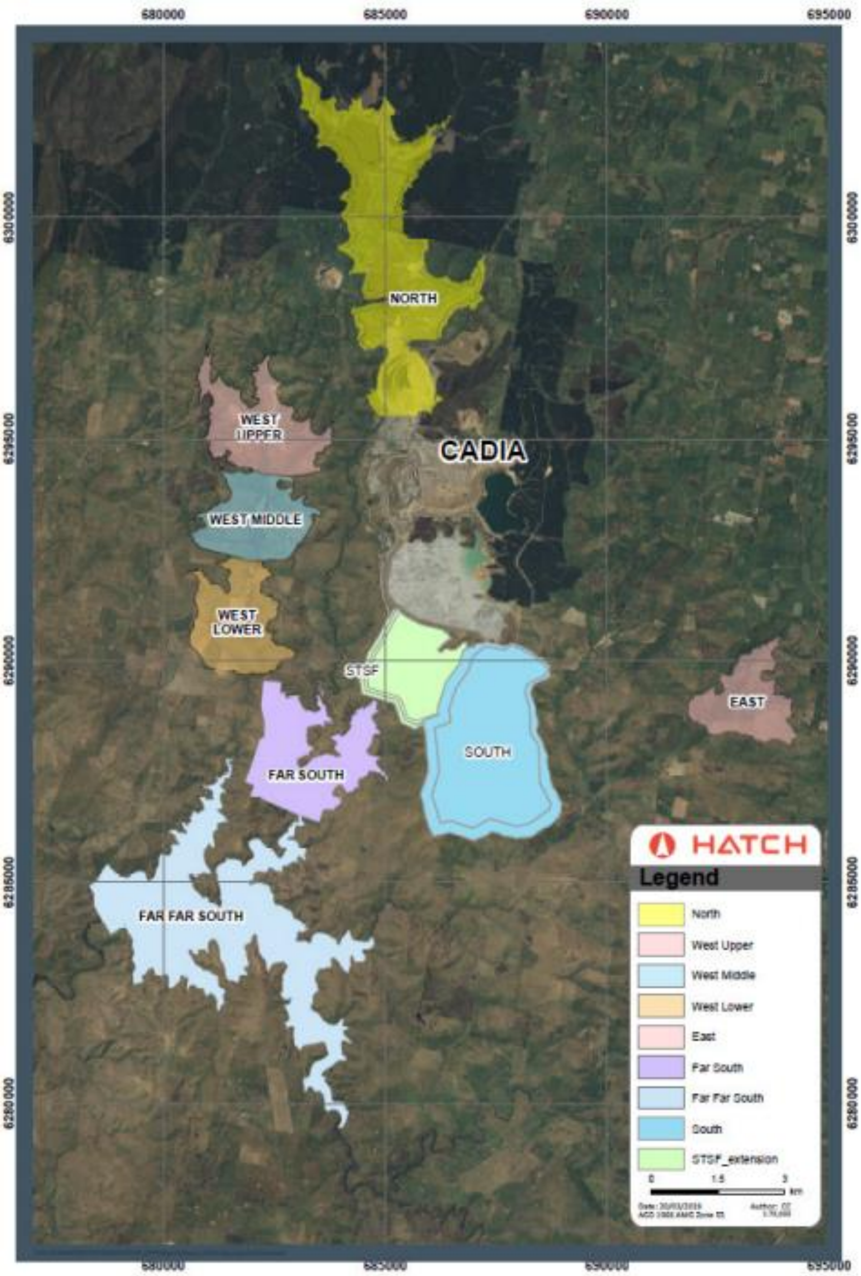

Figure 3.9 Locations considered for new TSFs (Hatch, 2019)

3.10.4 Multi criteria assessment

Hatch used the available information from previous studies undertaken and developed capital and operating costs for each of the options. Hatch combined these costs with the criteria listed below into a high-level multi criteria assessment (MCA) to select the most suitable sites and deposition methods.

3.10.4.1 Criteria considered

The criteria used for the high-level MCA comprised of:

- Geotechnical Failure Impact Consequence Catastrophic (GFICC): assesses whether potential TSF failure is catastrophic or not. Rating was independent of probability of failure, rather it was a function of the consequence if it occurred.
- Single or multiple TSFs required: based on whether the TSF could provide storage capacity to LOM tailings storage (approximately 700 Mt) and annual tailings generation rate (32 Mtpa). The criterion was rated either a 'YES' (the TSF meets both LOM and annual tailings rate) or 'NO' (the TSF option does not meet both LOM and annual tailings rate, therefore a secondary TSF would be required).
- Resource sterilisation: assesses whether there is a potential for coverage of unexplored mineral resources by the TSF, making them inaccessible and hence impractical to mine.
- Community and environmental acceptance: based on whether the TSF would be accepted by the community and environmental stakeholders or deemed unacceptable.
- Financial: considers capital costs (once-off initial investments to establish the facility) and operational costs throughout the life of the facility. Provides support information at a high level for decision. Further information on financial estimates is presented in Section 3.10.6.

3.10.4.2 Outcome

The assessment indicated that:

- Several TSF options could not meet the annual tailings generation rate and/or the LOM tailings storage requirements.
- All the East and West TSF options failed due to insufficient storage capacity and extreme environmental and community concerns associated with them.
- All North options assessed as part of the Golder (2019) study were deemed high risk and were eliminated, due to the following:
  - The consequence of failure of the TSFs located upstream of the Process Plant was deemed unacceptable. This has been defined in the context of the permanent presence of the downstream population at risk (PAR) at the Process Plant, in comparison to the presence of itinerant population downstream of the South locations.
  - The need for relocation of the water dam would result in major works.
  - The North site options would result in resource sterilisation, which was not acceptable.
- The only TSF options that satisfied all the 'YES' or 'NO' criteria were the South site options, being:
  - South conventional (thickened) slurry downstream raised embankment (Option S1 in Golder (2019)).
  - South conventional (thickened) slurry upstream raised embankment (Option S2 in Golder (2019)).
  - South dry stack (filtered tailings) (Option S5 in Golder (2019)).
  - South hydrocyclone sand wall embankment (Option S6 in Golder (2019)).
- The South conventional (thickened) slurry downstream raised embankment (Option S1 in Golder (2019)) was regarded as unfeasible due to extensive quantities of materials required for the construction works.
- The South sites associated with upstream embankments for conventional (thickened) slurry and paste have limited allowable rates of rise that do not meet the CVO production rates at the time. However, subject to the possibility of concurrent operation with the existing TSFs and the size of starter embankment, this option could still be viable.

As a result, only Options S2, S5 and S6 were considered worthy of further investigation.

The findings of this MCA are summarised in Figure 3.10, in which terminology is adopted as follows:

- Method:
  - ‘Wet’ refers to conventional (thickened) slurry and paste.
  - ‘Dry’ refers to dry stack (filtered tailings).
  - ‘Cyclone’ refers to hydrocyclone sand wall embankment.
- Construction:
  - ‘US’ refers to upstream raised embankments.
  - ‘DS’ refers to downstream raised embankments.
  - ‘NA’ refers to not applicable (relevant for dry stack deposition method).

LOCATION	NORTH			SOUTH				EAST			WEST		
METHOD	Wet		Dry	Wet		Cyclone	Dry	Wet		Dry	Wet		Dry
CONSTRUCTION	U/S	D/S	NA	U/S	D/S	U/S	NA	U/S	D/S	NA	U/S	D/S	NA
Geotechnical Failure Impact Consequence Catastrophic (GFICC) (Unacceptable)	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
Multiple TSF required to accommodate annaul or LOM tonnage	Y	N	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y
Resource Sterilisation	Y	Y	Y	N	N	N	N	N	N	N	N	N	N
Community & Environment Acceptance	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
Financial ($/t for LOM): $\frac{CAPEX + Total\ OPEX\ over\ Life}{Total\ Capacity}$	1.5	1.1	4.68	0.87	3.31	1.75	4.24	4.13	N/A	N/A	1.54	N/A	17.0
RECOMMENDED OPTIONS FAIL - A TSF Option is failed if the: GFICC = Y or, Multiple TSF = YES, or Resource Sterilisation = YES	**FAIL**	**FAIL**	**FAIL**	**Y**	**Y**	**Y**	**Y**	**FAIL**	**FAIL**	**FAIL**	**FAIL**	**FAIL**	**FAIL**

Figure 3.10 MCA of locations against high-level thresholds (Hatch, 2019)

3.10.5 Risk assessment

Risk assessment activities were undertaken to identify health, safety, environmental and community risks associated with establishing a new TSF. These activities entailed a HAZard IDentification (HAZID) workshop, a high-level project risk register and a detailed community and environmental review.

3.10.5.1 Main risks identified

The main risks related to health, safety, environment and community that were identified for the project are summarised in Figure 3.11.

No.	Risk Description	Inherent Rating	Current Rating	Target Rating
6	Environmental impact of project	8 - High	8 - High	12 - Medium
7	Permits not granted s required	M7 - Material Risk (Action Required)	M7 - Material Risk (Action Required)	M9 - Material Risk (Ongoing Control)
8	Inability to acquire required land	M7 - Material Risk (Action Required)	M7 - Material Risk (Action Required)	M9 - Material Risk (Ongoing Control)
9	Embankment failure	M7 - Material Risk (Action Required)	M7 - Material Risk (Action Required)	M11 - Material Risk (Ongoing Control)
10	Community objection to project	M7 - Material Risk (Action Required)	M7 - Material Risk (Action Required)	M9 - Material Risk (Ongoing Control)

Figure 3.11 Summary of risks identified during project risk review (Hatch, 2019)

3.10.5.2 HAZID workshop

The HAZID workshop was held on 2 November 2018 and was facilitated by Allman Consulting Pty Ltd (risk consultant), with attendees from Hatch, Newcrest and Golder. A summary of the HAZID findings is presented in Figure 3.12, which shows a table of Current and Target ratings for hazards identified to be associated with combinations of the tailings disposal methods and potential TSF sites described in Sections 3.10.2 and 3.10.3. For example, 'Dry Stack North' has 29 'High' level risks, compared to a target of 23 High level risks in the Newcrest risk assessment tool.

	CURRENT RATINGS						TARGET RATINGS					
Option	Material Risk (Action Required)	Material Risk (Ongoing Control)	Extreme	High	Medium	Low	Material Risk (Action Required)	Material Risk (Ongoing Control)	Extreme	High	Medium	Low
Cyclone South		1	8	7	4	3				12	2	9
Dry Stack South		1	15	27	9	5			1	23	20	13
Dry Stack North		1	13	29	9	5			1	23	20	13
Dry Stack Upper West		1	13	29	9	5			1	23	20	13
Dry Stack Middle West		1	13	29	9	5			1	23	20	13
Dry Stack Lower West		1	13	29	9	5			1	23	20	13
Paste South		2	4	8	6	4				9	4	11
Paste North		2	4	8	6	4				9	4	11
Wet Upper West		1	8	6	3	2				12	2	6
Wet Middle West		1	8	6	3	2				12	2	6
Wet Lower West		1	8	6	3	2				12	2	6
Wet South West		1	8	6	3	2				12	2	6
Wet East		1	8	6	3	2				12	2	6
Wet South		1	8	6	3	2				12	2	6
Wet North – Option 1		1	8	6	3	2				12	2	6
We North – Option 2		1	8	6	3	2				12	2	6
Existing thickener			9	15	4	2				14	9	7
High density paste		2	2	9	6	5				7	4	13
High density filtered		2	11	20	7	6			1	15	15	15
Comingled waste		1	5	16	5	3				11	10	9
Split system		1	5	16	5	3				11	10	9

Figure 3.12 Current and target ratings for hazards associated with TSF options (Hatch, 2019)

3.10.5.3 Community and environmental review

Newcrest undertook a community and environmental review in November 2018, to identify potentially material issues and rank the options relative to these issues. The review was conducted during a workshop on-site attended by the Newcrest Study Manager, HSEC Manager and the Superintendent – Environment and Community Relations.

