

CENTENNIAL COAL

MAIN TAILINGS DAM ANNUAL TYPE 2 INSPECTION, NEWSTAN COAL MINE





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WSP
LEVEL 3, 51-55 BOLTON ST
NEWCASTLE NSW 2300
PO BOX 1162
NEWCASTLE NSW 2300

TEL: +61 2 4929 8300
FAX: +61 2 4929 8382
WSP.COM

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A	July 2017	Original
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	NAME	DATE	SIGNATURE
Prepared by:	Michelle Black	July 2017	
Reviewed by:	Jamie Anderson	July 2017	
Approved by:	Jamie Anderson	July 2017	

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OUR REF: 2122823B-GEO-REP-17088 REVA_FINAL.DOCX

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SUMMARY

It is recommended that the following actions are continued:

- The growth of small trees and shrubs on the upstream and downstream batters and spillway should be monitored and removed during regular weed spraying. If extensive networks of tree roots are allowed to grow in to the dam wall they could provide pathways for seepage and internal erosion. Also, growth of large trees and shrubs in the spillway could cause obstruction to flood flows.
- The areas along the downstream batter prone to development of damp patches following rainfall should continue to be monitored. Any variations or increased seepage should be reported to a qualified dams engineer for inspection.
- Any water which accumulates downstream of the dam following heavy rainfall should not encroach against the toe of the downstream batter. It is understood that this situation has never occurred and water levels downstream of the dam are monitored.
- The O&MM is updated to include the procedure for collecting seepage data and the changes to the operational status of the site.
- The thick wide tailings beach should be maintained as this reduces the risk of seepage through the dam wall and the abutment areas.

The conclusions of this report are summarised below.

- The frequency of inspection and monitoring for a 'High A' consequence dam meets the requirements of the O&MM.
- The dam is considered to be operating safely and effectively.
- Beaching of tailings against the face of the embankment is in accordance with best practice tailings management.

1 INTRODUCTION

This report presents the results of a Type 2 (intermediate) surveillance inspection for the Main Tailings Dam at Newstan Coal Mine for Northern Coal Services (NCS). At the time of the inspection the dam had a 'High A' consequence rating and therefore was required by the Australian National Committee on Large Dams (ANCOLD), 2012 Guidelines on Tailings Dams to undergo an intermediate level inspection annually.

To meet the requirements of an intermediate surveillance inspection, the surveillance inspection was carried out with reference to DSC Guidelines DSC2C, DSC3F, DSC Form D19, the ANCOLD 2003 Guidelines on Dam Safety Management and ANCOLD 2012 Guidelines on Tailings Dams.

Newstan Colliery is in 'care and maintenance' and therefore will not be producing coal within the foreseeable future. The Main Tailings Dam still receives tailings material from Centennial Coal's Mandalong operation, however the quantities have been greatly reduced.

1.1 BACKGROUND INFORMATION

The Main Tailings Dam is in the Southern Reject Emplacement Area (SREA) at Newstan Colliery. The dam is on the southern side of Miller Road opposite the existing Newstan Colliery pit top facilities. The location of the dam within the mine site is shown on Figure 1.1 below.

The Main Tailings Dam was designed to provide long-term storage for tailings above ground and provide an area for disposal of coarse rejects. The dam has been constructed across a valley using clay fill and earthfill sourced from borrow within or near the storage and coarse reject material from the washery.

The Main Tailings Dam was designed by Parsons Brinckerhoff (now WSP⁽¹⁾) in 2006 and has been constructed in three construction stages (Stage 2 to Stage 4). The design and construction drawings for the dam are attached in Appendix A. Construction of Stage 2 was to RL 30 m, and was completed by Keller Civil Engineers Pty Ltd (KCE) in 2007. Construction of Stage 3 commenced in 2009 and was completed by KCE in 2011 to RL 40 m. Construction of Stage 4 of the dam commenced in late 2011 by KCE and has continued in small stages through 2012, 2013 and 2014. The proposed final crest level of the dam is RL 52.5 m, approximately 32.5 m above natural ground level at the downstream toe. Since Newstan Colliery was placed into care and maintenance on 1 August 2014, construction on the dam wall has ceased at RL43.5 m until further notice.

Earthworks and materials testing were carried out by Coffey Geotechnics during construction. Monitoring of construction was carried out by WSP to check that the works were undertaken in accordance with the design and specification.

(1) Parsons Brinckerhoff has been officially rebranded and will be referred to as WSP throughout this report.



Figure 1.1 Main Tailings Dam Location (Google Maps)

2 DAM DETAILS

2.1 LOCATION AND ACCESS

The dam is located southwest of the Newstan Colliery surface facilities at coordinates 366119E, 6350034N. The embankment footprint spans either side of a creek valley that runs through the mine site toward Fennell Bay. The natural valley slopes at approximately 6° toward the creek.

Parts of the upper edges of the valley were cut forming a highwall during former open cut mining operations, which ceased prior to construction of the dam. The exposed highwall areas have been buried during dam construction and tailings placement or have been rehabilitated.

An access road to the dam runs from the Newstan-Eraring Private Haul Road around the north side of the valley. The access road continues along the dam crest and runs around the perimeter of the storage area.

2.2 SITE GEOLOGY

The 1:100 000 Newcastle Coalfield Regional Geology map indicated that the Newstan pit top area is underlain by sandstone, siltstone, conglomerate and claystone of the Narrabeen Group and conglomerate, sandstone, siltstone, tuff and coal of the Moon Island Beach Subgroup.

Prior to construction, the highwall in the southern reject emplacement area exposed conglomerate, sandstone, siltstone, and the Great Northern Coal Seam. The geology of the site is not expected to have a significant impact on the Main Tailings Dam.

2.3 DAM TYPE

The dam has been designed as a zoned earthfill embankment with a vertical filter and horizontal drains. The central core of the dam has been constructed from clay fill won from the site and has a higher compaction specification than the dam shoulders to reduce the risk of seepage through the dam. The upstream and downstream batters have been designed and constructed at 2 horizontal (H) to 1 vertical (V) and 3H:1V respectively.

2.4 EMBANKMENT DIMENSIONS

At the time of inspection, the crest width was approximately 55m wide and 580m long. The crest height was at RL43.5 m, approximately 23m high.

Once complete the crest of the embankment will be 10m wide with a crest level of RL52.5 m, approximately 32.5m above natural ground level.

2.5 STORAGE VOLUME

The total storage area is approximately 170 m wide (max) by 380 m long, with an operational capacity of 5316 ML.

The dam has been designed with the following:

- total freeboard height of 2.5 m, with an operational freeboard of 2 m
- total freeboard – 1000 ML

- environmental containment freeboard volume – 500 ML
-

2.6 SPILLWAY

The final Stage 4 spillway has been designed as a trapezoidal channel with the following dimensions:

- invert width - 12 m
- depth - 0.5 m
- side batters - 3H:1V
- spillway capacity – 21 m³/s (meets DSC requirements for a 'High A' dam of 1: 10 000 000 AEP).

The current spillway design is summarised below and has been adopted from the Stage 2 design.

- invert width - 12 m
- depth - 1.5 m
- side batters - 2H:1V
- spillway capacity – 25 m³/s (meets DSC requirements for a 'High A' dam of 1: 10 000 000 AEP).

This is an interim emergency spillway until the final embankment height is reached. The spillway has been completely lined with rock rip rap and the invert level was at RL 42 m at the time of the inspection. The location of the spillway is shown on Figure 1.1

2.7 APPURTENANT WORKS

A small decant dam is located at the western end of the tailings dam. The decant dam is formed by a rock wall which acts as a filter screen for the supernatant that accumulates on the dam surface. The supernatant filters through the rock screen and is removed via a borehole into the underground workings in the Fassifern Seam, or is pumped to other surface water storage facilities at the site. The location of the decant dam is shown in Figure 1.1.

A seepage collector drain is located downstream of the dam embankment which collects seepage from the vertical and horizontal filter drains. Also following heavy rainfall, water pooled in the downstream area flows into the drain.

The flow in the drain is checked during routine inspections and sediment is cleaned out as required. The flow from the drain is measured by visual inspection and a v-notch weir located at the Seepage Dam which is immediately downstream of the Main Tailings Dam. Any increases in observed flow over the v- notch weir are noted during routine inspections. The location of the seepage collector drain and v-notch weir is shown on Figure 1.1.

2.8 CONSEQUENCE RATING

The dam was originally assigned a consequence category of 'High C' for sunny day and flood consequence failure. WSP carried out a dam break analysis in July 2011 in response to changes made to the DSC Guidelines in 2010. The results of this analysis are presented in WSP 2012 report 2107462A/PR-0376. Based on the revised results of the flood modelling and the ANCOLD 2003 Guidelines for Dam Safety Management a sunny day and flood consequence category of 'High A' was assigned to the dam. The flood mapping from this assessment is included in Appendix B.

In January 2012 at the request of the DSC, WSP provided the following additional information:

- re-assessment of the consequence category using Grahams Probable Loss of Life (PLL) method
- a check of the spillway capacity such that it can safely pass a PMPDF

— a check that the dam freeboard satisfies the requirements set out in the DSC documents DSC3B and DSC3F

The results were presented in WSP memo 2107462A/ME-0259 dated 23 May 2012. The results showed that the consequence category was 'High A' using the Grahams PLL and the dam freeboard and spillway meets the requirements of the ANCOLD, 2012 Guidelines on Tailings Dams.

Following operational changes at Newstan Colliery a risk assessment of the Main Tailings Dam was undertaken by WSP, NCS and Norm Himsley, an external Dams Consultant. One of the outcomes of the risk assessment was that revision of the Sunny Day Consequence Category for the dam would be appropriate considering the changes to operation within the colliery. Based on this risk assessment a request was put forward for the reduction of the sunny day consequence from 'High A' to 'Low'. This request was reviewed by the DSC at its October 2015 meeting. Further investigations including a dam break study and reports advising on the dam's operation and maintenance were requested before the reduced consequence category could be adopted. NCS have decided to not undertake this work and leave the sunny day rating as is, in the event that the mine goes back in to operation.

3 INSPECTION

An inspection was carried out on 16 May 2016 by Michelle Black, Senior Engineering Geologists from WSP, who was involved in the design of the dam and has undertaken regular inspections of the Main Tailings Dam since the commencement of construction in 2007. The inspection was undertaken during a period of fine weather. Details and photographs of the inspection are recorded below and DSC forms are included in Appendix C.

3.1 CONDITION OF THE DAM

3.1.1 STORAGE

The storage level was at RL 35 m, approximately 8.5 m below the crest level. A wide tailings beach was present along the entire length of the upstream batter. No water was pooled against the batter. A shallow decant pond was present at the west end of the storage area.

No evidence of mine subsidence features, such as development of sinkholes or loss of stored surface water, was noted in the undermined area of the storage, or has been noted in routine inspections of the dam storage since October 2011 (the date of the most recent sinkhole).



Photo 3.1 Dam Storage Area

3.1.2 UPSTREAM BATTER

The upstream batter was moderately vegetated with grasses and small shrubs. Tailings discharge was not occurring at the time of the inspection.

The tailings discharge point is moved along the upstream batter as required to maintain the tailings beach. No evidence of cracks or slips was noted. Minor erosion runnels due to surface runoff had developed along runoff flow paths. The batter appeared in a stable condition.

The growth of small trees and shrubs should be monitored and should be removed during regular weed spraying. If extensive networks of tree roots are allowed to grow in to the dam wall they could provide preferential pathways for seepage and internal erosion. Grass growth should be encouraged as it provides erosion protection.



Photo 3.2 Upstream Batter

3.1.3 TAILINGS DISCHARGE

Tailings are discharged from eight sub-aerial pipe outlets located along the length of the upstream batter. The discharge channels run down the face of the upstream batter and are lined with conveyor belt material along which the tailings are discharged. The conveyor belt material provides erosion protection during tailings discharge.

Tailings discharge was not occurring at the time of the inspection. Most recently tailings had been discharged from the northern end of the upstream batter. The discharge point is moved as required to maintain the tailings beach. NCS staff indicated that the tailings discharge equipment was operating effectively and that no incidents had been recorded.

3.1.4 CREST

The surface comprised coal chitter, which appeared to be generally well compacted. No cracking or slumping was evident. Some minor surface depressions were present which contained pooled water. The depressions were generally related to depressions at the base of windrows. The pooled water did not appear to have any impact on the integrity of the dam.



Photo 3.3 Dam Crest



Photo 3.4 Pooled water at the base of the upstream batter windrow

3.1.5 DOWNSTREAM BATTER

Coarse reject was exposed on the downstream batter, which contained numerous grass mounds and some small shrubs which had taken root. The batter appeared to be in good condition with no evidence of cracks or settlement. Some minor gully erosion was noted. The growth of shrubs should be monitored and should be removed during regular weed spraying.

No seepage was observed along the downstream batter. Commonly damp patches develop at the southern ends of the batter. None were observed during the inspection. These patches develop regularly along the downstream face following periods of heavy rainfall. They are not thought to be the result of seepage through the dam wall as they were present when the storage level was much lower and a wide tailings beach is present along the upstream batter. It is thought that they may be the result of crest and batter infiltration during periods of prolonged and/or heavy rainfall moving along bands of compacted earthfill where permeability variations and anisotropy are encountered.

Areas prone to development of damp patches should be monitored following rainfall. Any variations or increased seepage should be reported to a qualified dams engineer for inspection.

A line of grass generally grows along the centre of the downstream batter at approximately RL 31.5 m. The embankment material along this section is usually damp. Some seepage was present along the toe of the southern end of the downstream batter. This water is the result of surface water infiltrating through the upper layers of the downstream batter and seeping down to the toe of the dam, as seepage has been occurring here prior to the tailings level reaching the same level. It is also considered unlikely that the seepage is reporting here from the storage area due to the large tailings beach along the upstream batter. Some water was pooled in the downstream area of the dam. The water was not near the dam toe.



