# STRATFORD MINING COMPLEX
# LIFE OF MINE
# REJECT DISPOSAL PLAN

STRATFORDCOAL
Part of the Yancoal Australia Group

**REVISION STATUS REGISTER**

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# 1 INTRODUCTION

Stratford Coal Pty Ltd (SCPL) is a wholly owned subsidiary of Yancoal Australia Limited) and operates the Stratford Mining Complex (SMC), located in the Gloucester Valley of NSW. Yancoal under its subsidiary Duralie Coal Pty Ltd (DCPL) is also the owner of the Duralie Coal Mine (DCM), located 20 km to the south of the SMC.

The SMC has been in continuous operation since 1995 and has involved open cut mining and processing of coal from the Stratford Main pit and several smaller satellite pits (Bowens Road West, Roseville, Roseville Extension, Roseville West and Bowens Road North pits), within the Stratford Mining Leases at the Stratford Coal Handling and Preparation Plant (CHPP).

Coal production at the DCM commenced in March 2003 with run-of-mine (ROM) coal being railed to the Stratford CHPP for processing. The SMC and DCM product coals are railed to the port of Newcastle for export.

The Stratford CHPP reject stream comprises fine and coarse reject. The reject is pumped as a slurry (at approximately 45% solids concentration by weight) to the Stratford Main pit for disposal.

The emplacement of rejects at the SMC is (now) undertaken in accordance with the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 Schedule 3, Part 5, Clause 27 High Risk Activities – Emplacement Areas[1].

Development Consent DA 23 98/99 for the SMC requires rejects from the processing of coal to be disposed of in accordance with an approved Life of Mine Rejects Disposal Plan (RDP). A RDP for the SCM was approved by the NSW Department of Industry – Division of Resources and Energy[2] following commencement of operations in fulfilment of this requirement. The approved RDP was revised in 1998, 2003 and 2009 in response to changed reject disposal requirements.

This revision of the approved (2009 revised) RDP has been prepared by SCPL to consider the outcomes of a Reject Emplacement Area Assessment undertaken by the NSW Department of Industry - Resource Regulator (DIRR) on 19 October 2016.

[1] Previously in accordance with the Coal Mine Health and Safety Regulation 2006
[2] Formerly the Department of Primary Industries – Mineral Resources

# 2 PURPOSE AND SCOPE

The requirements and objectives of this revised RDP are to:

- Estimate the remaining life of the Stratford Main pit as a secure containment facility for reject disposal, including allowance for storage of supernatant water with a low risk of spill.
- Identify sufficient secure containment capacity to store the total projected volume of reject to be produced, including the reject from processing of coal from the DCM, beyond the life of the Stratford Main pit.
- Describe the rehabilitation strategy for any remaining reject left in the above-ground western reject area at the completion of the reprocessing operation consistent with the Mining Operations Plan (MOP).
- Describe the rehabilitation strategy for the Stratford Main pit once it reaches its reject disposal capacity consistent with the MOP.
- Facilitate control of water movement to and from the active reject disposal areas such that there is a low risk of surface and groundwater contamination either during the active mine life or post rehabilitation and lease relinquishment.
- Facilitate efficient, low cost disposal and management of reject both during the operational and the closure (rehabilitation) stages.
- Facilitate reject disposal operations that are in compliance with the regulatory guidelines and consent conditions.
- Provide for monitoring of reject disposal and associated water management system performance to establish ongoing compliance with the objectives of the plan and to enable ready deployment of corrective measures if required to maintain compliance.

# 3 STATUTORY REQUIREMENTS

SCPL's statutory obligations are contained in:

(i) the conditions of the NSW Development Consent DA 23-98/99;
(ii) relevant licences and permits, including conditions attached to mining leases; and
(iii) other relevant legislation (such as, for example, the *Work Health Safety (Mines and Petroleum Sites) Act 2013* and associated Regulation).

## 3.1 NSW DEVELOPMENT CONSENT

The conditions of the DA 23-98/99 relevant to this RDP are described below.