A snapshot of the key issues raised from the workshop is presented in Table 3.5.

Table 3.5 Summary of key environmental, community and capital impacts (Hatch, 2019)

	Preferred Locations			
Impact	West	South	North	East
Environment	New catchment (destruction of new creek ecology, required creek diversion.	Same catchment (no new creek diversion).	Same catchment (potential to use Forestry Land which is already degraded), features creek diversion.	New catchment (destruction of new creek ecology, requires creek diversion).
		Possible Endangered Ecological Communities (EEC).	Possible EEC.	Possible EEC.
	Prime agricultural land.	Prime agricultural land.		Prime agricultural land.
Community	Public road diversion – greater isolation for Panuara community.	Two directly impacted stakeholders.	Not directly visible to surrounding community.	Predominantly new stakeholder community – no previous relationship with Cadia, have formed an activist group to oppose the Flyers Creek Wind Farm with some success.
Capital Considerations	Land acquisition for footprint and buffer.	Land acquisition for footprint and buffer.	Land acquisition for footprint and buffer.	Land acquisition for footprint and buffer.
		Offset for EEC.	Offset for EEC.	Offset for EEC.
			Sacrifice Cadiagullong Dam.	
			Sterilises Big Cadia resources.	
Community/Regulatory Opposition (1 Low to 10 High)	10	7-8	4	10

3.10.5.4 Outcome

The assessments undertaken indicated that the North and South sites were preferred, as they were within the existing Cadiangullong Creek catchment that is already affected by Cadia. These sites were then considered for the Concept Study.

3.10.6 *Investment evaluation and financial analysis*

Hatch undertook an investment evaluation and financial analysis as part of the Concept Study, which included assessments of Capital Expenditure (CAPEX) and Operating Expenditure (OPEX), to support progressing towards a PFS.

3.10.6.1 TSF configurations considered

Following the MCA (refer Section 3.10.4) and risk assessment (refer Section 3.10.5) processes, the range of combinations between tailings disposal methods and potential sites was progressively filtered, based on considerations of functional adequacy, risk, community and environmental impact and cost.

This process led to the following list of limited TSF configurations, to be considered for the financial analysis:

- Option S2 – South site, conventional (thickened) slurry, upstream raised embankment.
- Option S4 – South site, paste, upstream raised embankment.
- Option S5 – South site, dry stack (filtered tailings).
- Option S6 – South site, distributed hydrocyclone sand wall embankment.
- Option S7 – South site, centralised hydrocyclone sand wall embankment.
- Option N9 – North site, paste, downstream raised embankment. Note that this was the only North site considered, given the outcomes shown in Section 3.10.5.2 – this option was deemed to have an acceptable level of risk to progress to the next step.

3.10.6.2 Investment outcome

The key findings from the TSF financial analysis were:

- On a cost and risk basis, only three options located in the South site were considered viable:
  - S5 - South Dry Stack
  - S6 - South Cyclone
  - S7 - South Cyclone
- The TSF required to fulfil the Cadia LOM was not within the current mine-owned land.

As previously stated in Section 3.9.2.2, upstream raising was subsequently dismissed as a viable option due to the 2018 dam wall breach at the NTSF.

3.10.7 *Study outcome*

In combination, the initial high-level MCA, the HAZID workshop, the community and environmental review, and the investment and financial analysis indicated that three options in the South site (Options S5, S6/S7) should be progressed to PFS stage. This conclusion is based on the following factors:

- Environmental: the South sites are situated within the same catchment meaning there is no new creek diversion, there is possible EEC and it is prime agricultural land.
- Community: the South sites are in proximity to two directly impacted stakeholders, including one landholder who owns four properties. The sites are subject to strong community attention.
- Capital: the South sites require land acquisition for footprint and noise impact buffer, and offsets for EEC.

The North site would include a new creek diversion, possible EEC, heritage issues, land acquisition for the footprint and the sacrifice of Cadiangullong Dam and sterilisation of Big Cadia resources. On balance, in contrast to the impacts identified for the North site, the South sites were considered to hold an acceptable level of risk to progress to PFS stage.

The findings from these analyses therefore informed the development of the PFS completed by Golder in 2021 (see Section 3.11).

This report acknowledges that the initial MCA undertaken by Hatch in 2019 did not use weighed criteria (it only included 'yes' or 'no' ratings, except for the cost assessment). Therefore, Newcrest and WSP (now incorporating Golder) undertook an additional MCA in 2023 applying a detailed weighting system in retrospect, which is presented in Section 3.11.

3.11 Golder 2021

3.11.1 Study scope

Following completion of the 2019 Hatch concept study, in 2021 Golder completed the PFS for one LOM TSF option located at the South site. This option was then termed TSF4 (Golder, 2021), which later became the STSFX. The approximate location of TSF4 is presented in Figure 3.13, the boundary of additional land purchased by Newcrest (the Knox property) is presented in orange.

The report included detailed engineering studies to a sufficient level to support the PFS, including preliminary geotechnical investigation, slope stability analysis, seepage analysis, assessment of liquefaction potential, freeboard assessment, deformation analysis, deposition plan, water management, consequence category assessment and risk assessments. One of the key outcomes of this study was to optimise the alignment of the TSF.

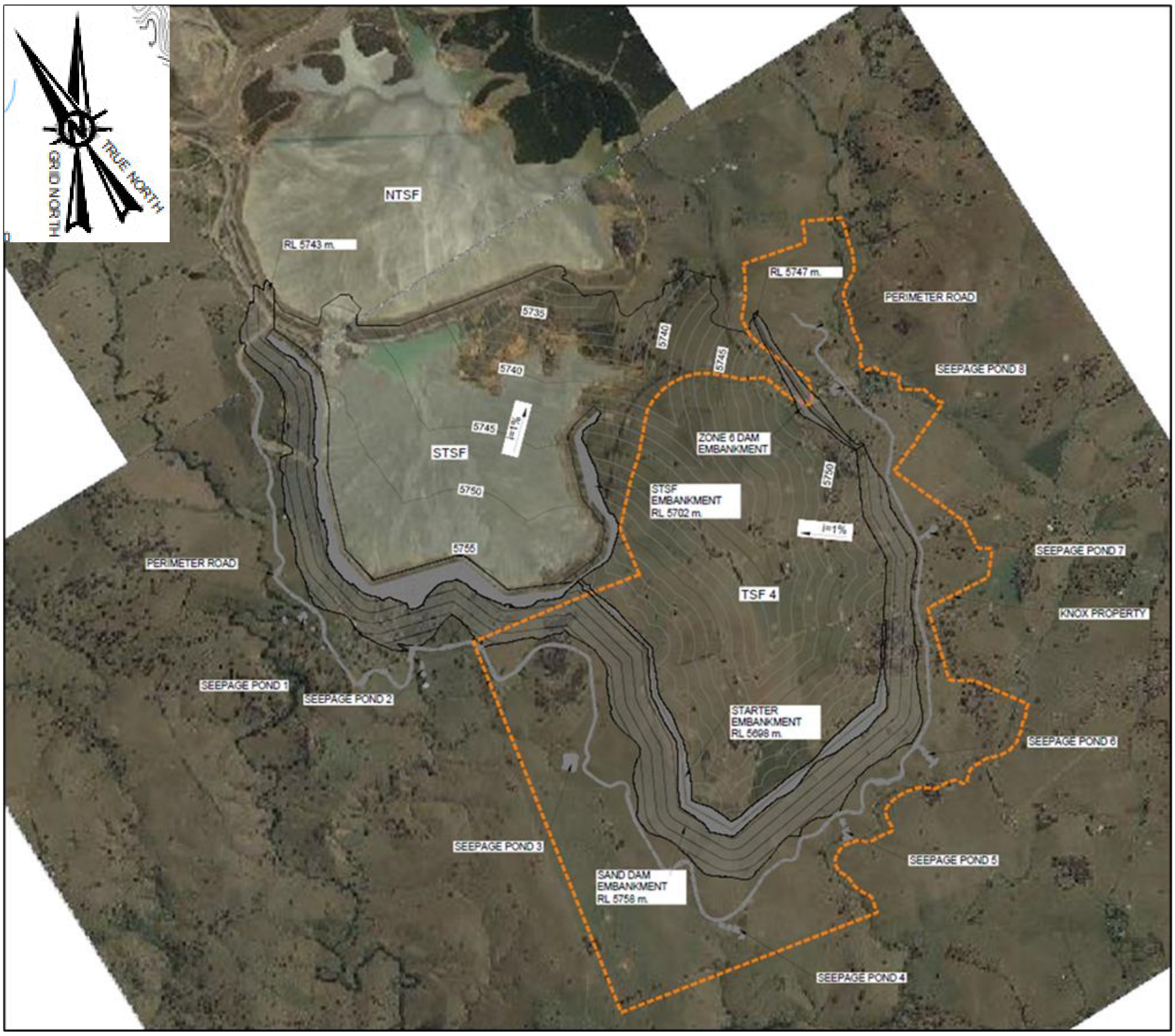

Figure 3.13 Approximate location of TSF4 (Golder, 2021)

The shortfall in tailings storage capacity considered in the report was equivalent to 1,084 Mt.

3.11.2 Tailings disposal methods

Four tailings storage options were initially considered as part of the PFS, which are outlined below. Note that a detailed description of the selection of the tailings deposition method is presented in Section 5.

1. Option 1 – Conventional (thickened) slurry.
2. Option 2 – Paste.
3. Option 3 – Dry stack (filtered tailings).
4. Option 4 – Hydrocyclone sand wall embankment, with a sand slurry (underflow) fraction at 70% solids content w/w and slimes slurry (overflow) fraction at 55% solids content w/w.

During the PFS:

- ATC Williams was responsible for the design of paste and thickened tailings TSFs.
- Golder was responsible for dry stacking and hydrocyclone sand wall embankment TSFs

- Wood was responsible for development of process and infrastructure to support above TSF options. Wood produced a consolidated PFS report that documented the above studies.

In the Golder 2021 study, dry stacking was initially considered, but it was not feasible from a technical or environmental perspective, so it was not progressed further. Further discussion about consideration of tailings disposal methods in included in Section 5. Therefore, the Golder 2021 study predominantly progressed Option 4, considering the centreline construction method, adopted based on initial estimates of sand availability.

3.11.3 Study outcome

The key outcome from the Golder study was the refinement of the TSF4 layout, away from properties to the east and Flyers Creek and Errowanbang woolshed. The TSF layout was also integrated with the STSF to minimise the overall disturbance area and limit the height of the facility.