Photo 3.5 Downstream Batter

3.1.6 SPILLWAY

At the time of the inspection the spillway was at RL 42 m and was lined with sandstone riprap on the downstream side and across the dam crest to the top of the upstream batter. The rip rap generally appeared in good condition. Some additional rip rap had been placed around the top of the downstream batter to reduce gully erosion forming around the crest in this area.

Some small shrubs have taken root in the rip rap on the downstream side. These should be removed during regular weed spraying so that they do not grow large enough to cause any obstructions.



Photo 3.6 Spillway



Photo 3.7 Additional rip rap at the top of the downstream batter

3.1.7 ABUTMENTS AND FOUNDATIONS

No evidence of differential settlement or cracking was noted on the batters in the abutment areas during the inspection. No signs of distress were observed in the foundation around the downstream toe.

3.1.8 DECANT AREA

At the west end of the storage area a dry rock wall acts as a coarse screen for tailings. Decant water is retained between this wall and an earthfill embankment through which three pipes at different levels connect to valving and

connections in a pit beyond. The pit is bounded by a second fill embankment which impounds runoff from the small catchment upslope and drains decant water into underground mine workings. NCS staff indicated that the decant pipes were operating effectively and no incidents had been recorded.

Once the dam is at its full height, the water level within the dam will eventually breach the dry rock wall. NCS had started constructing a new decant facility further to the west which would be operational for the life of the dam. Construction of the new decant facility has ceased along with raising of the dam embankment while the mine is in care and maintenance.

Previously following times of heavy rainfall NCS were often not able to decant from the Main Tailings dam to the underground workings as the water levels in the Fassifern seam would often be too high. Decant water was then stored on the dam until it could be pumped out via pipelines to other storage facilities on the site.

To manage water onsite, NCS has constructed a wastewater treatment plant, which is now operational. The treatment plant allows NCS to remove, treat and discharge excess water from the dam within the required 7-day time frame for a 'High A' consequence dam.



Photo 3.8 Decant Area

4 MONITORING

4.1 ROUTINE INSPECTIONS

Daily inspections of the dam are carried out by the washery manager or his delegate who have undergone dam inspection training. A sample copy of the inspection report is included in Appendix D. The daily inspection of the dam is visual, noting the condition of the following:

- rainfall, weather and results of previous checklist
- downstream area of the dam
- downstream batter of the dam embankment
- seepage collection drain flow rate (visual)
- flow rate at the v-notch weir at the Seepage Dam (measured three times per week)
- crest and upstream batter of the dam embankment
- percentage of tailings beach covering of the dam wall
- tailings pump, pipeline and valve condition
- water level relative to the freeboard (complies with DSC2A)
- decant pump and pipeline condition.

As part of this inspection, a review of the daily inspection reports for the 3 months prior to the inspection was undertaken. NCS staff have indicated that no major incidents had been recorded in the last 12 months. Staff indicated that regular maintenance of the pumps associated with the dam has been carried out.

4.2 NON-ROUTINE INSPECTIONS

One non-routine inspection was undertaken on 31 January 2017 and is documented in WSP report 2122823B-GEO-LTR-002 RevA. The inspection followed an audit by the NSW EPA of surface water and tailings dams at the site. The EPA audit was undertaken on 14 September 2014. The audit report raised concerns that NCS were not maintaining the tailings dam wall in a proper and efficient condition as there was evidence of gully and rill erosion and the growth of small shrubs on the dam wall.

An inspection of the dam was undertaken by Michelle Black from WSP, Neil Drakeford and David Baker from NCS. The inspection was undertaken during a period of hot dry weather and involved a walk over of the dam crest as well as the up and downstream batters and abutment areas. The following was noted during the inspection:

- Gully erosion along the side of the spillway had been remediated and rip rap has been placed along the crest area near the spillway to prevent further gully erosion from developing.
- Gully erosion was not observed on the up or downstream batters or abutments areas.
- Rill erosion was present along the up and downstream batters. The development of rill erosion is considered minor and has no impact on the dam's integrity. NCS undertakes routine inspections and maintenance of the dam in accordance with the dams Operations and Maintenance Manual. Rill and gully erosion is monitored and remediated as required.

- Small shrubs and grasses were present on the downstream batter. The presence of small shrubs and grasses is considered minor and assists with erosion control. NCS monitors vegetation growth on the dam during routine inspections and undertakes regular weed spraying to remove and larger shrubs and small trees before they become well established.
- The dam appeared to be operating in a safe condition and is operated and maintained in accordance with the Main Tailings Dam Operation and Maintenance Manual.

There have been no other non-routine inspections undertaken by an external consultant for the Main Tailings Dam since the previous surveillance inspection.

4.3 INSTRUMENTATION

No instrumentation is currently installed on the dam. NCS have planned to install piezometers and survey monuments on the dam once construction of the dam was complete. NCS have installed a remote telemetry system at the v-notch weir which reports back to CITEC, their onsite water management system.

DSC Guideline DSC2G recommends that automatic telemetered monitoring of the dam storage and rainfall is also installed in all High consequence category dams. Currently records of storage level and rainfall are based upon the daily inspection reports which are manually recorded into a site data base. Considering that the mine is now in care and maintenance and tailings delivery to the dam has been greatly reduced, installation of automatic telemetered monitoring of rainfall and the dam storage as well as installation of piezometers and survey monuments is probably not necessary provided daily monitoring is continued. Any increases in seepage at the dam will be remotely recorded and monitored at the v-notch weir.

4.4 COMPLIANCE WITH DSC REQUIREMENTS

The frequency of routine and surveillance inspections as well as monitoring of seepage, storage level and rainfall at the dam complies with the ANCOLD, 2003 recommendations for a 'High' consequence dam.

4.5 CONSTRUCTION MONITORING

Construction of the Stage 4 work continued through 2014 and ceased in 2015. The dam had approximately 7m of available freeboard which is sufficient capacity for storage of small volume of tailings which is expected to be produced from Mandalong at its current production rate.

The staged construction of the dam has been supervised and monitored as required by a geotechnical engineer from WSP. The construction monitoring involved checking earthworks testing results to ensure the construction materials and methods comply with the dam design and specifications.

The results of the construction monitoring to date are detailed in the following construction reports:

- 2122433A/PR-0091 (Stage 1 - 2007)
- 2122433B/PR-0151 (Stage 2 - 2008)
- 2122433C/PR-0632 (Stage 3 - 2012).
- 2172825A-GEO-RPT-0340 (Stage 3 to 4 – 2015)

5 DAM SAFETY AND OPERATION

5.1 DAM OPERATION AND INCIDENTS

There have been no incidents recorded at the dam since the previous inspection.

5.2 OPERATION AND MAINTENANCE MANUAL

The operations and maintenance manual (O&MM) was reviewed and updated by WSP in 2011 to reflect the construction level of the dam and the revised consequence category. The manual was updated further in 2012 when the washery officially became Northern Coal Services. The manual was also updated to reflect personnel changes at the mine and washery.

The checklist used for recording routine monitoring at the dam was amended by NCS staff in October 2008. This checklist is more comprehensive than that contained in the original O&MM and was included in the 2011 and 2012 manual revisions.

It is recommended that the O&MM is updated to include the procedure for collecting seepage data and the changes to the operational status of the site.

5.3 DAM SAFETY EMERGENCY PLAN

The dam safety emergency plan (DSEP) was reviewed by WSP most recently in 2014 following comments from the DSC in a letter dated 27 March 2014. The DSEP was amended to include the following:

- Dam alert levels assessed in accordance with DSC2G and flow charts created for each case
- A D17 form was submitted with the DSEP

A copy of the DSEP was submitted to the State Emergency Services (SES) for review. WSP received a letter from the SES in June 2015. The letter requested a copy of the Dam Break Analysis report to be provided to the SES.

An emergency drill was undertaken by NCS in 2016 to test the DSEP. The scenario for the drill was a serious piping incident at the dam, with the potential for the discharge of material off site. Minutes from the emergency drill planning session held by NCS are attached in Appendix E which provide further details regarding the drill. The emergency simulation was completed successfully and amendments to the DSEP were required.

5.4 SECURITY MEASURES

The dam is located in a dedicated mining area with no unauthorised access allowed.

5.5 PREVIOUS SURVEILLANCE REPORTS

Aside from the 2016 surveillance report there have been no other relevant reports aside from the routine inspections and the one non-routine inspection undertaken in January 2017.

5.5.1 2016 SURVEILLANCE REPORT RECOMMENDATIONS

Recommendations from the 2016 surveillance inspection report and follow up comments are provided below:

- The growth of small trees and shrubs on the upstream and downstream batters and spillway should be monitored and removed during regular weed spraying. If extensive networks of tree roots are allowed to grow in to the dam wall they could provide pathways for seepage and internal erosion. Also growth of large trees and shrubs in the spillway could cause obstruction to flood flows. *It is understood that NCS carry out regular weed spraying which should be continued.*
- The areas along the downstream batter prone to development of damp patches following rainfall should continue to be monitored. Any variations or increased seepage should be reported to a qualified dams engineer for inspection. *It is understood that NCS carry out regular monitoring of these areas which should be continued.*
- Any water which accumulates downstream of the dam following heavy rainfall should not encroach against the toe of the downstream batter. *It is understood that this situation has never occurred and water levels downstream of the dam are monitored.*
- The O&MM is updated to include the procedure for collecting seepage data and the changes to the operational status of the site. *It is understood that this has not yet been carried out.*
- The DSEP should be updated to reflect any changes to the Sunny Day consequence rating. *NCS have decided to leave the consequence rating of the dam as is in the event that the mine goes back into operation.*
- If no further construction on the dam wall is planned within the next 5 years then consideration should be given to installation of permanent instrumentation on the dam. NCS should develop a schedule to establish the instrumentation over the next 3 years. *The mine could go back into production and therefore construction of the dam may resume. Considering that the mine is now in care and maintenance and tailings delivery to the dam has been greatly reduced, installation of automatic telemetered monitoring of rainfall and the dam storage as well as installation of piezometers and survey monuments is probably not necessary provided daily monitoring is continued. Any increases in seepage at the dam will be remotely recorded and monitored at the v-notch weir. Once construction of the dam is complete installation of monitoring instrumentation should be undertaken immediately.*

5.6 FLOOD CAPACITY

At the time of the inspection the dam had a freeboard capacity of approximately 7m. The dam design requires that a minimum total freeboard of 2.5 m is maintained to preserve an appropriate margin against spilling.

5.7 STRUCTURAL STABILITY

The embankment has been constructed in accordance with the design prepared by WSP. No evidence of structural instability has been noted in any of the inspection reports prepared since construction of the dam embankment

5.8 EARTHQUAKE LOADING

Earthquake loading was considered during design of the dam. As the dam has been built in accordance with the design, the risk of failure of the dam under earthquake loading is considered low. However due to the dam's consequence rating being changed from High C to High A, an earthquake risk assessment was undertaken in accordance with the DSC guidelines DSC3C. Results from this assessment were used by WSP to assess the stability of the dam under earthquake loading using the program SLOPEW. The details of that assessment are reported in WSP report 2172926A-RPT-GEO-001 RevA.

Recommendations and conclusions from the assessment and report are given below:

- The dam is likely to undergo deformation potentially impacting the crest, crest settlement and cracking if subject to the design earthquake load

- To reduce the risk of piping failure due to cracking the dam should continue to be operated in accordance with the Operation and Maintenance Manual, where tailings material is beached against the upstream batter and water is not allowed to accumulate on the dam wall.
- To mitigate the risk of overtopping from loss of crest height due to settlement, the top operational freeboard of 2.0 m should be strictly observed.
- To increase the stability of the dam and reduce the likelihood of unacceptable deformation or loss of crest height under the design earthquake loading, the construction of a stabilising berm against the downstream batter is recommended.
- The targeted placement of coarse reject beyond the dam toe is consistent with NCS's long term coarse reject placement plan for the Southern Reject Emplacement Area which involves gradual filling of the downstream area of the Main Tailings Dam with coarse reject and eventual capping of the dam. Targeted buttressing of the embankment during rejects placement should occur concurrently with any future crest raise works.

5.9 SEEPAGE

Seepage has been regularly observed on the downstream batter near the southern abutment and near the dam toe. Long-term monitoring of these patches suggests that these areas develop a result of infiltration of rainfall into the coal chitter on the downstream batter. The patches generally appear wet following periods of heavy rainfall and dry out following dry weather. The patches do not appear to be influenced by water level changes in the dam storage. A wide tailings beach has developed along the entire length of the upstream face of the dam. Any seepage or wets spots along the downstream face originating from the storage are considered unlikely. Seepage along the downstream face is regularly checked during routine inspections.

6 MINING

6.1 CURRENT MINING AREAS

Newstan Colliery was placed into care and maintenance as of 1st August 2014 and is no longer mining coal. The active underground mining activities that were associated with Newstan Colliery are located approximately 3.7 km southwest of the dam and do not impact the integrity of the dam.

6.2 FORMER MINING AREAS

6.2.1 UNDERGROUND

The southern side of the dam storage area and dam embankment are underlain by bord and pillar mine workings. The workings are in the Great Northern Seam and are abandoned. The depth of mine workings underlying the current dam storage area and southern end of the embankment ranges from less than 10 m to greater than 25 m from the surface.

6.2.2 POTHOLE DEVELOPMENT

Following heavy rainfall in 2011 two potholes opened in an area of shallow bord and pillar mine workings located around the south and west perimeter of the dam storage area. No potholes have been noted under the dam embankment.

In early 2013 WSP undertook a geotechnical investigation to assess the depth and condition of the mine workings underlying the dam embankment, and to assess the condition of the mine roof. The details of the investigation are presented in WSP report 2161070A/PR-0220 and are summarised below.