**Waste**

33 The Applicant shall:

…

(c) dispose of rejects generated by the processing of coal on site in general accordance with the approved *SMC Life of Mine Reject Disposal Plan.*

## 3.2 WHS (MINES AND PETROLEUM SITES) REGULATION 2014

This RDP has been prepared in accordance with the requirements of the WHS (Mines and Petroleum Sites) Regulation 2014 Schedule 3 High Risk Activities Part 5, Clause 27 Emplacement Areas.

## 3.3 LICENCES, PERMITS AND LEASES

The date of grant and duration of the Development Consent, authorisations and licences relevant to the operation of the SMC are provided in Table 1 below.

**Table 1**
**Key Consents, Leases, Licences and Permits**

| Instrument | Relevant Authority | Date of Grant | Duration of Approval |
|---|---|---|---|
| Development Consent 23-98/99 | NSW Department of Planning and Environment (DP&E) | 26/11/2010 | The Applicant may carry out mining operations on site until the end of 2019. |
| Development Consent SSD-4966[3] | NSW Department of Planning and Environment (DP&E) | 29/5/2015 | The Applicant may carry out mining operations on site until the end of 2025. |
| EPBC Approval 2011/6176 | Commonwealth Department of the Environment and Energy (DEE) | 29/1/2016 | 30 November 2030. |
| ML1528 | NSW Department of Industry,– Division of Resources and Energy (DI-DRE) | 20/1/2003 | 21 years. |
| ML1447 | DI-DRE | 1/4/1999 | 21 years. |
| ML1409 | DI-DRE | 9/1/1997 | 21 years. |
| ML1577 | DI-DRE | 1/3/2006 | 21 years. |
| ML1360 | DI-DRE | 22/12/1994 | 21 years from renewal on 21/12/2015. |
| ML1538 | DI-DRE | 25/6/2003 | 21 years. |
| ML1521 | DI-DRE | 24/9/2002 | 21 years. |
| ML 1733 | DI-DRE | 8/4/2016 | 21 years. |
| Environment Protection Licence (EPL) 11745 & 5161 | NSW Environment Protection Authority (EPA) | 9/1/2001 | Until the licence is surrendered, suspended or revoked. The licence is subject to review every three years. |
| Exploration Authorisation (AUTH) 311 | DI-DRE | 14/10/2013 | 28 November 2017. |
| AUTH315 | DI-DRE | 14/10/2013 | 28 November 2017. |

[3] While SSD-4966 was granted on 29 May 2015, development under this consent has not yet commenced.

# 4 HISTORY OF REJECT DISPOSAL AT STRATFORD

The initial RDP for the SMC was approved by the DII-MR (now DI-DRE) in 1995. The RDP was contained in the *Stratford Coal Mine Environmental Impact Statement*[4] (EIS) and involved disposal to the above ground western reject emplacement area, which was developed in three cells. Reject disposal was to be transferred to the Roseville and Bowens Road West Pits following the completion of mining in these satellite deposits, and finally to a purpose created cell within the main out of pit overburden emplacement at the southern end of the Stratford Main pit.

An amended RDP was lodged by SCPL[5] in October 1998 and was approved by the DII-MR in January 1999[6]. The core change from the initially approved plan was the extension of the western reject emplacement area to the north and west of the previously approved cells 1, 2 and 3 to accommodate changes to the mine plan.

In June 2000, SCPL obtained approval for modifications to DA 23-98/99 to allow production of higher ash thermal coal. This change meant that coal recovery increased resulting in a lower rate of reject generation. The reduced life of mine reject emplacement requirement meant that the previously approved northwest extension of the western emplacement area was no longer required.

Following discussions with the DII-MR regarding changes to the particle size distribution in the pumped co-disposal reject, a coarse reject crushing system was established to introduce <50mm heavy media bath reject into the pumped co-disposal reject. This facility was commissioned in October 2000. These operational and reject disposal changes were incorporated in a revised mining operations plan (MOP) submitted to the DII-MR in May 2001.