Newcrest completed a review of the PFS documents prepared for TSF4. Following liaison with Newcrest stakeholders and consideration of the risks associated with each TSF option, Newcrest opted to further progress Option 4 (hydrocyclone sand wall embankment) for TSF4.

The Golder (2021) report provided a list of items that should be considered/investigated as the design progresses, ranging from operational parameters, design criteria, further investigations and site characterisation, design activities, construction planning, operations and governance.

3.12 Klohn Crippen Berger 2022

3.12.1 Study scope

The Golder (2021) report identified opportunities to improve the alignment of TSF4 embankment. During the PFS stage, it was also recognised that consultation with the community would be required prior to finalising the final alignment of TSF4 embankment. Following the announcement of CCOP, CVO then carried out consultation with the local stakeholders, to gather feedback on the alignment of TSF4 at its southern and eastern boundaries (Klohn Crippen Berger, 2022). From here on, TSF4 was referred to as 'STSFX'.

The final alignment for STSFX needed to be defined prior to advancing the feasibility studies (FS) design stage, to produce the environmental impact statement (EIS) and was required as an input for the design of adjacent structures (for example, realignment of Panuara Road) (Klohn Crippen Berger, 2022).

Acknowledging the importance of definition of the TSF4 alignment and the associated impacts, CVO engaged engineering consulting firm Klohn Crippen Berger (KCB) to undertake a MCA process to assess various alignment options considered for STSFX.

3.12.2 Multi-criteria analysis

Nine layout options were presented for consideration and considered for the MCA process. A modified version of Option 5 was also presented, referred to as Option 5A. The layout options considered are summarised in Figure 3.14.

Option #	Configuration Change from PFS
1	Realigned in northeast corner to avoid Cadia Road. Eastern embankment moved to west (further from residences to east).
2	As for Option 1 with western embankment moved to west into Rodds Creek Valley. Footprint retained within Project Area Boundary.
3	As for Option 1 with southern embankment moved ~2km north, away from residences to south. Overall footprint is reduced which increases TSF4 height.
4	Similar to Option 3 but southern embankment moved ~1km north.
5	Western embankment of Option 4 reconfigured to optimise storage and better align with proposed Panuara Road realignment and Project Area Boundary.
5A	Optimised configuration of Option 5 that removes embankment corners and more favourably follows topography.
6	Based on Option 5 with southwestern embankment extended into Rodds Creek Valley. Embankment follows Project Area Boundary.
7	Similar extent to Option 1 however the western, southern and eastern embankments are reconfigured to (a) remove corners, and (b) offset from proposed Panuara Road realignment.
8	Western embankment reconfigured to optimise storage within Rodds Creek Valley (outside of Project Area Boundary). Eastern embankment alignment.

Figure 3.14 Options considered for TSF4 realignment in the MCA and key change from PFS design (Klohn Crippen Berger, 2022)

The MCA process for STSFX alignment is outlined in Figure 3.15.

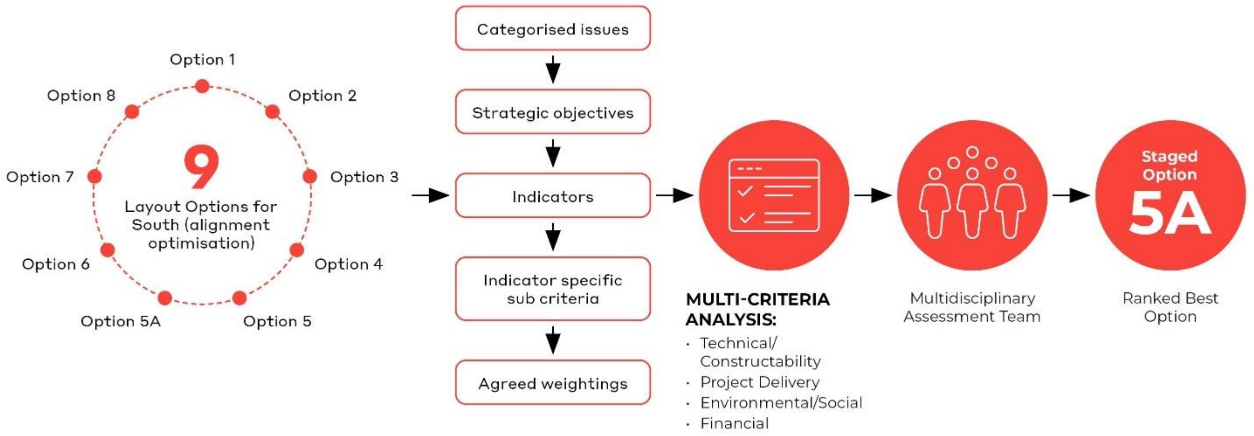

Figure 3.15 Multi-criteria analysis process

The MCA was conducted across two workshops in February 2022 and attended by KCB and Newcrest stakeholders. Each of the nine options was assessed against the evaluation criteria presented in Figure 3.16, as follows (Klohn Crippen Berger, 2022). The total MCA uses the evaluation criteria and goes through the process shown in Figure 3.16.

- Criteria were scored on a scale of 1 to 5 with a score of 1 denoting a lower preference / high constraint and a score of 5 indicating a higher preference / lower constraint. Scoring was conducted by subject matter experts for each discipline.
- Each evaluation criterion was assigned a values-based weighting: the weighting was first defined according to an individual's perspective on the relative importance of each objective / indicator against each other, then as a group, consensus was reached for each weighting.
- Weightings were assigned on a scale ranging from 1 (lowest importance) to 10 (highest importance). Sensitivity analyses were then applied to reflect the inferred priorities of different stakeholder perspectives that may not have been reflected in the workshops.

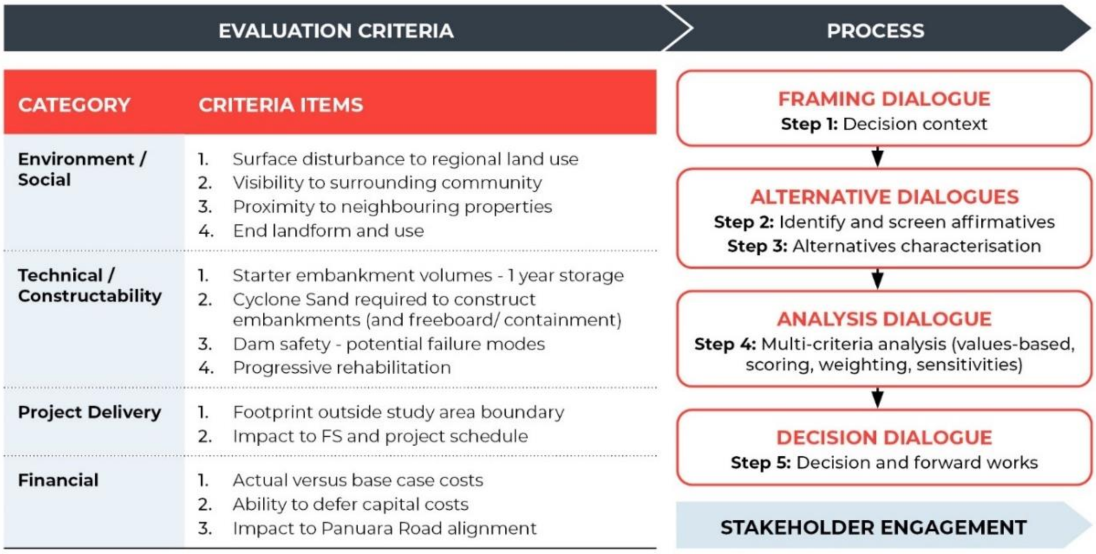

Figure 3.16 Multi-criteria analysis evaluation criteria

The above-shown process is then followed by a process of stakeholder engagement, leading to the confirmation of a TSF site, tailings disposal method and management system.

3.12.3 Consideration of environmental and community impacts

Newcrest appreciates the impact of ongoing operations at Cadia on surrounding neighbours and their livelihoods. The MCA included three key strategic objectives relating to environmental and social factors that informed the scoring and recommendation of the preferred layout option (Klohn Crippen Berger, 2022)

1. Reducing land disturbance – this was raised as a key concern for the community as larger surface areas within areas of higher agricultural value sterilises this area for future post-mining users.
2. Reducing height to improve visual amenity / closure landform aesthetics into surrounding landscape – this was raised as a key concern by the community and the NSW Government in relation to the dam wall height, stability, overall dam safety risk and the visual amenity of the dam wall on the surrounding landscape.
3. Avoiding proximity to the community / landowner dwellings to the east and west to mitigate potential impacts from visual amenity, dust and noise disturbance – raised as a concern from the community. It was noted that TSFs that are less likely to blend into the natural landscape at closure are less favourable.

Newcrest recognises that dust management is a critical component of the operation of STSFX. We will continue to listen to stakeholder concerns on this issue and ensure that dust particles in the air caused by tailings do not pose a threat to human health. Figure 3.17 details the community concerns and priorities that influenced the optimisation of the TSF layout that resulted in the selection of 5A.

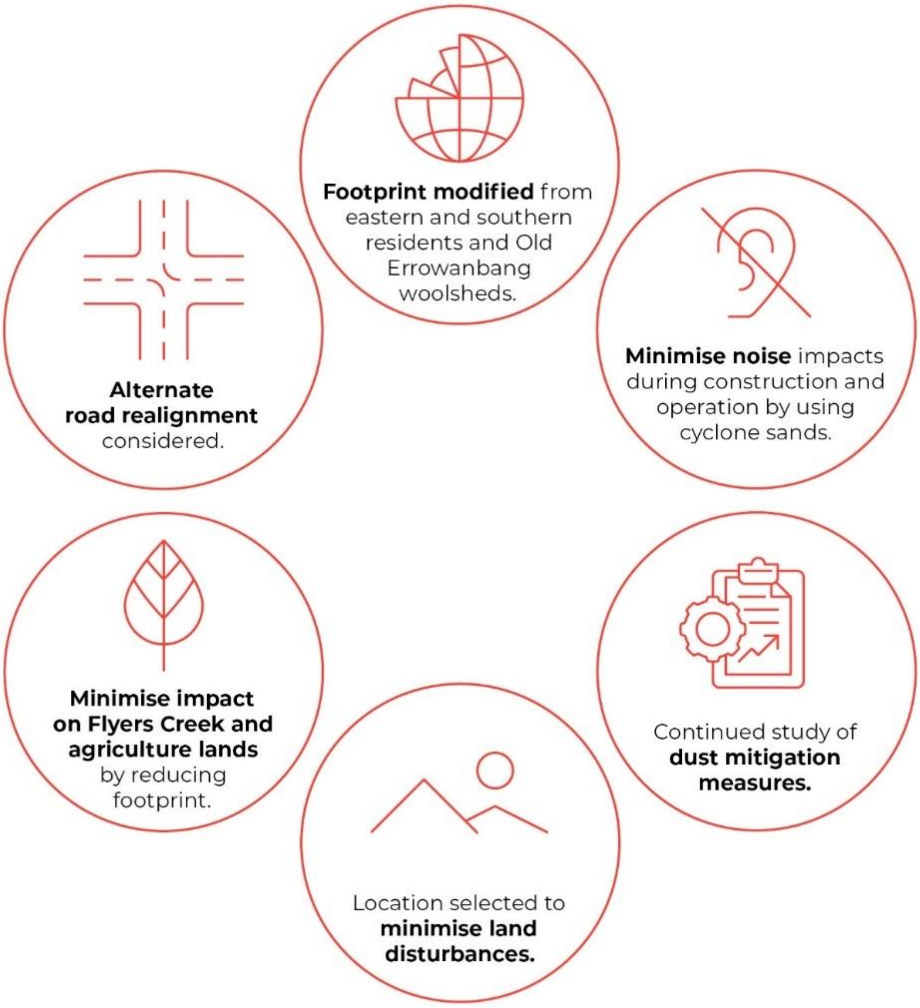

Figure 3.17 Community concerns and priorities

3.12.4 Study outcome

The MCA indicated that Option 5A was considered the preferred option to be further developed. Option 5A has the following characteristics:

- The smallest footprint of all the southern options.
- Greatest water efficiency.
- The lowest quantities of materials required for construction.
- Reduced energy consumption for operations.
- Reduced total tailings surface footprint to mitigate the risk of dust lift off.
- The highest crest of all options although lower than original concept design.
- The toe has been relocated further away from proximal neighbours to the east of State heritage areas.
- The ability to integrate with the existing STSF to minimise the overall footprint.