- Except for some minor block falls from the weathered, weaker rock in the immediate mine roof, the roadways generally appeared intact.
- Tailings material had accumulated on the mine floor. The thickness of the tailings appeared to increase to the southwest and partially blocks some of the roadways. The accumulated tailings material reduces the open void space within the mine workings to the southwest and therefore reduces the risk of pothole development progressing to the surface.
- The interbedded sandstone and conglomerate unit which forms the roof of the mine workings is of high to medium strength. The investigation did not reveal any continuous geological discontinuities such as joints, fractures or faulting. The lack of sub-vertical fracturing suggests that the area has not undergone significant subsidence. Also, the quality of the rock mass reduces the risk of pothole deformation occurring.
- Finite element analyses results indicated that construction of the dam and loadings from the tailings have no significant effect on the tunnels stability. Floor heave induced by the increased stresses around the tunnels is not significant. The tunnels appeared to be stable.
- Finite element analyses showed that the pillars are subject to stress increase due to the dam and tailings loading; however, the factors of safety are between 3 and 11. The coal pillars are expected to be long term stable in their current state and with the additional load of the final dam embankment.
- A risk of pothole development may exist in a small section of the workings underlying the final dam footprint where the cover depths are ≤ 10 m, as the roof material in this area may be weathered and may be subject to inundation during periods of heavy rainfall. It should be noted that while the southern upstream abutment is covered with tailings and free from surface water the risk of pothole development under the embankment in this area is reduced.

Because of the changed operational conditions at Newstan Colliery the risk of pothole development in the dam storage and below the dam embankment has been reduced. NCS undertook a risk assessment to review the likely causes and potential consequences of pothole failure in the dam area and the risk of such events happening given the changed operational conditions at the mine and dam. The changed operational conditions are summarised below:

- Newstan Colliery has gone in to 'care and maintenance' and no longer mines coal.
- The washery at Newstan will still operate but will wash a significantly reduced amount of coal from Centennial's Mandalong operation.
- Completion of the waste water treatment plant and increasing their license water discharge to 11 ML/day has allowed NCS greater control over their surface water management and has significantly reduced the risk of water storing on the dam surface for longer than a 7-day period.
- The tailings beach over the dam wall and in the area at risk of pothole development is very well developed following completion of the waste water treatment plant.

The results of the risk assessment indicated that given the current operating conditions at the dam the risk of further pothole subsidence was low. This risk is to be reviewed if the mine returns to full production.

6.2.3 AUGER MINING

Parts of the valley across where the Main Tailings Dam has been constructed were mined during former open cut mining operations. The exposed coal seam in the highwall underwent further extraction by auger mining techniques. The highwall areas have been buried during dam construction and tailings placement, or they have been rehabilitated.

The highwall areas which form the dam abutments were remediated prior to dam construction as the open auger mine holes were viewed as a potential seepage path which could lead to internal erosion of the embankment. The remediation involved cement stabilisation of the embankment fill placed immediately adjacent to the auger mine openings. Former auger mining voids were located near the southern abutment of the embankment.

The dam abutments are regularly inspected. Some seepage spots commonly occur along the southern abutment. These areas usually develop following periods of heavy rainfall. The number and size of the spots is generally consistent. No significant changes have been noted in these areas. The development of the thick, wide tailings beach in this area would reduce the risk of water seepage through the abutment.

7 SUMMARY

7.1 RECOMMENDATIONS

It is recommended that the following actions are continued:

- The growth of small trees and shrubs on the upstream and downstream batters and spillway should be monitored and removed during regular weed spraying. If extensive networks of tree roots are allowed to grow in to the dam wall they could provide pathways for seepage and internal erosion. Also, growth of large trees and shrubs in the spillway could cause obstruction to flood flows.
- The areas along the downstream batter prone to development of damp patches following rainfall should continue to be monitored. Any variations or increased seepage should be reported to a qualified dams engineer for inspection.
- Any water which accumulates downstream of the dam following heavy rainfall should not encroach against the toe of the downstream batter. It is understood that this situation has never occurred and water levels downstream of the dam are monitored.
- The O&MM is updated to include the procedure for collecting seepage data and the changes to the operational status of the site.
- The thick wide tailings beach should be maintained as this reduces the risk of seepage through the dam wall and the abutment areas.

7.2 CONCLUSIONS

The conclusions of this report are summarised below.

- The frequency of inspection and monitoring for a 'High A' consequence dam meets the requirements of the O&MM.
- The dam is considered to be operating safely and effectively.
- Beaching of tailings against the face of the embankment is in accordance with best practice tailings management.

8 LIMITATIONS

This report should be read in conjunction with the appended "Limitations of Geotechnical Site Investigation", in Appendix F which provides important information regarding geotechnical investigations and assessments.

Any changes to the scope of development of this site, or significant variation in conditions from those anticipated should be reported to this firm for reassessment.

9 REFERENCES

- ANCOLD, 2003; Guidelines on Dam Safety Management
- ANCOLD, 2012; Guidelines on Tailings Dams – planning, design, construction, operation and closure
- WSP, 2006; Main Tailings Dam Detailed Design Report, 2122433B/PR-0260 RevA
- DSC, 2010 Acceptable Earthquake for Dams DSC3C
- DSC, 2014 Consequence Categories for Dams DSC3A
- DSC, 2012 Tailings Dams DSC3F
- DSC, 2010 Surveillance Reports for Dams DSC2C
- DSC, 2010 Emergency Management for Dams DSC2G
- WSP, 2007; Stage 1 Construction Report, 2122433A/PR-0091
- WSP, 2008; Stage 2 Construction Report, 2122433B/PR-0151
- WSP, 2012; Stage 3 Construction Report, 2122433C/PR-0632
- WSP, 2013; report 2161070A/PR-0220
- WSP, 2015; report 2172926A-RPT-GEO-001 RevA.
- WSP, 2017; report 2122823B-GEO-LTR-002 RevA

APPENDIX A

DESIGN DRAWINGS



FOR

CENTENNIAL COAL COMPANY LIMITED

DRAWING SCHEDULE

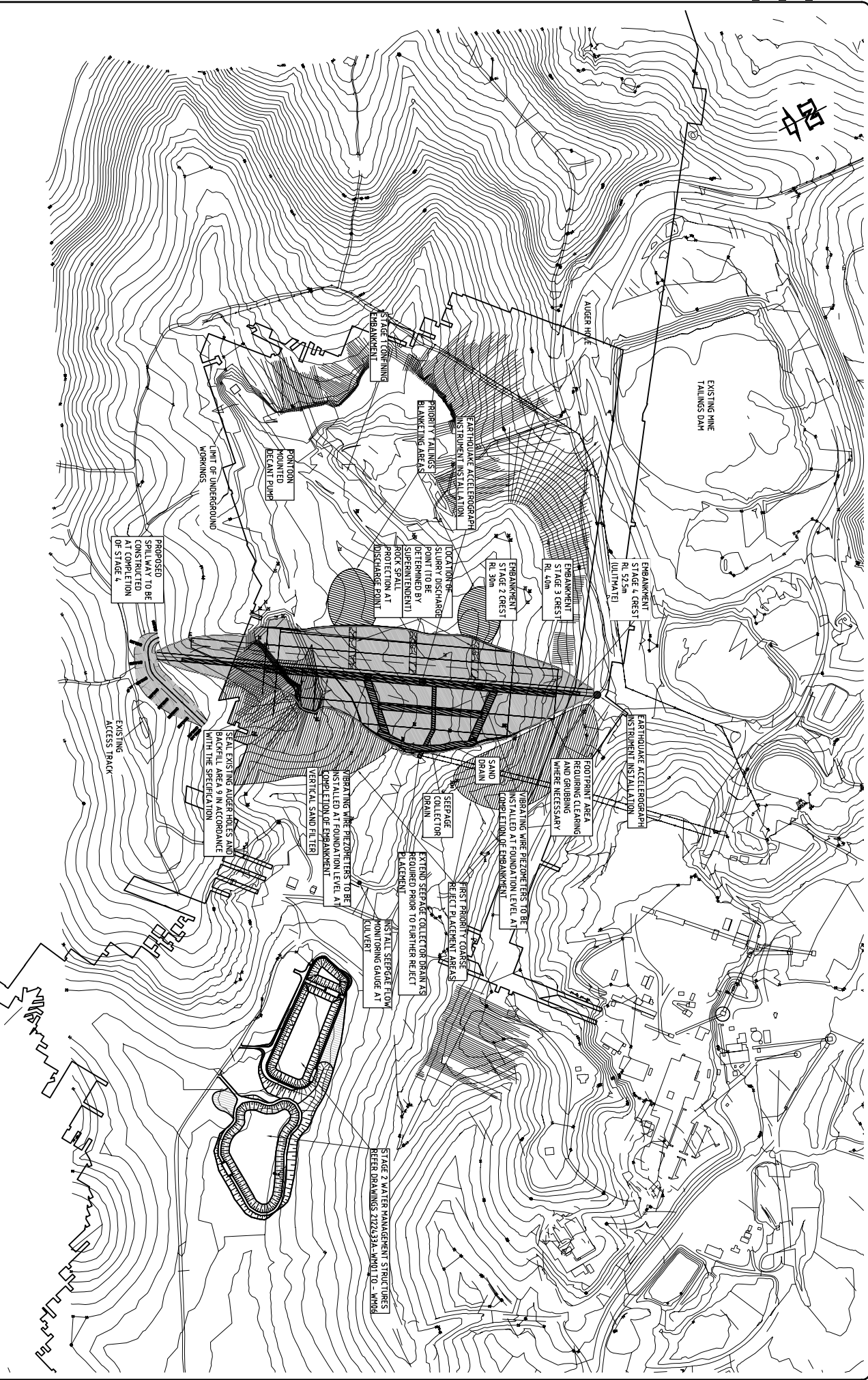
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2122433A_001_CIV_0003	GENERAL ARRANGEMENT STAGE 3
2122433A_001_CIV_0004	GENERAL ARRANGEMENT STAGE 4
2122433A_001_CIV_0005	LONGITUDINAL SECTIONS STAGE 2
2122433A_001_CIV_0006	LONGITUDINAL SECTIONS STAGE 3
2122433A_001_CIV_0007	LONGITUDINAL SECTION STAGE 4
2122433A_001_CIV_0008	SPILLWAY LONGITUDINAL SECTION
2122433A_001_CIV_0009	STAGE 4 AND SPILLWAY TYPICAL SECTION, DETAIL AND SETOUT
2122433A_001_CIV_0010	EROSION AND SEDIMENT CONTROL PLAN

[illegible]

<p>1 ORIGINAL</p> <p>DO NOT SCALE THIS DRAWING VERIFICATION OF SCALE VERIFY ALL DIMENSIONS ON SITE</p> <p>APPROVED _____</p> <p>SIGNED _____</p> <p>DATE _____</p>	<p>PB PARSONS BRINCKERHOFF</p> <p>Architects, Engineers, Planners, Mathematicians, Scientists and Surveyors</p> <p>Seale, 1, 3rd Floor 1000 Pennsylvania Avenue, N.W. Washington, D.C. 20004 Phone: 202/638-1100 Fax: 202/638-1102 Telex: 236311 Cable: 236311 E-mail: seale@pb.com</p> <p>Washington 412-2-6293-2500 New York 212-692-2500 Email: seale@pb.com</p>
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CLIENT CENTENNIAL COAL	PROJECT SOUTHERN REJECT EMPLOYMENT AREA NEWSTAN COLLIERY - MAIN TAILINGS DAM			
	GENERAL ARRANGEMENT			
APPROVED BY ENGINE MANAGER	DATE	PROJECT NO.	YEAR	DISCIPLINE
ENGINE SUPERVISOR	DATE	2122433A	001	CIV - 0000
ON BEHALF OF CENTENNIAL NEWSTAN				REV. C

100mm AT FULL SIZE



REV	DATE	DESCRIPTION	DESIGNER	CHECKER	APPROVER
A	20/03/08	PRELIMINARY ISSUE	AS	AS	AS
B	15/04/08	REVISED ALTERNATIONS	AS	AS	AS
C	08/11/08	FINAL REVIEW COMMENTS	AS	AS	AS