SCPL initiated a series of investigations and trials to demonstrate that excess water readily separates from the pumped co-disposal reject post disposal. The material has also been shown to be competent and able to form a stable rehabilitated landform. Based on these findings and advice from specialist geotechnical consultants (GE Holt and Associates), SCPL ceased combining crushed coarse pumped reject and allowed the combined fine and Dense Media Cyclone reject to be placed in the completed Roseville void. SCPL also successfully investigated the potential to recover and sell thermal coal from previously placed reject in the above ground western reject disposal area. Following approval by the DII-MR, SCPL has commenced the recovery and re-processing project that will ultimately see most of the above ground reject re-processed and the residual reject placed in mine voids, below eventual groundwater table levels. These two changes were reflected in a revised MOP lodged in May 2001 and approved by the DII-MR in June 2001.

Following the cessation of mining in the Stratford Main Pit in 2003 the CHPP rejects have been pumped as a co-disposed slurry via a pipeline to the Stratford Main Pit. A new RDP was prepared in May 2003 to reflect the use of the Main pit for rejects and this was revised again in December 2009 to reflect changes in ROM production at Stratford and Duralie.

The Stratford Main Pit would continue to be used for co-disposal of CHPP rejects at the Stratford Mining Complex until the end of coal processing which coincides with the end of mining planned at Duralie in 2018.

[4] Stratford Coal Mine, Environmental Impact Study, Stratford Coal Pty Ltd, 1994

[5] Mine development and all operations at Stratford were conducted by the corporate entity Stratford Coal Pty Ltd, a wholly owned subsidiary of CIM Resources Limited. Development of the Duralie project was undertaken by Duralie Coal Pty Ltd, a separate wholly owned CIM subsidiary company. Following the merging of the Stratford and Duralie projects a new operating company, Gloucester Coal Pty Ltd, was created as the single entity for both projects.

[6] Stratford Coal Project – Life of Mine Reject Disposal Plan, report prepared for Stratford Coal Pty Ltd by Gilbert and Sutherland Pty Ltd, September 1998.

# 5 REJECT CHARACTERISATION

## 5.1 REJECT FROM STRATFORD MINE AND DURALIE MINE

EGi[7] assessed the geochemical characteristics of the CHPP rejects (including DCM rejects) in 2010. The assessment included reviews of laboratory-generated wash trial and CHPP rejects testing carried out between 1995 and 1998, and co-disposed CHPP rejects testing in the Stratford Main Pit conducted in 2008.

Results showed that most co-disposed CHPP rejects represented by the samples tested from the Stratford Main Pit deposition area were Potentially Acid Forming (PAF) or Potentially Acid Forming – Low Capacity (PAF-LC), with low Acid Neutralising Capacity (ANC) and fast rates of reaction. Multi-element analysis suggested that materials represented by the samples tested would have no significant elemental enrichment (except for S), but would mobilise metals at low pH. Pyrite oxidation and acid release would be associated with elevated metal concentrations, including Al, Fe, Mn, Ni and Zn. These results indicated that implementation of appropriate management measures would be required to manage potential ARD impacts associated with the existing and proposed co-disposed CHPP rejects. Note that Stratford Main Pit water quality monitoring confirms that current management measures have successfully controlled pH from deposited CHPP rejects and maintained a circum neutral pH in the Stratford Main Pit.

The CHPP reject samples tested had lower acid forming potential than the laboratory generated DCM rejects samples, and indicated that the overall PAF/PAF-LC nature of the combined CHPP rejects deposited at the Stratford Main Pit was due mainly to the DCM ROM coal feed.

A further assessment of the geochemical characteristics of the CHPP reject material associated with the development of the Project is provided in the Geochemistry Assessment (SEP EIS Appendix L) prepared by EGi[8] (2012) in the *Stratford Extension Project Environmental Impact Statement, 2012*. A summary of the assessment is provided below.