3.12.5 Feasibility study of Option 5A: Option 5B

Further to the selection of Option 5A, an assessment was completed to consider a staged approach to STSFX, referred to as Option 5B. The work undertaken considered a stage approach to extending the STSFX to the east and south as well as an alternative to raising the STSFX to a similar elevation to the current height of the NTSF. Option 5B FS design is currently being prepared by KCB.

The Option 5B includes two alternate footprints, namely Stage 1B and Stage 2, as illustrated in Figure 3.18. Stage 1B has a reduced footprint and is therefore the preferred option to be progressed. Stage 2 has an increased footprint with higher propensity for dust emanation, it is located closer to residents and mine lease boundary and has a higher direct impact on the environment (due to its larger footprint). The Stage 1B option is referred to as STSFX and is presented in Figure 3.19.

The STSFX will provide the following benefits:

- Reduced footprint reducing disturbance and biodiversity impacts;
- Reduced impacts from dust and noise on local community stakeholders;.
- Creates an integrated single facility with the existing STSFX and NTSFX reducing visual amenity for neighbouring landholders;
- Adjusts the facility to match the 25-year approval extension timeframes allowing all stakeholders to assess any future request for another facility at a time closer to the approval date. This includes the opportunity to utilise currently excluded locations (e.g.: Ridgeway and/or Cadia East subsidence zones) or currently underdeveloped technologies, to further reduce impacts.
- The potential for temporary or progressive closure and rehabilitation in areas where construction and tailings placement is complete.

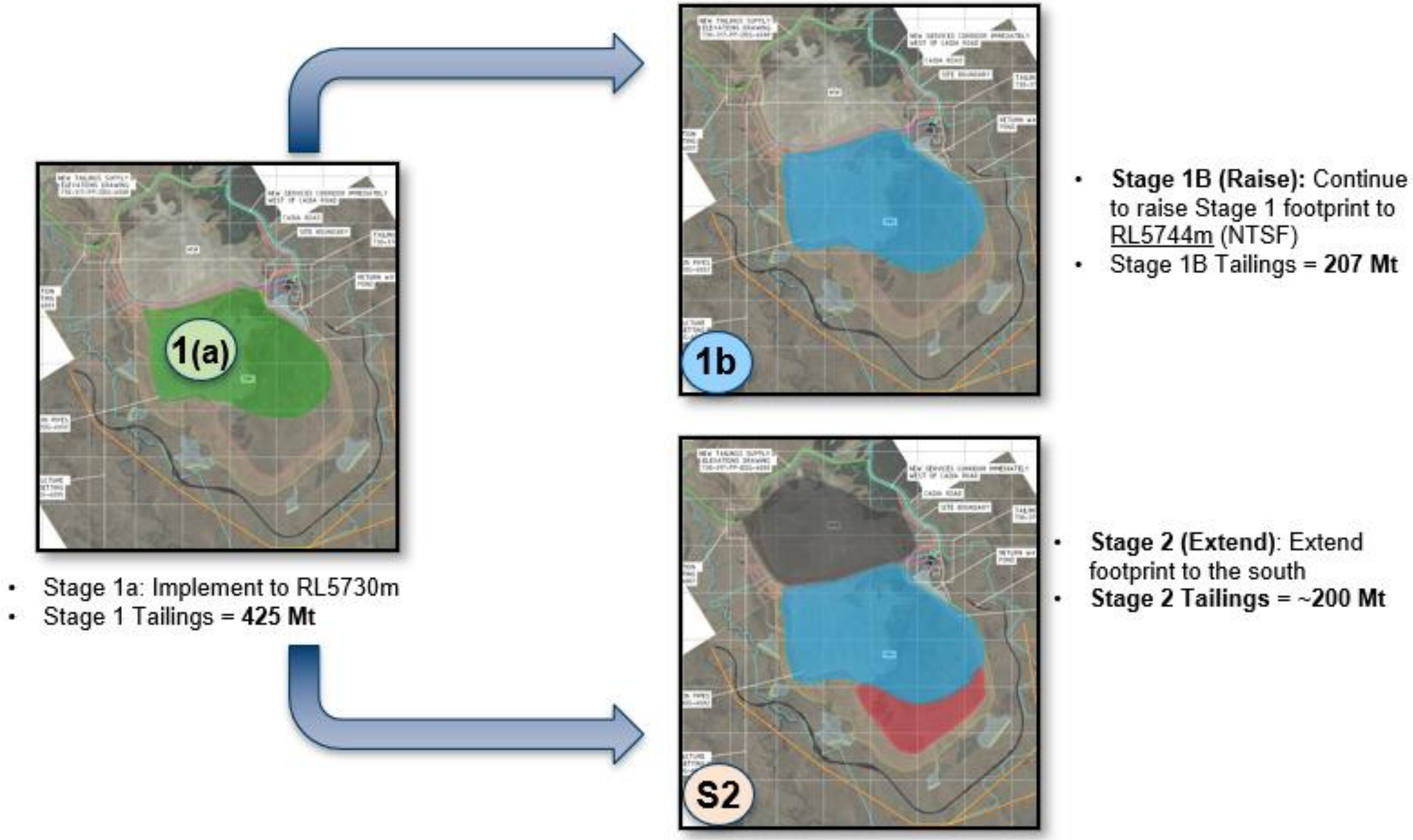

Figure 3.18 Comparison of Stage 1B and Stage 2

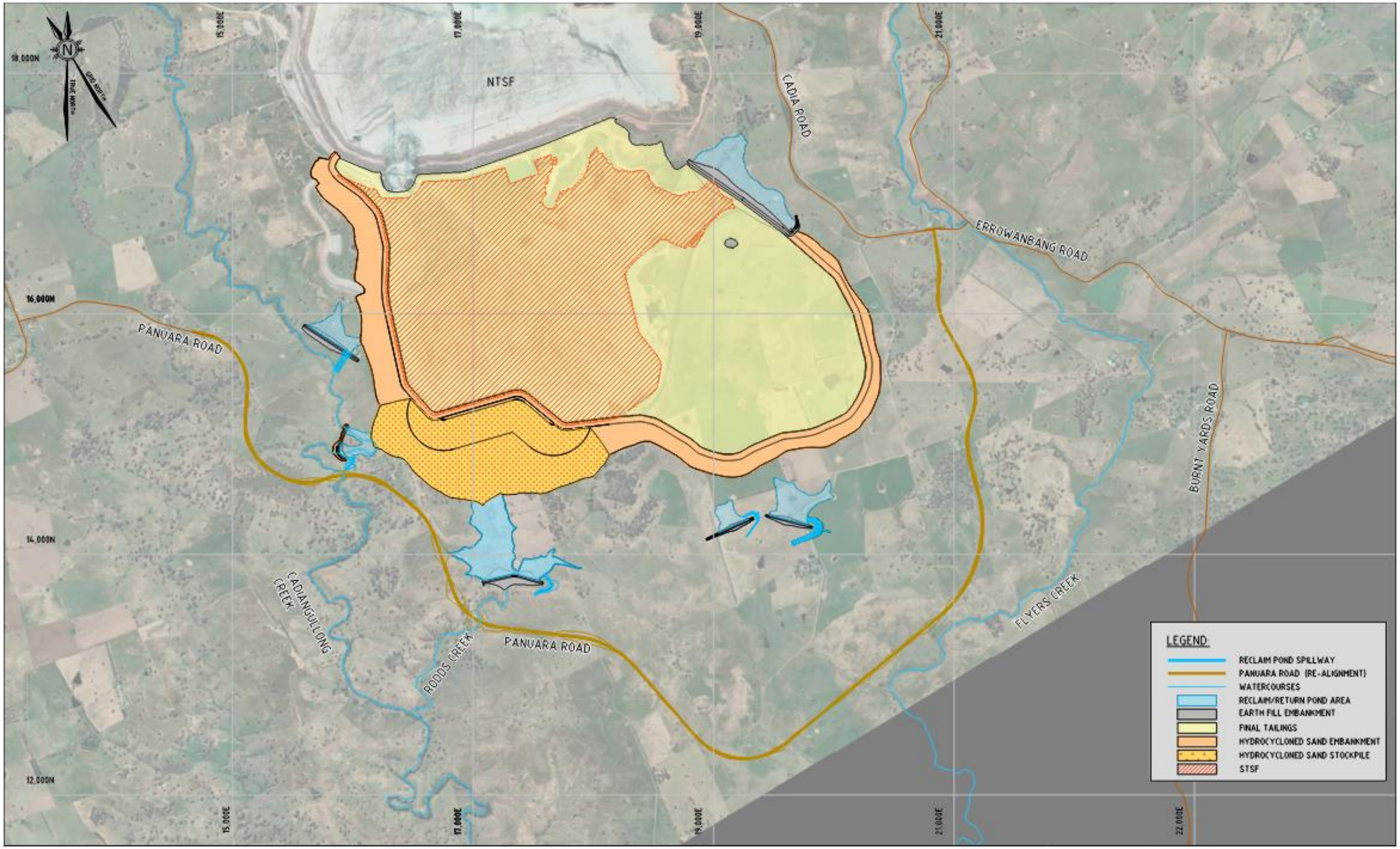

Figure 3.19 STSFX layout

4 Detailed multi-criteria assessment

4.1 Scope

The scope of the detailed Multi Criteria Analysis was to review for consistency the site selection and technology options aligned to the stated CCOP goals of minimising the impact of the facility on the environmental setting, reducing so far as practicable the impact on the local community and creating a facility that is fit for purpose and meets world best practice design principals.

To complete this scope Newcrest and WSP (now incorporating Golder) undertook an MCA, with the intent to:

- Consider semi-quantitative criteria (including weightings) for the site and tailings disposal options considered, based on risk assessments completed by Hatch in 2019.
- Align with GISTM's[5] Requirement 3.2, "For new tailings facilities, the Operator shall use the knowledge base and undertake a multi-criteria alternatives analysis of all feasible sites, technologies and strategies for tailings management (…)".