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Fax: +61 (0)3 9592 2001
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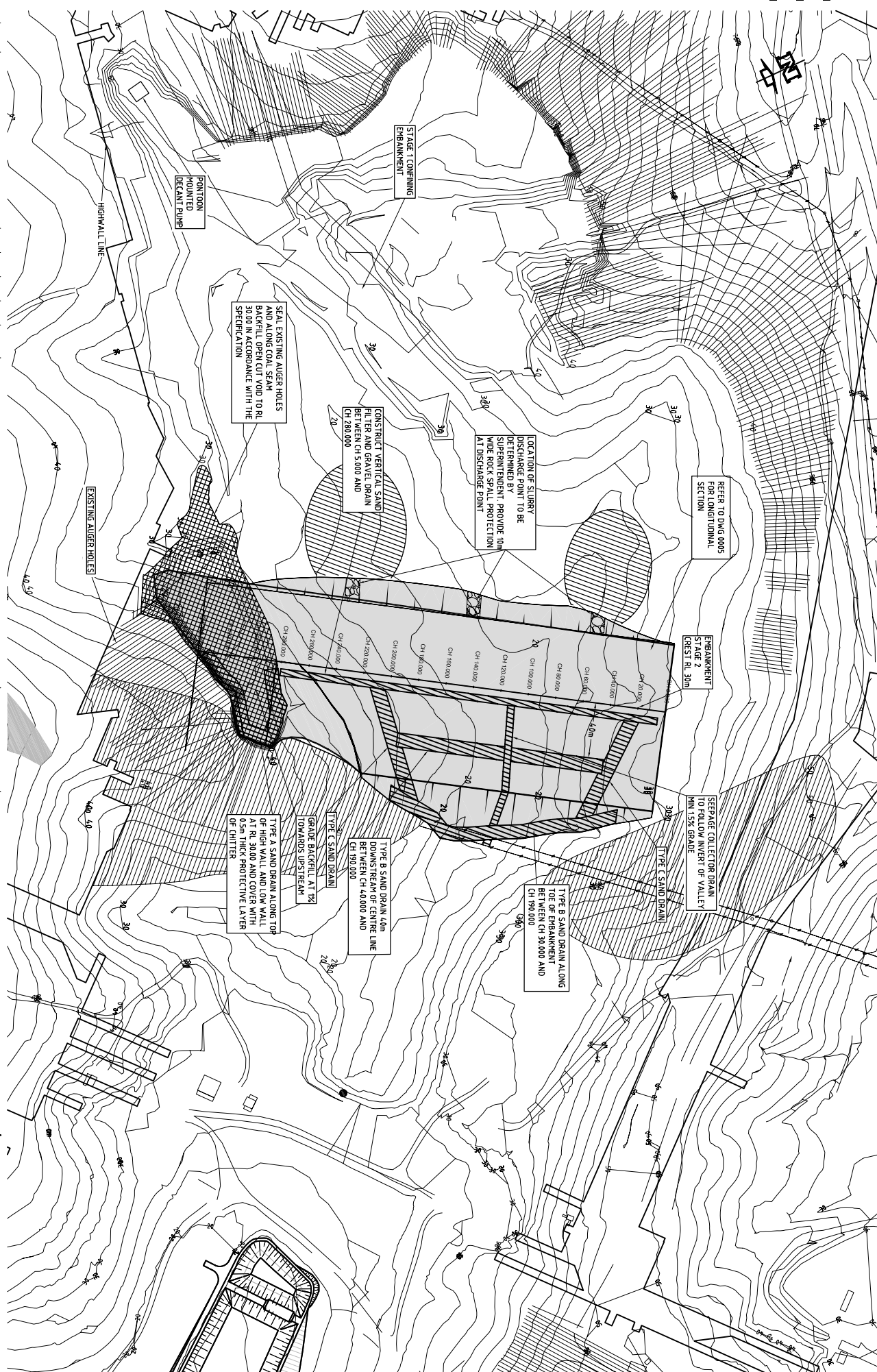
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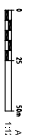
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NAME: _____		DATE: _____	
SIGNATURE: _____		OVERALL PLAN	
ON BEHALF OF CENTENNIAL COAL		DATE: _____	
		NUMBER: _____	
		REV: _____	



REVIEW DATE	DESCRIPTION	PREPARED BY	CHECKED BY	VERIFIED BY	APPROVED BY
20/03/2016	PRELIMINARY ISSUE	ASH	ASH	ASH	
15/06/2016	REVIEW ALTERATIONS	ASH	ASH	ASH	
18/11/2016	REVIEW COMMENTS	AW	AS	AS	
C		AW	AS	AS	

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Tel: 08 9423 3000 Fax: 08 9423 3001 Email: enquiries@pbparsons.com.au	

CLIENT

CLIENT _____

CENTENNIAL COAL

APPROVED BY _____ DATE: _____

MINE MANAGER _____

MINE SUPERVISOR _____ DATE: _____

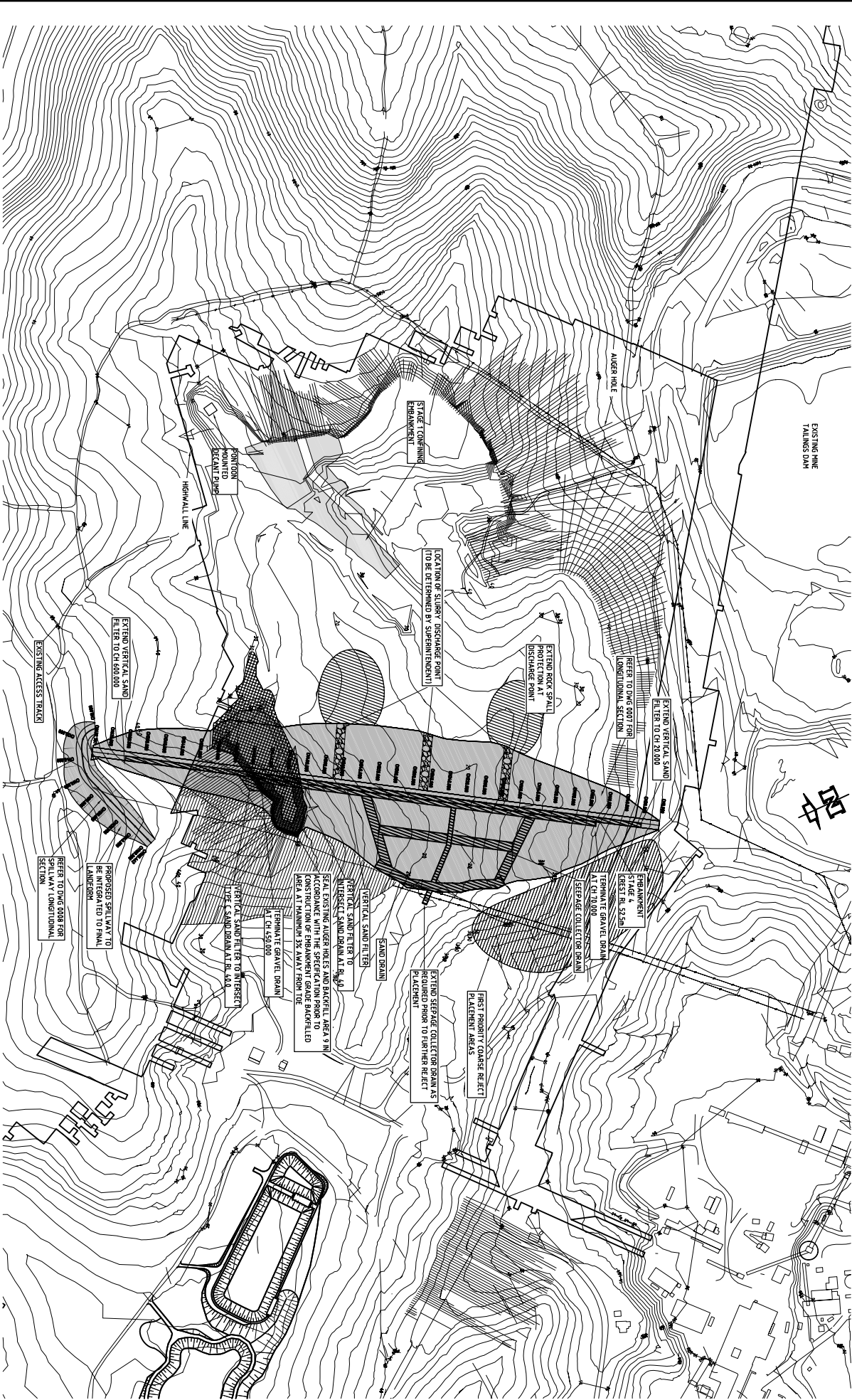
ON BEHALF OF CENTENNIAL NEWSTAN _____

PROJECT COST

PROJECT			
SOUTHERN REJECT EMPLACEMENT AREA			
NEWSTAN COLLIERY - MAIN TAILINGS DAM			
GENERAL ARRANGEMENT - STAGE 2			
PROJECT NO.	TASK	DISCIPLINE	NUMBER
2122433A	001	CIV	0002
			REV.
			C



CENTENNIAL COAL		PROJECT NO.	
APPROVED BY _____		SOUTHERN BELT EMBLEM AREA	
NAME PRINTED _____	DATE _____	NEWSTAN COLLIERY - MAIN TAILINGS DAM	
NAME SURVEYOR _____	DATE _____		
ON BEHALF OF CENTENNIAL COAL		GENERAL ARRANGEMENT - STAGE 3	
		PROJECT NO.	TASK - DISCIPLINE - NUMBER - REV
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Product: CENTENNIAL COAL
Drawing: 2122433A_001_CIV_0004

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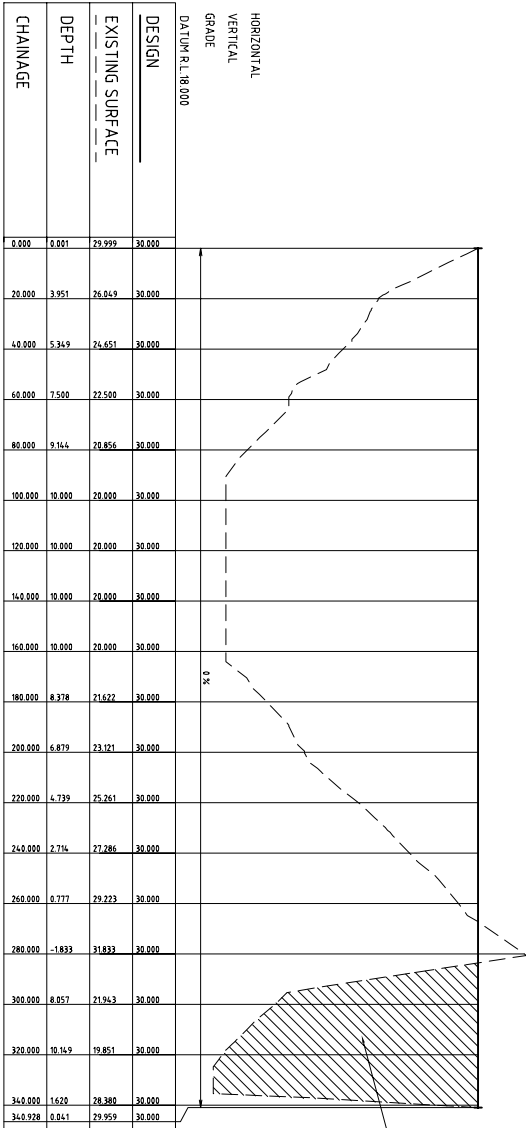
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Project: CENTENNIAL COAL

Product: CENTENNIAL COAL

Drawing: 2122433A_001_CIV_0004

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APPROVED BY: _____	PROJECT NO: _____
DATE: _____	DATE: _____
ON BEHALF OF CENTENNIAL COAL	GENERAL ARRANGEMENT - STAGE 4
	2122433A - 001 - CIV - 0004
	REV: C



STAGE 2
LONGITUDINAL SECTION
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REV	DATE	DESCRIPTION	DESIGNED	CHECKED	VERIFIED	APPROVED
A	20/03/08	PRELIMINARY ISSUE	AKS	AKS	AKS	
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Project No: 2122433A_001_CIV_0005
Drawing No: 2122433A_001_CIV_0005

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CENTENNIAL COAL

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NAME

DATE

ON BEHALF OF CENTENNIAL COAL

PROJECT

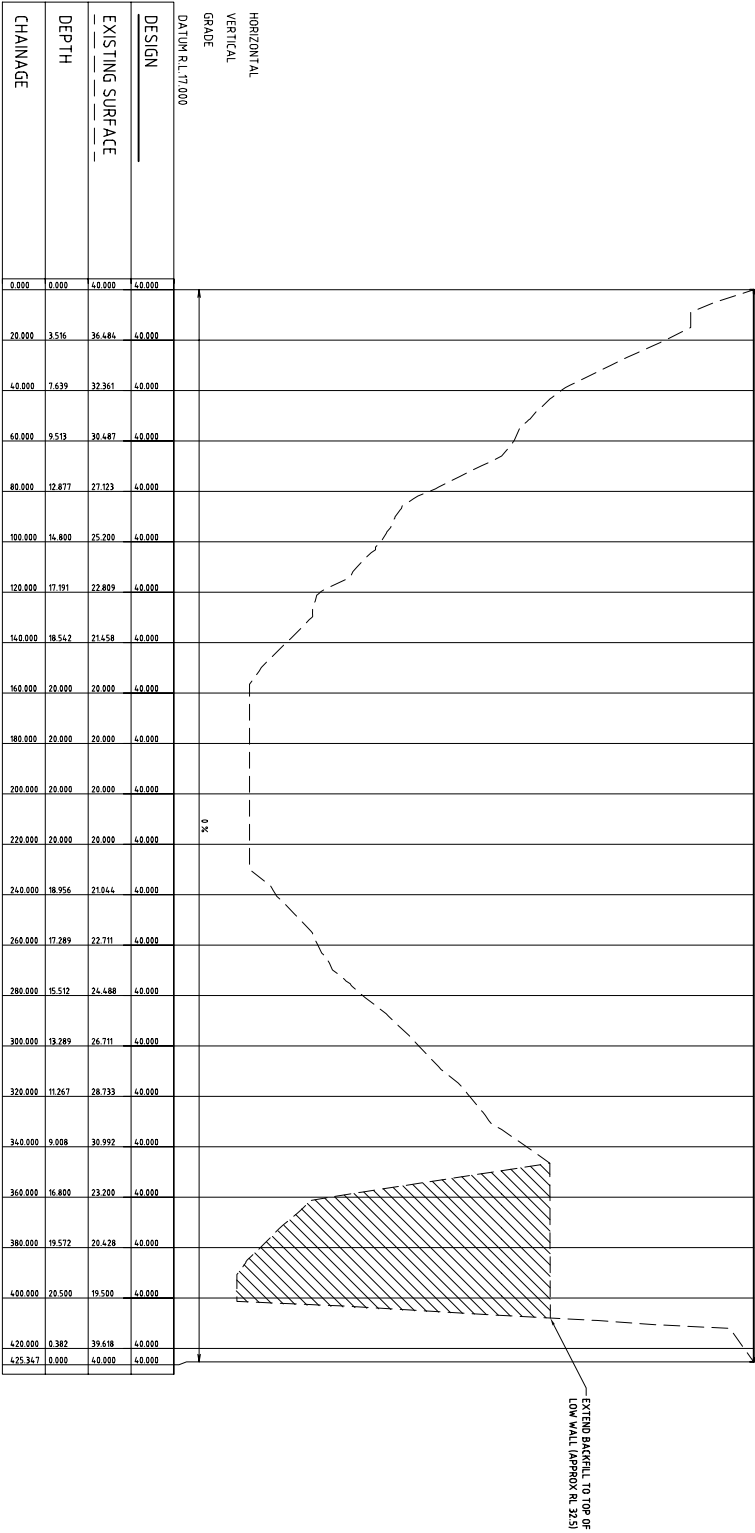
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NEWSTAN COLLIERY - MAIN TAILINGS DAM