Total sulphur distributions of raw coal from the Project open pits were reviewed and compared to the total sulphur distributions of raw coal currently processed at the CHPP. This review of raw coal total sulphur distributions indicated that the CHPP rejects from the Project would be expected to have a lower acid generating potential than rejects currently produced at the CHPP (SEP EIS Appendix L). As a result, the existing CHPP reject management measures outlined in the approved Life of Mine Rejects Disposal Plan (SCPL, 2009) were considered by EGi (2012) to be suitable for the Project.

A review of the physical characteristics (e.g. density and particle fractions) of the CHPP rejects was undertaken by Allan Watson Associates[9] (2012) and is provided as an attachment to the Surface Water Assessment (SEP EIS Appendix B) in the *Stratford Extension Project Environmental Impact Statement, 2012*. The results of the review have been used to assist with sensitivity analyses for the site water balance performance as significant volumes of water can be recycled from the co-disposal areas.

[7] EGi Document No 6902/905, "Geochemical Assessment of Co-Disposed Rejects and Tailings from the Duralie Extension Project and the Stratford Coal Mine", March 2010.
[8] EGi , "Geochemical Assessment of Stratford Extension Project", March 2012.
[9] AWA, "Geotechnical Characterisation of CHPP Rejects", March 2012.

# 6 REJECT PRODUCTION

Coal mining activities are not currently occurring at the SMC and no activities proposed under the Stratford Extension Project (SEP) are planned to commence prior to 2019. Small quantities (up to approximately 0.2 Mtpa) of coal recovered from the western co-disposal area continue to be re-processed in the CHPP. The RDP would be revised for any future operations.

Over the remaining project life, reject will be produced from processing of coal from the DCM and reprocessing of reject from western reject emplacement at Stratford. A breakdown of planned reject production over the remaining project life is shown in Table 2.

**Table 2**
**Indicative Coal and Material Production Schedule**

| Year | Overburden (Mbcm) | ROM Coal | | | | CHPP Rejects (Mtpa) | Product Coal for Rail (Mtpa) |
|---|---|---|---|---|---|---|---|
| | | Stratford Mining Complex (Mtpa) | DCM (Mtpa) | Western Co-Disposal Area Coal Recovery (Mtpa) | Total Processed^ (Mtpa) | | |
| 1 (2017) | 0 | 0 | 1.6 | 0.2 | 1.8 | 0.6 | 1.2 |
| 2 (2018) | 0 | 0 | 0.7 | 0.2 | 0.9 | 0.3 | 0.6 |
| **Total** | **0** | **0** | **2.3** | **0.4** | **2.7** | **0.9** | **1.8** |

^ Combined ROM coal mined by SMC, DCM ROM coal and western co-disposal area coal recovery.

$m^3$ = cubic metres Mbcm = million cubic metres. Mtpa = Million tonnes per annum.

# 7 REJECT DISPOSAL MANAGEMENT

This RDP is based on on-going pumped co-disposal of reject within the Stratford Main pit void. Reject disposal within the Stratford Main pit commenced operation in May 2003. Since that time approximately 19.1Mt of reject have been deposited in the Stratford Main pit (to the end of October 2016).

The EGi 2010 and 2012 Geochemical Assessment reports concluded that implementation of appropriate management measures would be required to manage potential ARD impacts associated with the existing and proposed co-disposed CHPP rejects. However, the Stratford Main Pit water quality monitoring confirms that current management measures have successfully controlled pH from deposited CHPP rejects and maintained a circum neutral pH in the Stratford Main Pit. As a result, the existing CHPP reject management measures outlined in the approved Life of Mine Rejects Disposal Plan (SCPL, 2009) were considered by EGi (2012) to be suitable for the Project.