4.2 Assessment criteria

As previously stated in Section 3.10, the initial high-level multi-criteria assessment undertaken by Hatch in 2019 did not consider weighted criteria (it only included 'yes' or 'no' ratings, except for the cost assessment). For this assessment Newcrest and WSP adopted the same criteria from the Hatch 2019 study for consistency.

The criteria assessment included:

- Noise and fugitive lighting impacts
- Dust generation capacity
- Catastrophic foundation failure potential
- Embankment failure potential
- Visual amenity impacts
- Waterway impact potential
- Construction safety
- Facility capacity
- Life of Facility Cost

Each criterion had a descriptor for its scoring, to allow for relative assessment of each concept. For example, the hazard/criteria for 'dust generation' was broken into the following to allow for scoring:

Additional TSF surface area:

1 (worst): >1,000 Ha

2 (marginal): 900 to 1,000 Ha

3 (fair): 800 to 900 Ha

[5] Global Industry Standard on Tailings Management

4 (good): 700 to 800 Ha

5 (best): < 700Ha

Weightings for each criterion were applied as the inverse of the hazard rating from the Hatch study – for example, the dust generation criteria had a hazard rating of 5 – Extreme, and so the weighting is 1/5 = 20%.

Newcrest and WSP assessed each concept against the assessment criteria. Each concept was assigned a score between 1 and 5 for each of the criteria, where a score of 1 represents very poor potential to satisfy a particular criterion and 5 represents a very good potential to satisfy that criterion. The total score for each concept was calculated by multiplying the score for each criterion by its relative weighting, and then all individual criterion scores were then summed up to produce a total score, to allow for ranking of the options.

The options considered were as follows. The code in parentheses, for example (S5) are those adopted in the prior sections of this report as described below.

- Dry Stack South (S5): refer to Option S5 in Section 3.9.2.
- Dry Stack North (N4): refer to Option N4 in Section 3.9.1.
- Dry Stack Upper West (W1): refer to Swallow Creek, north end in Section 3.5.
- Dry Stack Middle West (W2): refer to Swallow Creek, middle in Section 3.5.
- Dry Stack Lower West (W3): refer to Swallow Creek, south in Section 3.5.
- Paste South (S3): refer to Option S3 in Section 3.9.2.
- Paste North (N9): refer to Option N9 in Section 3.9.1.
- Wet Upper West (W1): refer to Swallow Creek, north end in Section 3.5.
- Wet Middle West (W2): refer to Swallow Creek, middle in Section 3.5.
- Wet Lower West (W3): refer to Swallow Creek, south in Section 3.5.
- Wet South West (SW1): refer to South Rodd's Creek in Section 3.5.
- Wet East (E1): refer to Gooleys Creek in Section 3.5.
- Wet South (S1, D/S): refer to Option S1 in Section 3.9.2.
- Wet North - Option 1 (N6B, 242MT): refer to Option N6B in Section 3.9.1.
- Wet North - Option 2 (N10B, 635MT): refer to Option N10B in Section 3.9.1.
- Cyclone South (S7): south centralised cyclone embankment, refer to Option S7 in Section 3.10.6.1.

4.3 Assessment outcome

The results of the assessment are presented in Table 4.1.

Table 4.1 Detailed MCA

Site and technology option	Average score
Dry Stack South (S5)	666
Dry Stack North (N4)	480
Dry Stack Upper West (W1)	465
Dry Stack Middle West (W2)	440
Dry Stack Lower West (W3)	440
Paste South (S3)	742

Site and technology option	Average score
Paste North (N9)	587
Wet Upper West (W1)	615
Wet Middle West (W2)	632
Wet Lower West (W3)	632
Wet South West (SW1)	689
Wet East (E1)	692
Wet South (S1, D/S)	697
cWet North - Option 1 (N6B, 242MT)	520
Wet North - Option 2 (N10B, 635MT)	534
Cyclone South (S7)	857

The MCA indicated the following as the top three options, from the highest to the lowest ranking option:

1. Hydrocyclone sand wall embankment disposal method for the South site.
2. Paste tailings discharge with upstream raised embankments at the South site.
3. Slurry tailings discharge at the South site with downstream raised embankments.

The outcome was driven by the following key factors:

- The South site scores better than other sites, mainly on the basis of having more favourable foundation conditions (compared to the North site) and being within an already disturbed water catchment.
- The foundation conditions for a TSF at the North sites are not favourable, which lowered the scores for North sites.
- The dry stack options have the lowest scores predominantly due to their size, the risk of dust generation and their CAPEX. The three lowest scoring options in the MCA were dry stack options.

The MCA confirmed the hydrocyclone sand wall embankment disposal method for the South site as the preferred option for the project.

5 Tailings deposition selection process

5.1 Overview

There are two components to a tailings deposition system, namely:

1. The condition of the tailings when transported and deposited in the TSF
2. The method used to raise the TSF above the initial earthworks.

Tailings are generated for 24 hours per day and 365 days per year, with the exception of periodic plant maintenance periods. This continuous operating requirement for the deposition system needs to be considered when selecting the system to be used, especially the noise associated with the deposition system.

Assessment of the most appropriate tailings deposition method continued throughout the Concept and Pre-feasibility design phases of the project, between 2019 and 2021, associated with the optimisation studies which resulted in the selection of STSFX site, see Figure 5.1.

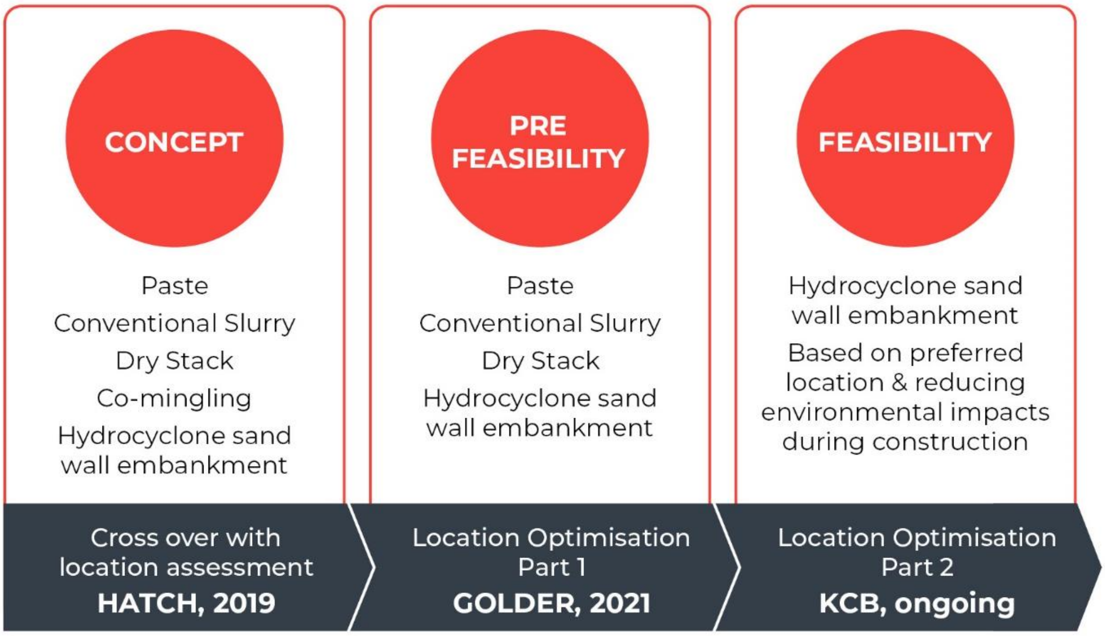

Figure 5.1 Deposition system selection process

In summary, all sites assessed between 2019 and 2021 considered the following deposition methods:

- Conventional (thickened) slurry – currently used at Cadia.
- Paste.
- Co-disposal with waste rock.
- Co-mingling.
- Dry stack (filtered tailings).
- Hydrocyclone sand wall embankment.

Some of the deposition methods were eliminated progressively through this process for the STSFX, leaving hydrocyclone sand wall embankment as the system considered the most appropriate to develop. The following sections summarise the characteristics associated with each deposition system and reasons for their elimination.

5.2 Thickened (conventional disposal)

The tailings leave the process plant as a slurry with a solids concentration of at about 25% w/w. Conventional or high-rate thickeners are used to thicken the slurry to a 55% solids concentration and this is then pumped to the TSF using conventional centrifugal pumps for disposal. This disposal technology requires that earthworks are used to construct embankments around the footprint of the TSF to contain the tailings. Waste rock is typically used at Cadia to form the required initial embankment and ongoing raises.

Thickening the tailings at the process plant before sending to the TSF recovers a significant percentage of the initial slurry water for reuse and reduces the size of the pumping system and the power requirements. Supernatant water is released by the tailings on settling and this water is also returned to the process plant for reuse.

It is recognised that the conventional disposal system offers the following advantages with respect to dust management:

1. The spigot deposition system can be manipulated to keep the tailings beach moist enough to minimise dust generation.
2. There is no dust from outer slope as this consists of erosion resistant rock.
3. The embankment construction activities are generally a daytime and weekday operation only, reducing noise generation from the site.

Thickened disposal was eliminated on the basis of needing some 220 Mm^3 of waste rock to construct the starter embankment and the ongoing embankment raises, requiring the opening of a substantial quarry to supply this rock – in essence a small open cut mine.

5.3 Paste

A deep tank thickener is used to produce a paste, typically with a solids content of 65% w/w or greater. A paste generally has to be pumped to the TSF using positive displacement pumps, as it can have a consistency of toothpaste. Embankments are also required to contain the deposited paste tailings, similar to those required for the thickened tailings.

The paste pumping system recovers more water for reuse at the thickener than the conventional system, but requires more power to drive the paste to the TSF, where there is no supernatant water to recover.

It is recognised that the paste disposal system offers the following advantages with respect to dust management:

1. A crust forms on the top of the paste beach, limiting dust generation.
2. There is no dust from outer slope as this consists of erosion resistant rock.
3. The embankment construction activities are generally a daytime and weekday operation only, reducing noise generation from the site.

Paste disposal was eliminated on the basis of also needing some 220 Mm^3 of waste rock to construct the starter embankment and the ongoing embankment raises, requiring the opening of a substantial quarry to supply this rock – in essence a small open cut mine.

5.4 Co-mingling

Co-mingling is being used in the coal mining industry to dispose of their tailings. In this case the tailings are dewatered on belt press filters and trucked to the mine, where they are placed in the same location as the mine waste rock is dumped (co-dispose and co-place), effecting an in-situ mixing process (co-mingle).

Co-mingling was eliminated on the basis of Cadia no longer producing the large volumes of waste rock that the Cadia open pit generated, as it is an underground mining operation now.

5.5 Dry Stack

The tailings need to be dewatered to allow them to be mechanically transported (as opposed to hydraulic transport) to a "stack" and then compacted sufficiently to reduce its likelihood of liquefying under earthquake loading. This requires the use of a large number of large plate filter presses. The dry (filtered) tailings are then either trucked or conveyed to the stack, where they are spread and compacted or dumped by a stacker over an advancing stack face. The high tailings tonnage rate produced by Cadia limits the tailings transporting and deposition options to conveying and stacking.