LONGITUDINAL SECTION

STAGE 2

PROJECT NO. 2122433A - 001 - CIV - 0005

REV. C



STAGE 3
LONGITUDINAL SECTION
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1:200 (V) 1:40

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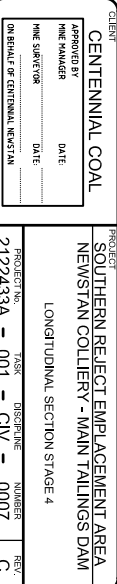
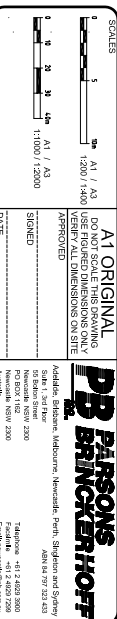
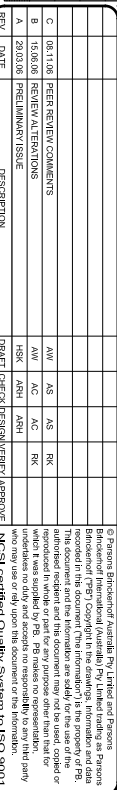
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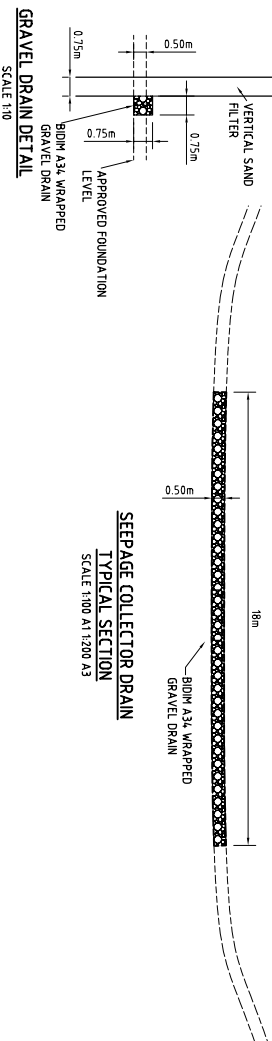
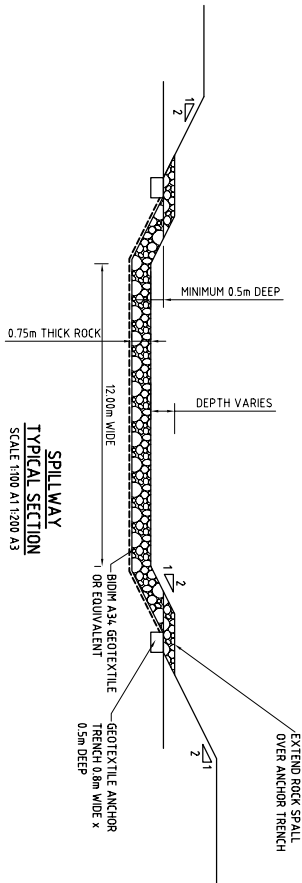
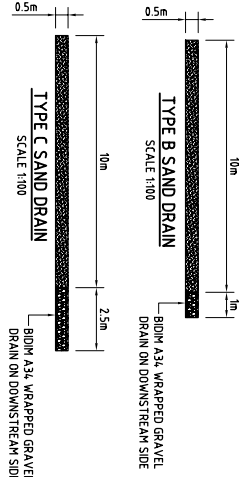
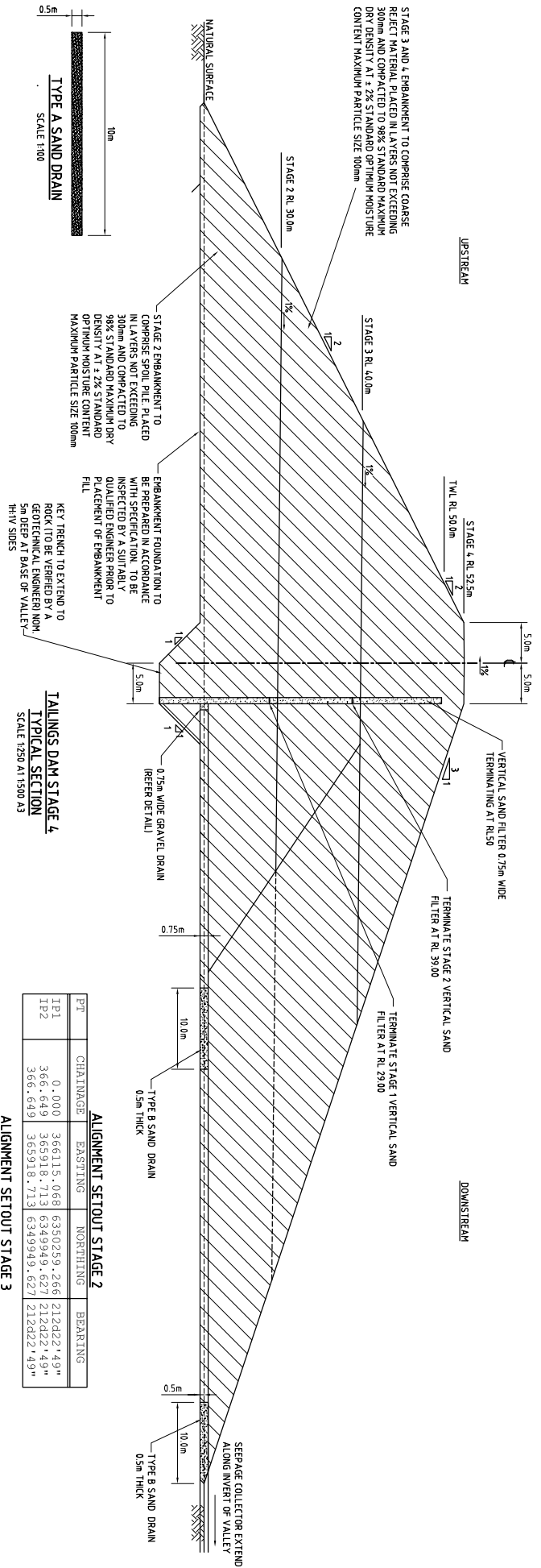
PROJECT

LONGITUDINAL SECTIONS
STAGE 3

0006

REV.





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IP2	366.649	365918.713	6349949.627	212d22.49"
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PT	CHAINAGE	EASTING	NORTHING	BEARING
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IP4	461.806	365908.170	6349914.328	212d22'49"
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PT	CHAINAGE	EASTING	NORTHING	BEARING
IP5	0.000	366189.233	6350344.010	212d32'49"
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CLIENT	CENTENNIAL COAL	PROJECT	SOUTHERN REJECT EMPLACEMENT AREA NEWSTAN COLLIERY - MAIN TAILINGS DAM				
	ASSIGNED BY _____ DATE _____ HR. MANAGER _____ HR. SUPERVISOR _____ DATE _____ ON BEHALF OF CENTENNIAL NEWSTAN _____		STAGE 4 & 8 SPILLWAY TYPICAL SECTION DETAILS AND DETOUR PROJECTION TASK DISCIPLINE NUMBER REV 2122433a 001 CIV 0009 0				



RUNOFF CAPTURED UPSTREAM OF EMBANKMENT
TO BE FLOCCULATED AND PUMPED UNDERGROUND
AS REQUIRED

CONSTRUCT TEMPORARY LIP DRAIN
TO DIVERT RUNOFF AROUND
CONSTRUCTION AREA

CONSTRUCT SILT FENC
AT TOE OF BATTER

EXISTING SUB-CAUSEWAY DAM TO BE FLOCCULATED AND DEWATERED AS REQUIRED. WATER TO BE PUMPED UNDERGROUND AS APPROVED BY SI SUPERINTENDENT

PROJECT SOUTHERN REJECT EMPLACEMENT AREA NEWSTAN COLLIERY - MAIN TALINGS DAM			
EROSION AND SEDIMENT CONTROL PLAN			
PROJECT No.	TASK	DISCIPLINE	NUMBER
2122433A	- 001	- CIV	- 0010
			REV. C

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PROJECT
SOUTHERN REJECT EMPLACEMENT AREA
NEWSTAN COLLIERY - MAIN TAILINGS DAM

- Note -

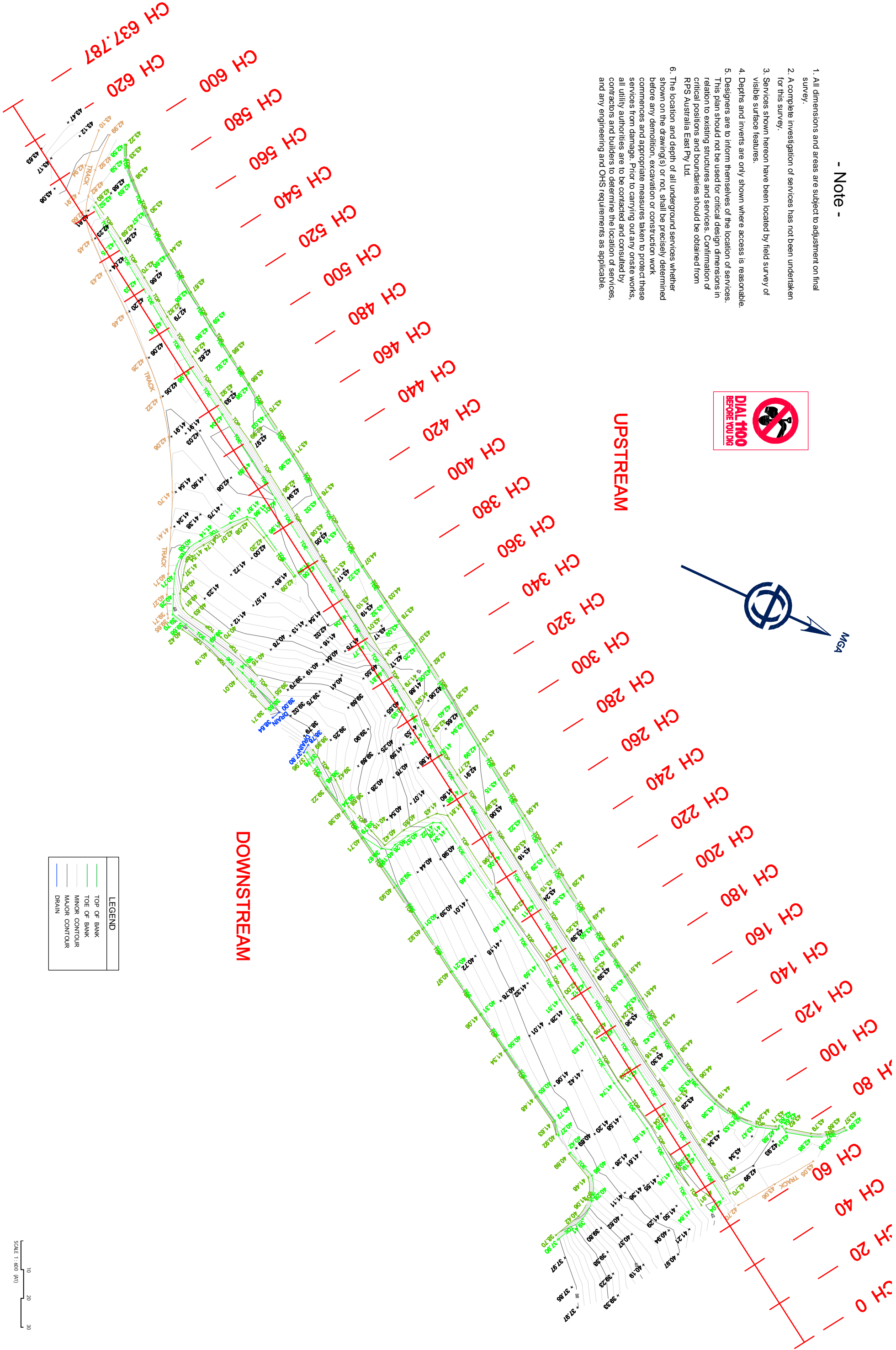
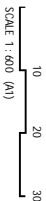
1. All dimensions and areas are subject to adjustment on final survey.
2. A complete investigation of services has not been undertaken for this survey.
3. Services shown hereon have been located by field survey of visible surface features.
4. Depths and inverts are only shown where access is reasonable.
5. Designers are to inform themselves of the location of services. This plan should not be used for critical design dimensions in relation to existing structures and services. Confirmation of critical positions and boundaries should be obtained from RPS Australia East Pty Ltd.
6. The location and depth of all underground services whether shown on the drawing(s) or not, shall be precisely determined before any demolition, excavation or construction work commences and appropriate measures taken to protect these services from damage. Prior to carrying out any onsite works, all utility authorities are to be contacted and consulted by contractors and builders to determine the location of services, and any engineering and OHS requirements as applicable.