Rejects at the SMC have been previously characterised as being PAF, therefore measures to manage rejects are in place. The disposal of CHPP rejects is managed in accordance with this Life of Mine RDP. Rejects management measures include placement into the Stratford Main Pit where they are progressively inundated with water to prevent significant pyrite oxidation and acid generation in the long term, with monitoring of water quality undertaken during operations and provision for lime (calcium hydroxide - $Ca[OH]_2$) dosing and limestone (calcium carbonate - $CaCO_3$) treatment as required. These measures will continue for the current project.

## 7.1 STRATFORD MAIN PIT REJECT DISPOSAL METHODOLOGY

All reject (coarse and fine) is pumped to the Main pit as slurry. Duralie reject, which forms a proportion of the total reject stream, has previously been classified as PAF-HC. As such, a principal requirement for placement of co-disposal reject under the approved RDP has been for a combination of sub-aqueous and sub-aerial deposition with limestone treatment and progressive inundation.

This methodology as described in the RDP 2009 has successfully controlled the formation of acid conditions in the Stratford Main pit, with recorded pH in water samples not falling below 6.3 since 2003. Recorded pH of reject beach samples has generally been near neutral with since 2003 with only occasional lower readings.

Pumped co-disposal reject is disposed of via a reject delivery pipeline located along the pit access road and directed towards the low point within the pit void. Sub-aqueous beaching of co-disposal reject deposited directly into water is undertaken wherever practical and safe. This is achieved by “floating” the delivery line into the disposal area from the land-based take off point at the southern end of the pit. Discharge occurs from a stationary deposition location. As a result, submerged beach slopes estimated at between 5 and 15% are formed. Deposition at any one location continues until the beach rises to within 0.5m of the water surface. At this time the deposition location is moved.

The original sub-aqueous deposition had resulted in a low density tailings deposit that was likely to consolidate extremely slowly if at all given its deposition beneath the water level in the void. In the current RDP 2009 SCPL commenced a combined approach of sub-aerial and subaqueous deposition of reject, to facilitate a higher density reject deposit.

Sub-aerial deposition would be facilitated by relocation of the reject discharge point to the southern end of the pit, however previously this has been located on the western side of the pit. The discharge point would be alternated from the south western corner around to the central southern side to form a beach from the south-western side of the Stratford Main pit sloping to the south-eastern side (refer Figure 1). Water recovery would be undertaken from the south-western side of the pit. Following this, reject

deposition would also occur west to east from the south with water recovery from the south-west of the pit.

Control of acid generation in the sub-aerially deposited reject would be facilitated by incorporating limestone into the reject stream, establishing reject beaches 2-3 m above water level such that they are significantly inundated with rising pit waters within 6-12 months, dosing the reject beach surface with lime at appropriate rates, and alternating the discharge point so that deposited reject beaches are essentially not exposed for more than 1 year.

EGi have advised that application of <4mm size limestone at a rate of 80t $CaCO_3$/hectare incorporated into the top 300-500mm of exposed surface reject should provide sufficient control of Acid Rock Drainage (ARD) from exposed materials until they are inundated. Limestone would be incorporated into the top surface of the surface reject via surface broadcasting/spreading and ripping with appropriate equipment.

In addition limestone (<4mm size) will be introduced to the CHPP reject stream at a rate of approximately 5 kg/t (based on a neutralising value of >90%) when Duralie coal is being processed. Limestone analysis will be conducted on a regular basis to test sizing and neutralising value. The rate at which limestone is introduced may be reviewed based on results from monitoring (refer Section 9).

Limestone will be introduced into the CHPP with Duralie coal at the plant feed. The method for introducing lime will comprise a front end loader feeding lime into the CHPP hopper. The average rate of lime that will be introduced is 1.5 kg/t of ROM coal as DCM coal has a yield of approximately 70%. Lime will pass through the CHPP and go into the reject stream at 5 kg/t before being deposited in the Stratford Main Pit. Alternative methods of introducing lime to the reject stream may be used.

Guidelines on limestone addition rates for co-disposed reject and tailings placed in the Stratford Main Pit are presented in details within Appendix A.