An example of dry stack operations is presented in Figure 5.2.

An obvious advantage of dry stacking is the increased water recovery and decreased water loss due to the filtration process.

- Dry stacking was eliminated from further consideration due to:
  - The dust that would be generated off the sides and top of the dry stack that could not be controlled in the same manner as is practised in slurry deposition systems.
  - The continuous noise generated by the conveyor and stacker system, which would be required to operate 24 h/day to meet the capacity required for Cadia.
  - The light pollution required to provide a safe working environment for the operational crew through the night.

Figure 5.2 Dry stack tailings deposition at La Copa Mine, Chile

5.5.1 Benchmarking

Dry stacking is used for mine tailings, but to date these have been much smaller mines with a lower tailings production rate, using both trucking and conveyor/stacking transport systems. Dry stacking is also used for power station ash, using both trucking and conveyor/stacking transport systems. Note that, for this case, that the ash is collected dry at the power station, using ash collection systems and then a small quantity of water is added to reduce dust and to allow the ash to be adequately compacted.

A number of very large copper mines in Chile have looked at dry stacking as a water saving measure, noting that dry stacking is now favoured in the global mining industry to reduce the risk of flow failure occurring. However, the technical challenges of dewatering such high tailings throughputs is yet to be overcome.

See Appendix A for an expanded examination of dry stack tailings storage examples in Australia and overseas.

5.6 Hydrocyclone sand wall embankment

Hydrocyclone sand wall embankment has not been used in Australian mineral mining (although many of the sand mining operations use hydrocyclones to re-construct sand dunes) and for this reason it was not pursued in the earlier studies. Hydrocyclone sand wall embankment dams were, however, are mandatory in Chile under legislation introduced in late 2006.I

Noting that Newcrest operates sand dams in the Americas and has this experience available to assist the design of the hydrocyclone sand wall embankment dam and in training of their operators.

5.6.1 Sand wall embankment advantages

Sand wall embankment TSFs provide several advantages when compared with the systems listed above, including:

- They do not need the large volumes of rock to construct the containment embankments.
- The hydrocyclone sand wall embankment and the fine balance of the tailings can both be pumped to the discharge locations, which is the tailings transportation system associated with the lowest cost.
- A higher percentage of the process slurry water is recovered for reuse, compared with conventional disposal.
- The hydrocyclone sand wall embankment (which in a conventional disposal system, is discharged as tailings) is used to form the containment embankments. This reduces the total tailings containment volume required, as a percentage of the tailings is stored in the embankments.
- Mobile equipment use is limited in number and to daylight hour operations.

The sand wall embankments can be constructed in a downstream (embankment foundation comprising of competent ground) or centreline (embankment foundation comprising of competent ground and tailings) direction. This is a significant improvement in stability, compared to upstream embankment raising (embankment foundation comprising of tailings only).

5.6.2 Dust management

Dust off any TSF can be a problem if not managed, but the hydrocyclone sand wall embankment system maintains the advantage that conventional disposal has, namely the ability to keep the tailings beach wet, provided that tailings deposition is planned accordingly.

The outer slope of the sand dam is compacted, to reduce its propensity to liquefy under earthquake loading. This action also helps with the control of dust generation from the outer slopes.

The management of dust on the beach and the slopes will be augmented, when needed, by large area water cannons, whilst early development of the final toe and slope will allow implementing temporary vegetation and early rehabilitation, further reducing the propensity for dust.

5.7 Outcome of deposition technology selection for Cadia

The TSF construction and operation technologies available to Cadia for the proposed TSF are listed in Chapter 5, Table 5.1.

In summary, Table 5.1 confirms that a hydrocyclone sand wall embankment system provides the most applicable tailings disposal and management technology for this site. This conclusion is based on the low technical risk, lower energy usage, lower land disturbance requirement, no increase to dust disturbance and the significantly reduced quarry requirement.

This report acknowledges that dry stack is the preferred technology for community stakeholders. Significant consideration was given to this option, however dry stacking was eliminated from further consideration due to:

- Management of the dust that would be generated off the sides and top of the dry stack was going to be difficult to control.
- There would be continuous 24-hour noise generated by the conveyor and stacker system that would carry a distance during the night.
- The site would need to be well lit to enable continuous operation, which would produce light pollution clearly visible from the surrounding properties.
- The capital and operating costs were significantly higher than for the other tailings disposal systems considered.

Table 5.1 TSF construction and operation technologies assessment (Newcrest Mining Limited, 2023)

CONSIDERATION	THICKENED & PASTE	CO-MINGLING	DRY STACK	HYDROCYCLONE SAND WALL EMBANKMENT
Land disturbance (biodiversity impacts)	Significantly higher levels of land disturbance due to topography.	Similar land disturbance and technical risk to other options presented.	Similar land disturbance & technical risk to other options presented.	**Marginally lower** land disturbance requirements to other options.
Noise	Increased noise due to need for new rock quarry.	Increased due to higher mobile equipment requirements and new rock quarry.	Increases in noise due to 24-hour operation of conveying and deposition equipment and large workshop adjacent to tailings facility.	Quieter operation**.** **Lower noise levels** for impacted residents. Significantly **reduced** quarry.
Dust	Increased dust due to need for new rock quarry.	Similar to other options.	Increased dust due to dry nature of the material and intervention required.	Similar dust levels to those on current facilities (pre-2019).
Water	High water recovery, requiring improved water management.	High water recovery, requiring water management.	High water recovery, requiring improved water management.	**No increase** in water recovery above current requirements.
Technical Risks	Similar technical risk to other options.	-	High due to liquefaction during high rainfall events / placement in potential water pathways.	**Low** - increased embankment stability.
Quarrying requirement	New rock quarry required to create embankments.	New rock quarry required to co-dispose the tailings.	No requirement for waste rock to store tailings.	Rock only required for starter embankment.
Other	-	-	Upstream diversions required to prevent inundation of stack. Not used anywhere else at required tonnage rates of Cadia. Increased energy consumption.	Hydrocyclone sand wall embankment construction **uses less energy** than some other tailings technologies (paste, dry stack, rock placement)

6 Conclusions

This report summarises the process undertaken to select the most appropriate site and deposition technology for an additional TSF at Cadia, which is required to provide sufficient storage capacity for the LOM.

The key outcomes of the location assessment were that:

- Each site within the mining lease area were valley fill options within pristine creek systems.
- No single site could accommodate the LOM tailings.
- Most sites were visible to nearby neighbours.

A decision was made by Cadia to carry out further site assessments to attempt to locate a LOM site for a TSF in the vicinity of Cadia, outside its mining lease area. The search was extended to a 40 km radius around the mine.

The criteria used for this search included sites with relatively flat ground and not located on intensive agriculture land. The only suitable site identified that was i) within a reasonable distance from Cadia, ii) on relatively flat ground and iii) not within a river course was the South Errowanbang site, now named the STSFX.

CVO narrowed the site options to the Cadiangullong creek (North site) and the STSF Errowanbang (South site) and assessed different tailings disposal methods for these options. Golder assessed the pros and cons associated with the North and South sites from 2018 to 2019, as follows.

The main advantages associated with the Cadiangullong creek (North site) are:

- The narrow valley results in reduced construction quantities for embankment.
- The site is within 5 km of the process plant.
- The site is located relatively further from neighbouring properties, compared to the South site.

The main disadvantages associated with the Cadiangullong creek (North site) are:

- The land is forested area to the north of the site, implementing the TSF at this location would result in significant impacts to biodiversity and plant community species as well as fauna.
- Four Mile Creek Road would need to be relocated.
- Increases the dam consequence rating compared with the South site, due to process plant downstream. This has been defined in the context of the permanent presence of the downstream PAR at the Process Plant, in comparison to the presence of itinerant population downstream of the South locations.
- High capital cost associated with sediment and runoff control infrastructure.
- Cadiangullong Dam would need to be replaced and a site identified which would increase potential environmental impacts.
- The embankment would be founded on loosely backfilled mine waste over the Cadia north pit and would be extremely technically challenging.
- A major diversion channel and drop-structure would be needed to carry runoff from the 90 km^2 catchment located upstream of the TSF, divert runoff around the TSF and deliver it to the Cadiangullong diversion channel around the Cadia pit, which would:
    - Require a major excavation into the rock to form the diversion channel.
    - Result in significant environmental impacts.

The main advantages associated with the Errowanbang (South site) are:

- Most of the ground has a low slope of ±2.5%, falling from east to west.

- There is a very limited external catchment (it is within the current TSF catchment area and river system) and this runoff can be diverted relatively easily.
- There is a suitable location for a surface runoff sediment control dam in the lower Rodds Creek valley.
- Lower land disturbance, compared to the North site.
- Waterway impacts are negligible and no new catchment affected.

The main disadvantages associated with the Errowanbang (South site) are:

- All options would be visible, to some extent, to the landholders to the east, south and west.
- The footprint is adjacent to Flyers Creek.
- The Panuara and Meribah roads would need to be relocated.
- The site is about 6.5 km from the process plant.

The North site option significantly contradicted several of CVO's agreed technical (failure risk, loose embankment foundation, relocation of the water storage dam, WSD), environmental and community (relocation of public busy road, disturbance of forested area and impact to biodiversity, major diversion channel and drop structure to divert runoff from catchment area upstream, resulting in major environmental impacts) criteria and was discounted from further examination.

The South site TSF was therefore selected as the most suitable option (most of the ground has flat slope, it is within the current TSF catchment area and river system, it provides the ability to integrate with STSF, resulting in lower land disturbance area compared to the North site, waterway impacts are negligible with no new catchment affected, adequate foundation conditions may be achieved) and later was redesignated as the South TSF eXtension (STSFX).

Each deposition technology was assessed for suitability at the preferred South Errowanbang site. It was assessed that the hydrocyclone sand wall embankment method was most suitable to the STSFX site. It was assessed that the hydrocyclone sand wall embankment tailings deposition system was most suitable to Cadia for the following reasons:

- Marginally lower land disturbance requirements compared to other options (in alignment with previously presented *Social and environmental requirement 1*);
- Significantly reduced quarry rock and borrow requirements (in alignment with previously presented *Social and environmental requirement 1*);
- Hydrocyclone sand wall embankment construction uses less energy than some other tailings technologies (paste, dry stack, rock placement) and is more amenable to Newcrest's zero carbon emissions goals (in alignment with previously presented *Social and environmental requirement 1* and *Technical requirement 5*).
- Noise levels similar to the current NTSF and STSF operations and lower than other options (in alignment with previously presented *Social and environmental requirement 2*);
- Similar dust levels to the dust generated by the NTSF and STSF when operating and lower than other options (in alignment with previously presented *Social and environmental requirement 2*);
- Lower technical risk due to increased embankment stability inherent in the technology (in alignment with previously presented *Technical requirement 4*);
- No increase in water recovery above current requirements (in alignment with previously presented *Technical requirement 5*);

In considering the community's primary concern about dust management (*Social and environmental requirement 2*), the advantages of this technology are as follows:

- It maintains the advantage conventional disposal has, namely the ability to keep the tailings beach wet, provided that tailings deposition is planned accordingly.
- The outer slope of the sand dam is compacted to minimise its propensity to liquefy under earthquake loading and this action assists to control dust generation from the outer slopes.
- To further reduce dust generation from the beach and the slopes, large area water cannons will be used, whilst early development of the final toe and slope of the embankment will allow implementing temporary vegetation and early rehabilitation, further reducing the propensity for dust.