UPSTREAM

DOWNSTREAM

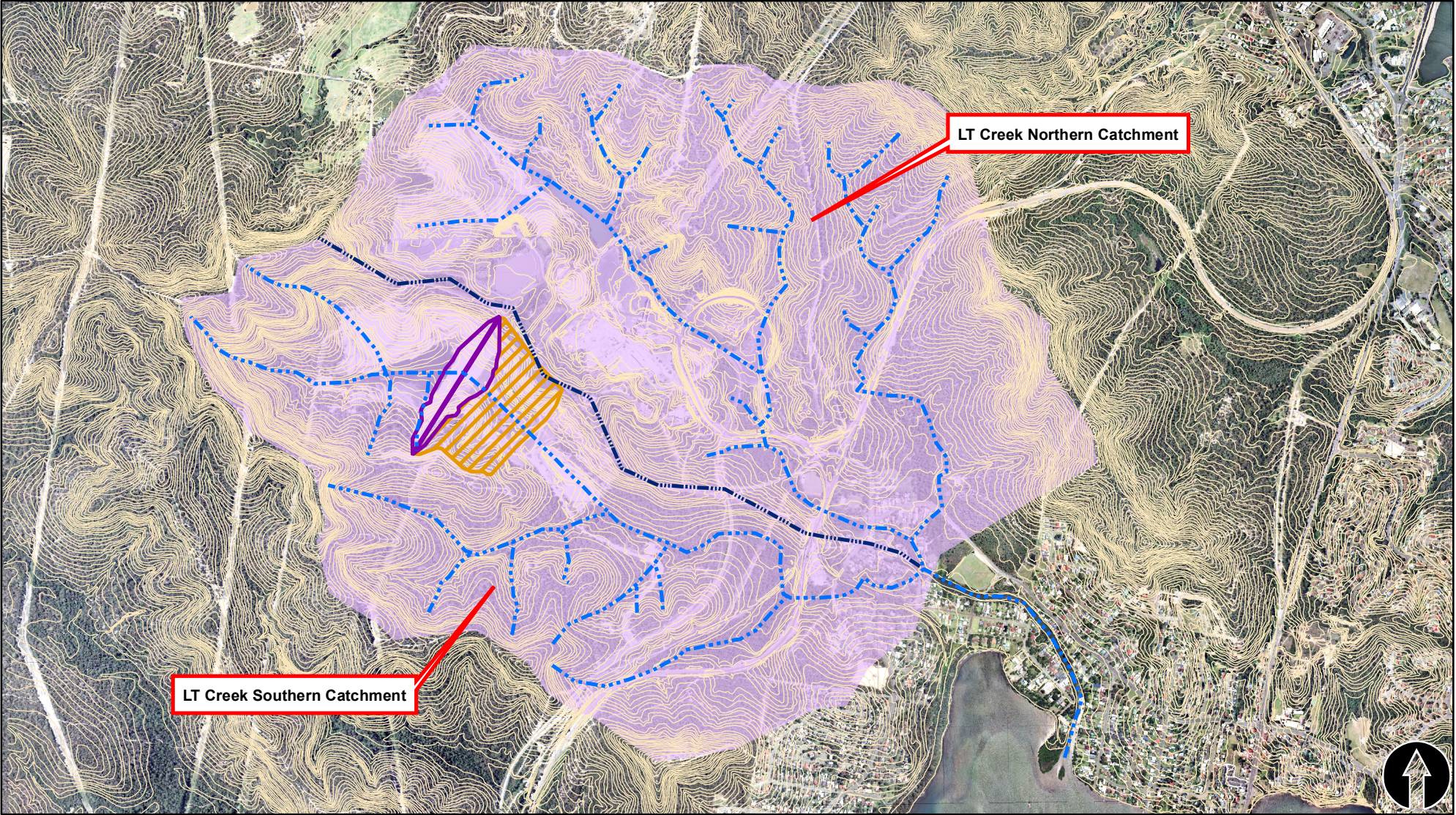
LEGEND	
—	TOP OF BANK
—	TOE OF BANK
—	MINOR CONTOUR
—	MAJOR CONTOUR
—	DRAIN



APPENDIX B

FLOOD MAPPING





LT Creek Southern Catchment

LT Creek Northern Catchment

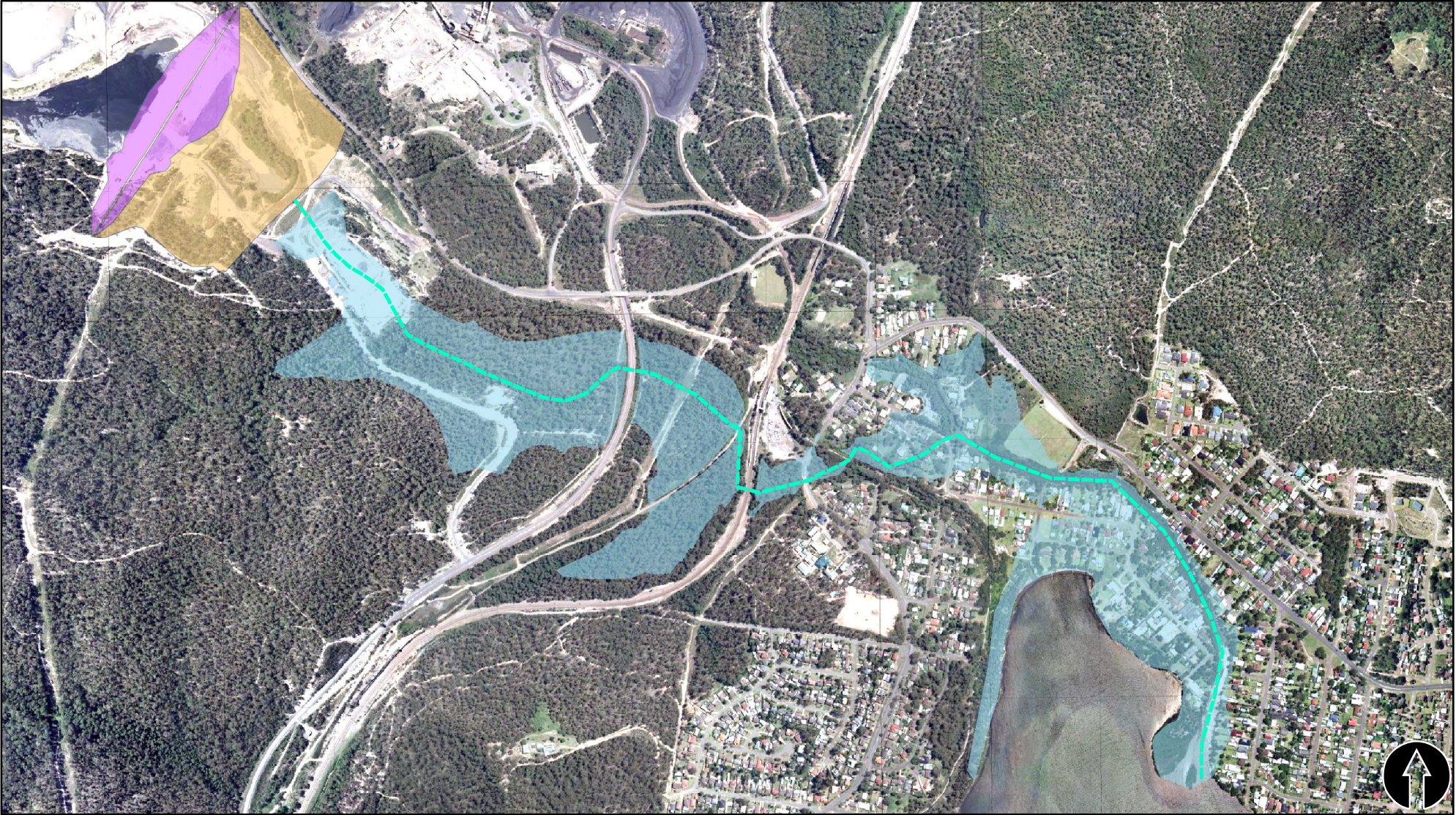
Legend

- Drainage
- 2m contour
- Catchment boundary
- Main tailings embankment (ultimate structure)
- Downstream area filled with coarse reject
- Catchment area



Figure 3.2 LT Creek Catchments
Newstan, Lake Macquarie, NSW

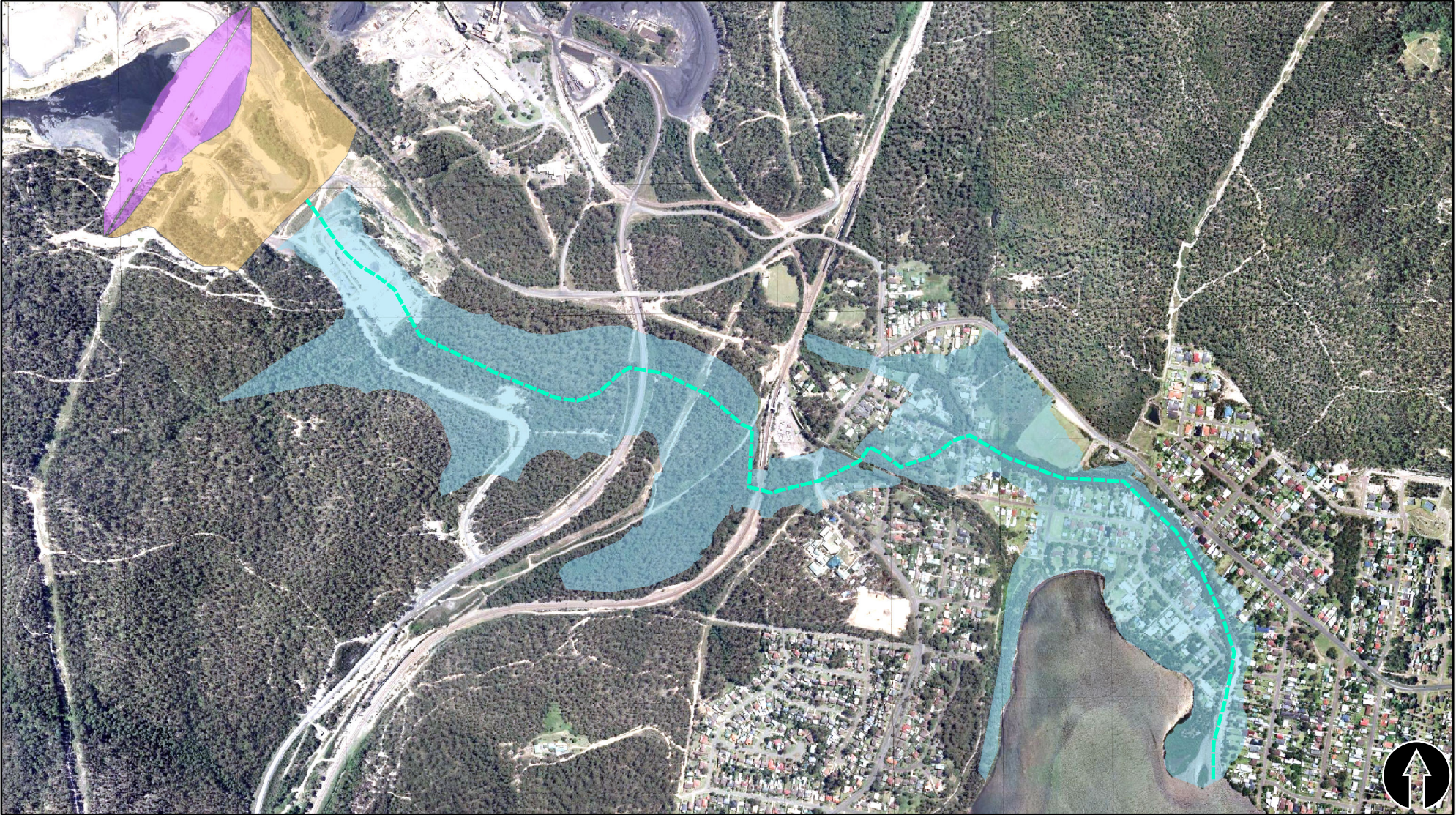
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- Legend**
- Creek centreline
 - Main tailings embankment (ultimate structure)
 - Breach flood envelope
 - Downstream area filled with coarse reject

Figure 3.3 Estimated peak breach flood envelope – Stage 3 ‘sunny day’
Newstan, Lake Macquarie, NSW

\\AUNCLF\proj\Centennial_Coal_Company\2107462A_Dam_survey_failure_analysis\10_GIS\Projects\ESR\2107462A_GIS_F003_3_A001.mxd / SuatSR / 12/07/11



Legend

- Creek centreline
- Main tailings embankment (ultimate structure)
- Breach flood envelope
- Downstream area filled with coarse reject

Figure 3.4 Estimated peak breach flood envelope – Stage 4 ‘sunny day’
Newstan, Lake Macquarie, NSW

\\AUNCLFproj\Centennial_Coal_Company\2107462A_Dam_survey_failure_analysis\10_GIS\Projects\ESR\2107462A_GIS_F03_4_A001.mxd / SuatSR / 12/07/11



- Legend**
- Creek centreline
 - Breach flood envelope
 - Downstream area filled with coarse reject
 - Main tailings embankment (ultimate structure)