On-going monthly monitoring of Stratford Main pit water quality (refer Section 9) would continue and would provide feedback on the adequacy of lime dosing.

A coarse reject stream, comprising particles from 100mm size down to about 12mm, may be produced at the CHPP. This second waste stream (most likely to be PAF or PAF LC) would temporarily report to Bowens Road West pit where from it would be recovered by excavator and truck and deposited within the lower levels of the Stratford Main pit void.

All activities required under the proposed reject disposal methodology would be subject to risk assessment including compilation of specific Safe Work Method Statements for key tasks.

## 7.2 REJECT DISPOSAL SCHEDULE

Given the reject production schedule in Table 2, the rate of rise of the reject surface within the Stratford Main pit depends on the density of the deposited reject. The rate of rise has been calculated based on averaged historical survey of the tailings beach and estimated at 1.5 m/year. A filling schedule for the Main pit has been calculated for a reject density of 1.2 t/m$^3$.

Table 3 summarises the notional filling schedule for the Stratford Main pit over the next 2.25 years. It is currently not proposed for reject to be placed in the Stratford Main pit higher than the estimated pre-mine groundwater level, estimated to be equal to the level of the adjacent Avondale Creek at

approximately[10] RL 114m, in order to maintain reject saturation and limit potential for long term reject oxidation.

**Table 3**
**Summary of Stratford Main Pit Reject Disposal Schedule**

| Timing (End of Year) | 1.2 t/m$^3$ Reject Density | | |
|---|---|---|---|
| | Reject Volume (ML) | Remaining Pit Capacity* (ML) | Reject RL** (m AHD) |
| Oct-Dec 2016 | 42 | 19,030 | 84.5 |
| 2017 | 500 | 18,530 | 86.0 |
| 2018 | 250 | 18,280 | 87.5 |

* To spill at RL 116m

** Approximate head of beach RL - assuming 1.5 m/year rate of rise.

## 7.3 WATER MANAGEMENT

Reject disposal and process water recovery is a major component of the water management and water supply system at Stratford. The bulk of water used on-site is in the CHPP and recovery of water for re-use in the CHPP is the single largest component of the overall supply system. Water management at the SMC is described in further detail in the SMC Water Mater Management Plan. On average the site has operated in surplus with more water on average being yielded from the mine, and mine infrastructure catchments, than has been needed in supply for the mining and processing operations. Management of this excess water has been by way of containment in the Stratford East Dam, storage in Stratford Main pit and controlled release to Avondale Creek under a discharge licence[11]. Prior to the commissioning of reject disposal in the Stratford Main pit, transfer of mine water to Stratford East Dam ceased as did controlled release to Avondale Creek. Figure 2 shows a schematic of the mine water management system.

The Bowens Road West void continues to be used as a transient storage for runoff from the CHPP and coal stockpile area. Any water which accumulates in the void is pumped to the Return Water Dam which is then recycled through the CHPP.

The Return Water Dam continues to receive local runoff from the adjacent western reject area and associated reprocessing operations. This water is used in the CHPP and for dust suppression on haul roads. In the unlikely event that excess water builds up in this storage there is provision for it to be pumped, via the CHPP, across to the Main pit.

Stratford East Dam contains fresh water runoff, water from mine de-watering, and past transfer of excess water from the Roseville reject disposal area. Since commissioning of reject disposal in the Stratford Main pit, the Main pit has been used for storage of excess water on site and Stratford East Dam has not been used for this purpose. Water levels in the Stratford East Dam have fallen from RL 162m in early 2003 to less than RL 158m in late 2008 and RL 159m in late 2016 (RL 164m spillway level). Monitored electrical conductivity (a measure of salinity) has reduced from 2,400 µS/cm in 2003 to approximately 1,400 µS/cm in 2008 and to 900 µS/cm in late 2016. The Stratford East Dam continues to provide longer term water supply security for both the CHPP and for haul road watering.