Nine different site layout options were prepared, from which the MCA process identified that Option 5A was the most suitable option for STSFX. Two MCA processes included a range of environmental and social criteria that informed the final selection. In response to community concerns across a range of issues, Option 5A has been further refined and is now known as Option 5B. The incorporation of stakeholder feedback into the design process for the STSFX resulted in a reduced impact due to the footprint of STSFX, being the furthest distance from community and State heritage areas.

The layout progression from before the Hatch MCA, up until Option 5A and the final STSFX design based on community feedback is illustrated in Figure 6.1 to Figure 6.3.

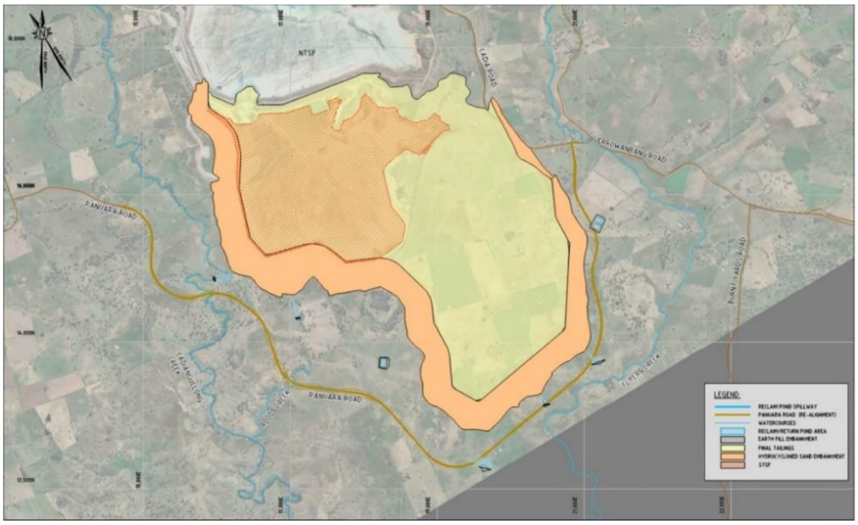

Figure 6.1 STSFX configuration prior to MCA

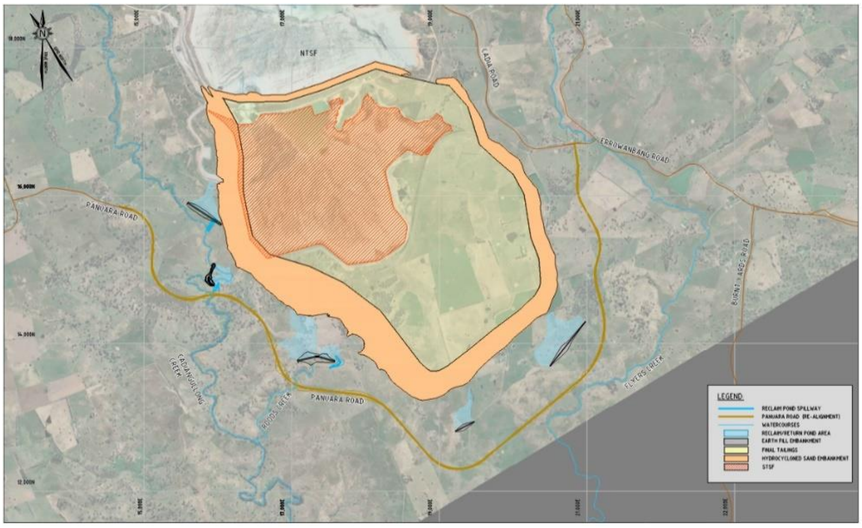

Figure 6.2 Option 5A selected as a result of the MCA

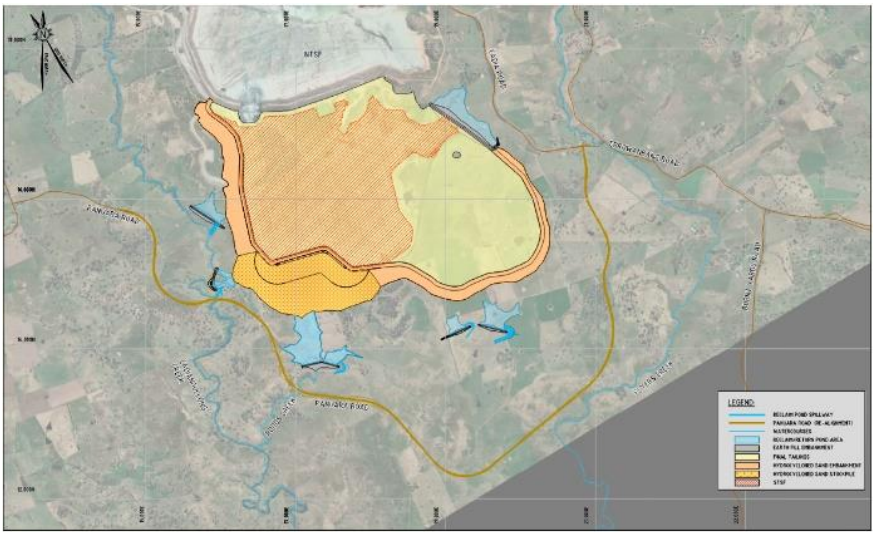

Figure 6.3 STSFX

This report demonstrates that, on balance, the South Errowanbang site coupled with hydrocyclone sand wall embankment method provides CVO and the community with the best opportunity to secure continued operations at Cadia while reducing adverse environmental and social impacts.

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Appendix A

Benchmarking of dry stack as a tailings deposition technology

A1 Dry stack benchmarking

Usage of dry stack tailings deposition technology has been benchmarked across Australia, North America, South America, the South Pacific and Africa.

Table A.1 Dry stack benchmarking

Site	Country	Mineral	Production (tpd)6	Deposition topography	Processing & equipment	Transport equipment	Climate	STATUS	OPERATIONS	References
Karara Mine	WA, Australia	Iron ore	35,000 of tailings	Dry stacked onto flat terrain	— Mechanically dewatered to around 15% moisture (course and fine fraction) — Dewatering screens (course fraction) — Mechanical press filtration (fine fraction)	Stacking conveyor	Dry; annual average precipitation 310mm; annual average evaporation 3,875	Operating	Fixed infrastructure solution - Dry tailings will be stacked in 4 Lifts to the maximum height approved by the WA government. This has created a smaller tailings storage footprint and improved site rehabilitation potential.	(FLSmidth, 2020) (International Mining, 2020) (Bis Industries, 2022) (Hore & Luppnow, 2014)
La Coipa Gold Project	Northern Chile	Gold, silver	18,000 of tailings	Dry stacked onto sloping topography.	— Excess water removed via filter belt to <20-25% moisture. — Transported via conveyor. — Distributed via mobile stacker - spread out and compacted to increase density of the stack.	Truck or stacking conveyor. Distributed via mobile stacker.	Dry/cold; temps between -5C to 29C; average rainfall between 12 to 20mm	Operating	Stored in a series of cells that are constructed using compacted, stacked layers of the filtered tailings Each cell is designed with a specific slope and height to maximise storage capacity, while minimising risk of slop failure/instability	(Tailings.info, 2021) (Williams, et al., 2012)
Goro Mine	New Caledonia	Nickel, cobalt	70,000 of material per year 60 m height	Dry stacked onto flat terrain	— Dewatered and filtered via thickeners and vacuum belt filter to remove approx. 20% moisture. — Transported and dumped into stacking area.	Conveyors, storage bins, articulated dump trucks, and front-end loaders	Warm tropical; temp between 17C to 35C; annual average rainfall of ~1060mm	Operating	Backed by Tesla Tailings dam leak released salt-laden liquid following heavy rain in Aug 2022 Tailings are compacted into thin layers, sloping slightly towards the centre of storage cell, minimising risk of slope instability and maximising storage capacity. This is regularly monitored	(New Century Resources, 2020) (Mining Technology, 2020)
Pumpkin Hollow Mine	Nevada, USA	Silver, gold, copper,	Maximum tailings generation rate of 65,700 dry tons	Dry stacked onto flat terrain; deposited underground as paste	— Dewatered and filtered via thickeners and vacuum belt filter (pressure filter)	Mechanical belt conveyors and truck transport and placement	Arid; average annual precipitation ~127mm	Operating (temporary closure)	Last update 2020 confirmed filter presses for the dry stack tailings operating to design specs	(Nevada Copper, 2019) (Nevada Copper, 2020) (Nevada Copper Corp., 2019)
Rosemont Mine	Arizona, USA	Copper, molybdenum, silver	~75,000 – 90,000	Dry stacked onto flat terrain	— High compression thickeners and pressure filtration	Stacking conveyor	Arid; average annual rainfall ~440mm; average annual evaporation 1800mm	Proposed	The water extracted through this process will be reclaimed and reused for mining purposes.	(Hudbay, 2023) (Hudbay, 2019)

6 Tons per day

Site	Country	Mineral	Production (tpd)6	Deposition topography	Processing & equipment	Transport equipment	Climate	STATUS	OPERATIONS	References
									Waste rock (the non–ore bearing rock) will be used to construct a buttress around the tailings facility.	
Greens Creek Mine	Alaska, USA	Silver, lead, gold, zinc	1,600 of tailings	Unknown	— Dewatered via thickening and filtrating to create moisture levels acceptable for transport. — Transported to a smaller area at the same site.	40t trucks, spread by dozer, compaction with vibratory roller	Cool climate: -6.7C to 18.3C Annual precipitation 1,400 mm to 2,290 mm	Operating	Polymetal underground tailings - tailings are placed at a series of 1-foot layers within cells. Underlain by a liner system to prevent groundwater from flowing into or water leaching. Has sufficient capacity to accommodate tailings to the end of life in 2030. Early-stage engineering studies underway to determine modifications to accommodate additional material beyond the life	(Condon, 2012) (Hecla Mining Company, 2022) (SLR International Corporation, 2022)
Raglan Mine	Northern Quebec, Canada	Nickel, copper, cobalt	~3,500 of tailings	Unknown	— Dewatered using high pressure filtration (filter press)	Conveyor system (4kms long)	Arctic, permafrost: average temp -10C	Operating	Tailings is deposited in layers and compacted using heavy machinery	
Minto Mine	Yukon, Canada	Copper, gold silver	4,200 of metals	Unknown	— Thickener and pressure filter system dewatering to below 20% moisture	Truck	Subarctic Moderate precipitation in the form of rain and snow Annual temperature below 0C	Closure	Once mining was complete in the Minto Main pit, Capstone applied for permission to shut down the dry-stack facility and instead pipe slurry tailings into the pit. In 2013 the Yukon government granted the water-licence amendment, so slurry tailings are now being deposited in the pit.	(Access Consulting Group, 2007) (Canadian Mining Journal, 2014)
Skorpion Zinc Project	Southern Namibia	Zinc	116,280 of tailings per month	Unknown	— Belt filter — High average moisture content of 40%	Conveyor stacker system	Hot/cold/dry >1cm rain annually Average coastal temp 9C to 20C Inland regions hot during the day and cold at night	Operating	Water scarce region favours filtered tailings to minimise water consumption The filter cake is a fine grained material with significant clay and mica fractions and has a high average moisture content of 40%	(Copeland, Lyell, & van Greunen, 2006)
Twin Hills	Namibia	Gold	5 Mtpa	Unknown	Filtration tests on thickener underflow demonstrated that tailings filter cake containing about 23% moisture on average could be generated for disposal, to		Hot/cold/dry >1cm rain annually Average coastal temp 9C to 20C Inland regions hot during the day and cold at night	PFS stage	A double-lined, dry-stack tailings storage facility constructed adjacent to the process plant for deposition of the process plant tailings as stacked filter cake. It is expected all contained solution will be evaporated preventing any	(Mining Stock Education.com, 2022)