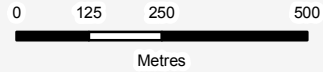
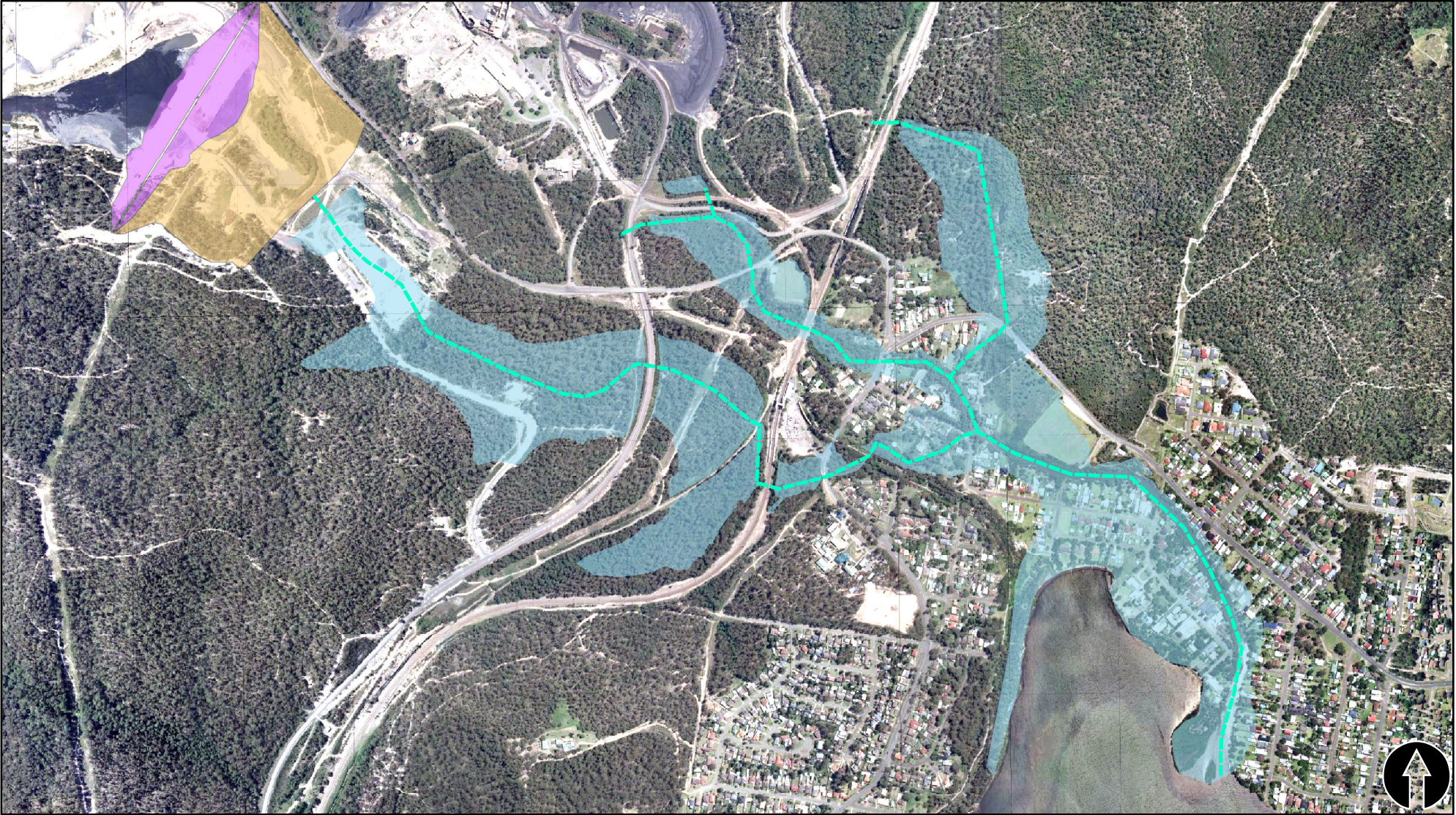


Figure 3.5 Estimated peak breach flood envelope – PMP only
Newstan, Lake Macquairie, NSW

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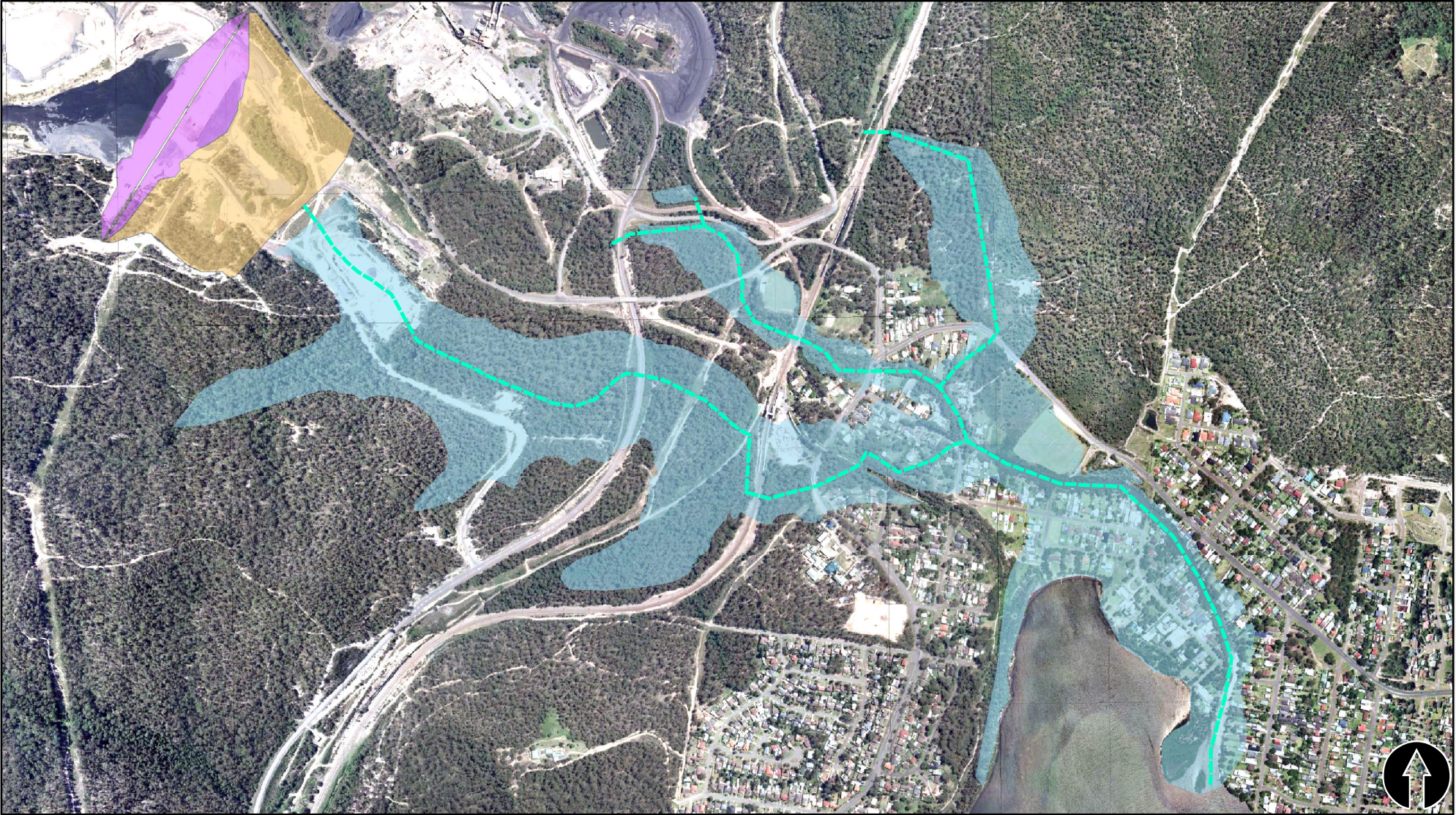


Legend

- Creek centreline
- Main tailings embankment (ultimate structure)
- Breach flood envelope
- Downstream area filled with coarse reject

Figure 3.6 Estimated peak breach flood envelope – Stage 3 ‘flood failure’
Newstan, Lake Macquarie, NSW

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Legend

- Creek centreline
- Main tailings embankment (ultimate structure)
- Breach flood envelope
- Downstream area filled with coarse reject

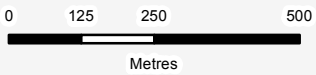


Figure 3.7 Estimated peak breach flood envelope – Stage 4 ‘flood failure’
Newstan, Lake Macquarie, NSW

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APPENDIX C

DSC FORMS





Basic Data Form for Dams

1. Name of dam: Stage 2 Tailings Dam (Main Tailings Dam)
2. Location of dam:
 - a) Place Name: Newstan Colliery (Fassifern)
 - b) CMA Topographic Series Map Name: Lake Macquarie
Number: _____
 - c) Co-ordinates: 366119E,6350034N ☒ MGA ☐ AGM (please tick)
 - d) Please attach a copy of the appropriate CMA Topographic Map showing the outline of the area covered by full supply level (indicating Reduced Level) of the dam and any further augmentation.
3. River/Stream: LT Creek
4. Owner: Centennial Coal Phone No.: 02 4956 0226
Address: Fassifern Road Fassifern

Owner's Representative: Neil Drakeford Phone No.: 02 4956 0236
Address: Newstan Colliery
Fassifern Road Fassifern

5. Catchment Area: 6.8 km²
6. Dam Height: 32.5m m
7. Storage Volume: 210 ML
 - a) Material stored (attach details): Tailings
8. Purpose of Dam: Tailings Storage
9. Type of Dam (i.e. concrete gravity, zoned earthfill, etc.) Zoned earthfill

10. Design Flood Assessment

Inflow Flood Peak: 1.3 m³/s Annual Exceedance Probability: 1 in 100 000 AEP

Method: Generalised Short Duration Method Date: July 2011

a) Spillway Type: Trapezoidal Channel

11a. Sunny Day Consequence Category: (please circle one – see DSC3A)

Extreme High A High B High C Significant Low Very Low

Reasons for assessment (including PAR): >100 people and >50 properties affected

11b. Flood Consequence Category: (please circle one – see DSC3A)

Extreme High A High B High C Significant Low Very Low

Reasons for assessment (including PAR): >100 people and >50 properties affected

12. Names of and River Distances to Downstream Reservoirs: See flood models in Appendix C

The following data is required for existing dams only.

13. Engineered by: Parsons Brinckerhoff

14. Constructed by: Kellers

15. Year of completion: Still under construction

16. Frequency of Surveillance Inspections: annually

17. Date of last Inspection: September 2012

18. Was a Surveillance Report prepared? Yes

Michelle Black

Name

Michelle Black 24/7/2017

Signature & Date

Designation (Owner,
Manager, Consultant etc.)



New South Wales Government

Dams Safety Committee

Dam Owners Address Form (D8)



Explanation

Owners of Prescribed Dams are required to provide this information and to notify the Committee of any changes.

The focus of the Dams Safety Act is on "owners" of dams taking actions to ensure the safety of their dams. It is therefore important for the Committee to identify dam owners. However in some cases it may be quicker for all concerned if the Committee contacted, or provided copies of correspondence to, some other person. Spaces are provided to enable you to nominate these persons.

The full contact details for the "owner" must be provided. In all cases official correspondence will be addressed to this person. For small organisations, or dams owned by individuals, this may be all the information required.

There is no need to enter contact details more than once. Simply mark the box "As above" or similar to indicate that the same person is an alternative contact.

In relation to the following dam(s): [Write dam names here]

Stage 2 Tailings Dam (Main Tailings Dam)

I advise that the following information is correct to the best of my knowledge

(signed) Michael DeB date ... 24/7/2017

1. The owner of these dams in terms of S 4(1) of the Dams Safety Act 1978 is:

Organisation/Person Centennial Coal

This organisation:

- ☒ Owns the land on which the dam is located*
- ☒ Manages the dam
- ☒ Maintains the dam
- ☒ Holds the Mining Lease on which the dam is located
- ☒ Operates the dam

Tick all that apply

* If you (or your organization) do not own the land please advise the name and address of the landowner below

The following organisations may also be owners of the dam in terms of S 4(1) of the Act:

.....

.....

.....

.....

2. Official correspondence should be addressed to:

Name	Neil Drakeford		
Organisation	Newstan Colliery **		
Position	Washery Manager		
Mail (Line 1)	Newstan Colliery		
(Line 2)	Fassifern Road		
(Line 3)			
City	Fassifern	State	NSW
		PCode	2283
Ph	02 4956 0236	FAX	02 4956 0237
		Mobile	0428 683 354
Email	neil.drakeford@centennialcoal.com.au		

** This will be the same as the owner organization listed on page 1

3. The following person may be contacted to discuss the status of the dam, arrange for inspections, or for other informal queries:

Name	As above		
Organisation			
Position			
Mail (Line 1)			
(Line 2)			
(Line 3)			
City		State	
		PCode	
Ph		FAX	
		Mobile	
Email			

☒ Please mark official correspondence to "Attention of" this person ***

OR

☐ Please provide copies of official correspondence ("cc:") to this person

*** You can only tick this box once on this form. Cross check Q3, Q4 and Q5

4. The following person provides specialist dam safety advice on the dam (is our internal or external "Dam Safety Consultant") and may be contacted informally if there are technical queries in relation to the surveillance of the dam:

Name Michelle Black
 Organisation Parsons Brinckerhoff
 Position Senior Engineering Geologist
 Mail (Line 1) 3/55 Bolton Street
 (Line 2)
 (Line 3)
 City Newcastle State NSW PCode 2300
 Ph 02 4929 8312 FAX 02 4929 7299 Mobile 0425349746
 Email mblack@pb.com.au

☐ Please mark official correspondence to "Attention of" this person***

OR

☒ Please provide copies of official correspondence ("cc:") to this person

*** You can only tick this box once on this form. Cross check Q3, Q4 and Q5

5. The following person is located at the dam and may be contacted in an emergency situation for advice on the status of the dam (ideally this person would be located close to the dam):

Name Neil Drakeford
 Organisation As above
 Position As above
 Mail (Line 1) As above
 (Line 2)
 (Line 3)
 City State PCode
 Ph FAX Mobile
 Email

☒ Please mark official correspondence to "Attention of" this person***

OR

☐ Please provide copies of official correspondence ("cc:") to this person

*** You can only tick this box once on this form. Cross check Q3, Q4 and Q5



TAILINGS DAM - INTERMEDIATE REPORT REQUIREMENTS

Checklist for owners and consultants preparing Reports

Please return this form completed with Report

The following checklist covers the minimum items to be included in Intermediate Reports. Please tick against each item to indicate completion of the item in the Report, and enclose the signed D19 Form with the copy of the Report submitted to the Dams Safety Committee. Please note that Reports which do not address all relevant items may not be accepted.

- ☒ Owner to provide cover letter indicating that the owner accepts the report and containing a program to carry out recommendations.
- ☒ Conclusions (in point form).
- ☒ Recommendations (in point form), separate from the Conclusions.
- ☒ Basic Dam Details – location, type of dam, height, crest length, storage volume, consequence categories, outlet works, spillway type and hydrology, etc.
- ☒ Inspection
 - o Details of inspection – names of inspection team, date, weather conditions, storage level.
 - o Condition of dam, e.g. evidence of slips, erosion, cracks, sink holes, piping, subsidence, seepage, settlement, movement, misalignment, etc. & history (old, recent or continuing).
 - o Condition of Abutments & Foundations – seepages related to the storage, slips, erosion, piping, etc. & history.
 - o Condition of Spillways – stability, erosion, blockages, movement, etc. & history.
 - o Condition of Storage Basin & Downstream Areas.
 - o Condition & operability of inlet & outlet works, spillway works and other mechanical & electrical equipment.
- ☒ Monitoring
 - o Type of instrumentation and frequency of monitoring.
 - o Comment on monitoring measurements since the previous Report – seepage (rates & quality), pore pressures, groundwater, deformation surveys, rainfall, storage level, etc.
- ☒ Comment on compliance of inspection and monitoring procedures with the ANCOLD "Guidelines on Dam Safety Management - 2003".
- ☒ Comment on status of O & M Manual and Dam Safety Emergency Plan (DSEP).
- ☒ Findings of any reports produced since the previous Report.
- ☒ Incidents which have occurred since the previous Report and actions taken.
- ☒ Changes to the dam, operating procedures, developments, management or operating staff since the previous Report and their effect on dam safety.
- ☒ Comparison to the previous Report, action taken as a result of that Report's recommendations and any recommendations not carried out.
- ☒ Provide information on mining activities close to the dam or storage.
- ☒ An opinion as to whether the dam is safe in terms of the Committee's requirements.
- ☒ Signatures of Report writers.
- ☒ Appendices
 - o Dam data sheets - D1 & D8.
 - o Drawings, e.g. Site, General Arrangement, Cross-Section, Spillway, Outlet Works, etc.
 - o Photographs of main aspects of dam taken during the inspection, particularly areas commented on in the Report.
 - o Monitoring data summary sheets.
 - o An IBM compatible CD, or equivalent, containing a Microsoft Word format file of the text and a PDF of the entire report including drawings and photos.

Checklist completed by:

Michelle K. 24/7/2017

APPENDIX D

INSPECTION REPORT





NCS Manager or his Delegate Daily Operating Inspection Sheet

	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Date	12/03/16	13/03/16	14/3/16	15/3/16	16/3/16	17/3/16	18/3/16
Time	6:30am	6:30am	6:00	6:00	6:00	6:00	6:00
Weather	FINE	FINE	Fine	Fine	Rain	Rain	Fine
Rain Gauge	0	0	0	0	1mm	2mm	0
Previous days Checklist sighted	Y	Y	Y	Y	Y	Y	Y
Use a tick to indicate satisfactory and a cross if unsatisfactory. Unsatisfactory items must be detailed in the comments section below							
DMN012 Main Tailings Dam (Stage 2)							
Downstream of dam for springs, seepage etc.	✓	✓	✓	✓	✓	✓	✓
Downstream slope for springs, seepage etc.	✓	✓	✓	✓	✓	✓	✓
Downstream slope for slumps, cracks or erosion	✓	✓	✓	✓	✓	✓	✓
Crest & upstream slope for slumps, cracks or erosion	✓	✓	✓	✓	✓	✓	✓
Beach coverage of dam wall at waterline	100%	100%	100%	100%	100%	100%	100%
Tailings pump, pipeline and valve condition	✓	✓	✓	✓	✓	✓	✓
Spillway Invert RL	41.50m	41.50m	41.50m	41.50m	41.50m	41.50m	41.50m
Water Level RL for 2m freeboard must be less than	39.50m	39.50m	39.50m	39.50m	39.50m	39.50m	39.50m
Water Level - RL reading	<35.00	<35.00	<35.00	<35.00	<35.00	<35.00	<35.00
Decant pump flow and pipeline condition	✓	✓	✓	✓	✓	✓	✓
Decant Pumps / Pipeline destination	#8	#8	#8	#8	#8	#8	#8
Availability of Decant Bore Plug	Y	Y	Y	Y	Y	Y	Y
Downstream Drainage "V" Notch Weir Flow	N/R	N/R	N/R	N/R	N/R	N/R	N/R
SREA General							
Tailings Destination	NP	NP	#2	#2	#2	#2	#2
Haul Road 2 Dam Level (DMN016)	Low	Low	Low	Low	Low	Low	Low
Clean Water Dam Level (DMN015)	0	0	0	0	0	0	0
Seepage Treatment Dam Level (DMN014)	0	0	0	0	0	0	0

Pre Sediment Dam Level (DMN013)	Low/Med/High	Low	Low	Low	Low	Low	Low	Low
Causeway Dam Level	Low/Med/High	Low	Low	Low	Low	Low	Low	Low
Main Haul Road Condition (To Stage 2 Dam)	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Internal Roads Condition (Past Stage 2 Dam)	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Reject Emplacement Area Condition	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Reject Emplacement Windrows	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Lighting Tower Facilities	Satisfactory or Unsatisfactory	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Condition of Safety Signs	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Power Line Clearances	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Evidence of Spontaneous Combustion	Y/N	N	N	N	N	N	N	N
NREA and Newstan Surface								
2000T Bin O/Flow Stockpile Stability	Satisfactory or Unsatisfactory	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ROM Stockpile Stability	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
ROM Stockpile Evidence of Spontaneous Combustion	Y/N	N	N	N	N	N	N	N
PP87 Pollution Transfer Pump	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
PP88 Pollution Transfer Pump	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
PP90 Sewage Transfer Pump	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
PP91 Sewage Transfer Pump	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Rail Loop Stockpile Stability	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Rail Crossing Condition	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
Haulage Contractor's Yard (power is ON)	Y/N	Y	Y	Y	Y	Y	Y	Y
Surface Catchment Dam Level (DMN002)	Low/Med/High	Low	Low	Low	Low	Low	Low	Low
Final Pollution Dam Level (DMN001)	m	0	0	0	0	0	0	0
Surface Overflow Dam Level (DMN005)	Low/Med/High	Low	Low	Low	Low	Low	Low	Low
Rail Loop Dam Level (DMN003)	Low/Med/High	Low	Low	Low	Low	Low	Low	Low
Connolly's Dam Level (DMN004)	m	1.8	1.8	2.0	1.9	1.8	1.8	1.9
FPN930 Connolly's Dam Pump Floating Pontoon	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓

Grauch's Dam #1 Level (DMN006)	Low/Med/High	Low	Low	Low	Low	Low	Low	Low
Grauch's Dam #2 Level (DMN007)	Low/Med/High	Low	Low	Low	Low	Low	Low	Low
Main By-Wash Dam Level (DMN008)	Low/Med/High	High	High	High	High	High	High	High
Fassi #1 Borehole Water Level	m	19.46	19.49	19.54	19.57	19.60	19.64	19.68
NREA Tailings Dam Safe Areas (DMN010)	1,2,3,4,5,6,7,8	Ave	Ave	Ave	Ave	Ave	Ave	Ave
NREA Tailings Dam Unsafe Areas (DMN010)	1,2,3,4,5,6,7,8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NREA Haul Road Conditions	Satisfactory or Unsatisfactory	✓	✓	✓	✓	✓	✓	✓
NREA Evidence of Spontaneous Combustion	Y/N	N	N	N	N	N	N	N
CWP950 Clean Water Plant								
Clean Water Plant (CWP950) Discharge Flow	Litres / Sec	60/ps *	118 lps	115.2 lps	120.2 lps	127.4 lps	120.2 lps	120.2 lps
McKendry's Dam Level (DMN009)	Meg/Litres	6.05	5.86	5.37	5.10	5.00	6.64	6.51
LDP01 Quality	NTU	3.56	3.72	0.1	0.1	0.1	0.1	0.1
Weekly Fence Inspections	Satisfactory or Unsatisfactory	N/A	N/A	✓	N/A	✓	N/A	✓
Truck Tarps	Satisfactory or Unsatisfactory	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Inspected by		Kob for	Kob for	Kob for	Kob for	Kob for	Kob for	Kob for
Signed		Kob for	Kob for	Kob for	Kob for	Kob for	Kob for	Kob for
NCS Manager Weekly Review	Sign	Kob for	Kob for	Kob for	Kob for	Kob for	Kob for	Kob for
I certify that the inspections have been carried out as directed and are a true and correct representation of the conditions at the time								
Unsatisfactory Item Details, Comments or Maintenance Required (Work Order No)								
* VAN 961 - FINE CLOSE								

APPENDIX E

EMERGENCY SIMULATION MINUTES





Centennial Coal

Minutes of Meeting Emergency Drill Planning Session Northern Coal Services

DATE: Friday, 26 August 2016

VENUE: Northern Coal Services

PRESENT: Neil Drakeford; Michael Gale; Jason Boersma; Clinton Brockwell; David Baker; Matthew Gilbert.

MATTERS ARISING

1. EMERGENCY DRILL – NCS

The scenario for the drill will be a serious piping incident in the dam, with the potential for the discharge of material off site.

- What is the trigger?
- What observations have been made?
- What history of dam inspections available?
- Are telephone lists correct?

2. Telephone Number Checks

- Called Helen SES and number is ok
- Dam engineers ok (Parsons Brinkerhoff)
- Dam safety committee called first number on list and phone not manned. Got hold of Steve Knight on mobile. Steve was pleased with the call and proactive review and testing of system and requested a short summary of the test after the completion of test.
- Called LMCC to test. The number was answered after about two minutes. The number is not manned 24 hrs a day but is diverted to supervisor after hours.
- The listed number for DIRE did not work. Have updated to DRE and new numbers
- Ministry for health did not have an emergency number listed. They took details and called back



Agency	Number	Result
Internal Notification List		
Mine control room	4956 0252 or 4956 0271	In order
CPP Manager	4956 0236 or 0428 683 354	In order
Giacci – Chris Somner	0419 977 714	In order
Dam construction	0428 683 654	Will change with new engineer
Mine Manager	4956 0205 or 0438 560 227	In order
Environmental coordinator	4956 0206 or 0482 438 792	In order
External notification list		
SES	1300 737 236	In order
Dam engineer	0402 115 072	In order
Dam Safety Committee	98 428 073 or 0403 681 645	In order
DRE	1300 814 609 or 4931 6666	Updated number
EPA	131 555	In order
LMCC	4921 0333	In order
Sydney Trains	1300 038 500	In order
NSW fire and rescue	1300 729 579	In order
Ministry for health	4924 6477 or 4921 3000 (ah)	Number changed
Work cover	131 050	Number changed

3. DUTIES FOR EXERCISE

Dave Baker	<p>Initiate the simulation - The scenario is a serious piping incident in the dam, with the potential for the discharge of material off site.</p> <ul style="list-style-type: none"> Use the words this is a simulation at the start of every communication Initiate simulation
Control Room	<ul style="list-style-type: none"> Initiate EMP Notify manager of event Use the words this is a simulation at the start of every communication No external calls to be made during simulation
Neil Drakeford	<ul style="list-style-type: none"> Initiate EMP Notify dam engineers (0425 349 746) Notify Jason (045 845 2940)



Grant Watson	<ul style="list-style-type: none">▪ Notify Andy Myers – This is a simulation▪ Notify Dam safety committee (0402 331 141)▪ Notify DRE (0458 013 968)▪ Notify Sydney Trains (4935 8919)▪ Notify LMCC (0402 331 141)▪ Notify NSW fire and rescue (0417 295 774)▪ Notify work cover (0458 013 968)
Michael Gale	<ul style="list-style-type: none">▪ Notify EPA (0417 295 774) (assume all other notifications made)▪ Complete
Jason Boersma	<ul style="list-style-type: none">▪ Scribe
Daniel Piason	<ul style="list-style-type: none">▪ Fire and Rescue during event
AlexLim	<ul style="list-style-type: none">▪ DRE and Work Cover during event
Mandy Holt	<ul style="list-style-type: none">▪ Sydney Trains during event
Clinton Brockwell	<ul style="list-style-type: none">▪ DSC and LMCC during event

APPENDIX F

LIMITATIONS STATEMENT



Scope of services

This geotechnical site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on data

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Geotechnical investigation

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the client and expressly for purposes indicated by the client or his representative. Use by any other persons for any purpose, or by the client for a different purpose, might result in problems. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

This geotechnical report is based on project-specific factors

This geotechnical engineering report is based on a subsurface investigation which was designed for project-specific factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained this geotechnical engineering report cannot be used:

- when the nature of any proposed development is changed
- when the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

The limitations of site investigation

In making an assessment of a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however this often does not result in any overall cost savings for the project. The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation, and can not always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

Subsurface conditions are time dependent

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

Avoid misinterpretation

A geotechnical engineer should be retained to work with other appropriate design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

Bore/profile logs should not be separated from the engineering report

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to 'Guidelines for the Provision of Geotechnical Information in Construction Contracts' published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

Geotechnical involvement during construction

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed and to conduct additional tests which may be required and to deal quickly with geotechnical problems if they arise.



Legal Limitations of Geotechnical Site Investigation

Report for benefit of client

The report has been prepared for the benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

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