Site	Country	Mineral	Production (tpd)6	Deposition topography	Processing & equipment	Transport equipment	Climate	STATUS	OPERATIONS	References
					reduce plant water consumption.				possibility of it being recycled to the plant.	
Alunorte refinery	Brazil	Aluminium refinery		Unknown	— Press filtration — Pipe conveyors — Mechanical compaction	Pipe conveyors	Average temp 30C, 76.6% humidity, annual precipitation 140mm	Operating	The filter presses produce a dry cake and is transported to the DRS2 disposal site by using a pipe conveyor. At the deposit, the dry cake is spread out in layers and then compacted using machinery	(Castilho, Melo, Diniz, & Pantoja, 2019)
Alcoa Pinjarra Alumina Refinery	Western Australia	Aluminium refinery	~10,000 of material	Unknown	— Thickening — Press filtration technology — Stacking method - deposited it in layers ~0.4-0.7m thick. After initial drying, the mud is turned by bulldozers or Amphirols which turn the dry top surface in and places the wet mud on top	Bulldozers/ Amphirols	Warm, dry summers and mild, wet winters Max summer temp average over 30C and can exceed 40C. Winter max temp ~17C. Average annual rainfall 706 mm	Operating (last update 2019)	Bauxite residue generated from the alumina refining process will be forced through very large filters that squeeze out the waste water, which will be recycled in the refining process. About 50 percent of the mud fraction of the bauxite residue is processed.	(Alcoa, 2019) (Alcoa, 2018)
Zijin Buritica Gold Mine	Antioquia, Colombia	Gold	4,000 of material	Unknown	— Filtered			Proposed	The dry-stack construction started mid-2019	(SRK Consulting, 2017)
Salares Norte Mine	Atacama, Chile	Gold, silver		Unknown	— Cyanide detoxification — Thickening — Dewatering by filtration – 3 vertical place pressure filters (moisture content (17.6%) — Transported — Compacted	Trucks	Dry/arid	Proposed (2022)		(Golder, 2022)

Appendix B

Hatch 2019 TSF option summary

B1 Tailings disposal characteristics summary

The following assumptions were used to formulate characteristics on the following TSF options

Average dry density of whole tailings (consolidated, end of filling)	1.50	t/m^3
Average dry density of cyclone tailings sand (underflow, consolidated, end of filling)	1.65	t/m^3
Average dry density of cyclone overflow (consolidated, end of filling)	1.35	t/m^3

Table B.1 TSF Options characteristics

																			Topsoil stripping - 3D area			Closure - 3D area		
#	Alternative - construction type, tailings type (non-embankment deposition)	Construction type[1]	Tailings type	Minimum downstream toe RL (m AHD)	Final embankment/ stack crest RL (m AHD)	Maximum tailings RL (m AHD)	Final embankment/ stack crest height[7] (m)	Starter embankment height (m)	Starter embankment volume (Mm3)	Volume of upstream or centreline raises (Mm3)	Total embankment (non-tailings) volume[6] (Mm3)	Total tailings or stack volume (Mm3)	Volume ratio[10]	Tailings capacity (Mt)	Distance[2] (m)	Controlled rate of rise (m/y)	Life (y)	Tailings output (Mtpa)	Embankment footprint (Ha)	Basin footprint (Ha)	Total stripping area[3] (Ha)	Tailings beach or platform area (Ha)	Exposed embankment or stack slope area (Ha)	Total closure area[3] (Ha)
N1	CG Old quarry - U/S, slurry[8]	U/S	Slurry	725	835	834	110	40	0.92	1.30	2.2	124.5	56.1	186.8	2,300	2.5	28.5	2.7 to 32.0	7.1	295.4	302.5	295.4	7.1	302.5
N2	CG Old quarry - D/S, slurry	D/S	Slurry	725	835	834	110	N/A	N/A	N/A	14.7	115.2	7.9	172.9	2,300	N/A	5.4	32.0	41.5	297.9	339.4	312.5	26.9	339.4
N3	CG Old quarry - U/S, paste (central)	U/S	Paste	725	835	856	110	40	0.92	1.30	2.2	177.2	79.8	265.8	3,600	2.5	39.2	1.0 to 9.3	5.6	371.4	377.0	371.4	41.5	412.9
N4	CG Old quarry - stack, cake[9]	Stack	Cake	725	835	980	110	N/A	N/A	N/A	2.1	**561.2**	273.6	**841.8**	5,800	N/A	26.3	32.0			1,380.0			1,380.0
N5	CG Plant - D/S, slurry	D/S	Slurry	707	773	772	66	N/A	N/A	N/A	2.6	78.3	30.2	117.4	700	N/A	3.7	32.0	14.8	110.9	125.7	219.1	10.7	229.8
N6A	CG Nth of old quarry - D/S, slurry	D/S	Slurry	737	837	836	100	N/A	N/A	N/A	10.7	72.1	6.7	108.1	3,000	N/A	3.4	32.0	32.5	239.6	272.1	242.2	21.5	263.7
N6B	CG Nth of old quarry - D/S, slurry	D/S	Slurry	736	865	864	129	N/A	N/A	N/A	21.5	161.5	7.5	242.2	3,000	N/A	7.6	32.0	51.1	427.9	479.0	429.9	33.5	463.5
N7A	CG Sth of water dam - D/S, slurry	D/S	Slurry	745	845	844	100	N/A	N/A	N/A	6.7	50.5	7.5	75.8	3,500	N/A	2.4	32.0	21.1	183.4	204.5	182.9	14.8	197.7
N7B	CG Sth of water dam - D/S, slurry	D/S	Slurry	745	875	874	130	N/A	N/A	N/A	14.8	130.7	8.8	196.1	3,500	N/A	6.1	32.0	39.6	384.4	424.0	369.7	29.0	398.8
N8	CG Nth of water dam - D/S, slurry	D/S	Slurry	783	880	879	97	N/A	N/A	N/A	7.9	77.7	9.8	116.5	4,800	N/A	3.6	32.0	27.7	258.3	286.0	250.8	20.5	271.3
N9	CG Old quarry - D/S, paste (DVD)	D/S	Paste	725	835	970	110	N/A	N/A	N/A	14.7	**517.7**	35.3	**776.6**	8,900	N/A	24.3	32.0	30.9	1,252.5	1,283.4			1,230.8
N10A	CG Old quarry - D/S, slurry (DVD)	D/S	Slurry	725	835	894	110	N/A	N/A	N/A	14.7	252.5	17.2	378.8	7,400	N/A	11.8	32.0	30.9	681.0	711.90	702.5	21.5	724.0
N10B	CG Old quarry - D/S, slurry (DVD)	D/S	Slurry	725	855	917	130	N/A	N/A	N/A	24.5	**423.5**	17.3	**635.3**	8,400	N/A	19.9	32.0	52.9	949.3	1,002.20	979.7	30.4	1,010.1
N11	CG Old quarry - D/S, slurry 0.4% (DVD)	D/S	Slurry (0.4%)	725	835	854	110	N/A	N/A	N/A	14.7	198.1	13.5	297.2	6,300	N/A	9.3	32.0	30.9	534.4	565.30	555.9	21.5	577.4
																								-
S1	ER South - D/S, slurry	D/S	Slurry	670	780	779	110	N/A	N/A	N/A	168.4	**463.9**	2.8	**695.9**	8,800	N/A	21.7	32.0			1,064.3			1,079.3
S2	ER South - U/S, slurry	U/S	Slurry	670	770	769	100	30	7.1	13.5	20.6	**501.1**	24.3	**751.7**	8,700	2.5	30.0	18.8 to 32.0			1,022.4			1,037.7
S3	ER South - U/S, paste	U/S	Paste	670	770	769	100	30	7.1	13.5	20.6	**445.7**	21.6	**668.5**	8,700	2.5	29.6	16.4 to 32.0			1,022.4			1,048.9
S4	ER South - U/S, paste (central)	U/S	Paste	670	770	787	100	30	7.1	13.5	20.6	**524.8**	25.4	**787.2**	7,800	2.5	30.8	22.8 to 32.0			1,022.4			1,048.0
S5	ER South - stack, cake	Stack	Cake	670	770	789	100	N/A	N/A	N/A	0.7	**561.9**	828.2	**842.9**	7,800	N/A	26.3	32.0			994.4			1,000.3
S6	ER South - cyclone tailings sand	Centreline	Slurry (0.4%)	670	770	769	100	35.0	7.2	121.6	7.2	**558.0**	77.5	**789.8**	7,800	4.0	26.7	32.0			1,011.1			1,070.0
ST1	STSF Ext - D/S, slurry[4]	D/S	Slurry	674	702	701	28	N/A	N/A	N/A	0.8	13.9	17.8	20.9	5,800	N/A	0.7	32.0	5.4	89.2	94.6	89.2	4.7	93.9
ST2	STSF Raise to 720 (with ext) - U/S, slurry[5]	U/S	Slurry	610	720	719	110	N/A	N/A	2.4	2.4	83.8	35.4	125.7	5,900	2.5	7.2	12.5 to 24	-	-	N/A	552.0	62.0	614.0

Notes:
1. D/S - downstream; U/S - upstream; DVD - down valley discharge; Centreline - cyclone underflow embankment
2. The approximate distances are straight line distances from the middle deposition point (or centre of the stack platform) to the existing tailings thickener located at reference coordinates 685 320 mE, 6 294 900 mN (MGA 94 Zone 55).
3. 3D areas reported.
4. Characteristics of extension wall only
5. Final embankment height and starter dam height includes consideration of the existing STSF arrangement. Upstream raise volume only includes walls above RL 702 m.
6. For stacked tailings, assume on average a 3 m high embankment with a 10 m crest width is provided to manage contact and non-contact runoff and provide access around the entire perimeter.
7. For stacked tailings, final stack platform elevations are not considered, only the elevation at the crest of the side slopes.
8. Starter dam crest width 30 m and upstream raises based on 4H:1V planar slope stepped back to inside crest of starter. Starter and raise volumes from N3 Muck modelling adopted.
9. Bench RL 785 m, bench width 100 m, crest RL 835 m with platform rising upstream at 2%
10. Total tailings to non-tailings embankment materials.