[10] Refer Figure 4 of Stratford Coal Project – Life of Mine Reject Disposal Plan, report prepared for Stratford Coal Pty Ltd by Gilbert and Sutherland Pty Ltd, September 1998.

[11] Under a variation to the Environment Protection Licence 5161 issued in June 2001.

Bowens Road North (BRN) and Roseville West open cuts have in the past been de-watered to the Return Water Dam for reuse in the CHPP. Since ceasing operations in BRN and Roseville West in 2014, groundwater inflow and rainfall has been allowed to accumulate in the pit voids. Since early 2016 water from the Stratford Main pit is able to be transferred to the BRN pit to help maintain control over the water level in the Stratford Main pit. In 2016, enhanced evaporator sprays were set up on the Stratford Main pit waste emplacement to reduce the volume of stored water in the Stratford Main pit. However for the purposes of the water balance model (described below) these evaporators have (conservatively) not been included as a water management measure.

A water balance model has been developed (using GoldSim software) to simulate the behaviour of the SMC water management system from October 2016 to the end of 2018. The model simulates all site storages and their associated catchments as well as water movements associated with the mining, coal processing and reject disposal/activities on a daily basis. The model simulates daily changes in stored volumes of water in response to inflows (rainfall and groundwater) and outflows (evaporation, dust suppression use, irrigation loss and spill [if any]). The model simulates 123 possible mine life "realizations", each of 2¼ years, to the end of 2018. Realization 1 uses climatic data from 1889 to 1891; realization 2 uses data from 1890 to 1892; realization 3 uses data from 1891 to 1893 and so on. In order that recent climate be included in as many realizations as all other years in the record, climate data was "wrapped" with data from 1889 to 1891 added to the record after 2010. In this way, historically representative climatic realizations are produced which can be used to test the water management system over a wide range of climatic conditions. By ranking simulated outcomes, the model can be used to estimate the probability and consequences of different water management outcomes occurring.

The key outcome of the simulation model for planning the Stratford Main pit reject disposal is spill risk. As the pit fills with reject, less space becomes available for storage of water – the risk of spill increases as this space diminishes. The model was run starting in October 2016 with an assumed reject density of 1.2 t/m$^3$ used to calculate the diminishing capacity of the Main pit.

Model results show that spill from the Stratford Main pit is not predicted to occur under any realization which implies <0.1% spill risk until the end of 2018.

Based on the above model predictions, in order to keep spill risk to a minimum assuming a reject density of 1.2 t/m$^3$, reject should be able to be disposed of into the Stratford Main pit until at least 2018. Periodic survey of the in-pit reject surface, together with monitoring of reject tonnages should allow reject densities to be checked to refine the above estimates in the future. It is not currently proposed to place reject above RL 114m in order to keep the reject below the estimated long term groundwater level.

Model predicted Stratford Main pit water volume versus time is shown in Figure 3. This plot shows that the water volume in the Stratford Main pit towards the end of the modelled period should be low, but will depend on climatic conditions experienced in the coming years (note that modelling has assumed a non-recoverable or "dead" water storage volume of 500 ML). Ongoing water balance reviews will allow improved predictions of the likely water volume at the end of reject disposal into the Stratford Main pit.

# 8 REHABILITATION STRATEGY

Rehabilitation of the CHPP reject disposal areas would be undertaken generally in accordance with the SMC Mining Operations Plan (MOP). Performance and completion criteria for the rehabilitated reject disposal areas are described in the MOP.

## 8.1 WESTERN REJECT DISPOSAL AREA

Previous geochemical investigations on reject material (by EGi) have indicated that potential exists for generation of acid drainage from the reject area, as well as elevated salt levels. As a means of minimising the impact of this, the original design for rehabilitation of the western emplacement area involved an engineered cover consisting of capillary breaking layer and compacted cover to restrict oxygen and water ingress into the reject and therefore potential oxidation of the placed potentially acid forming beach materials.

Gilbert & Sutherland (in a previous Amended Life of Mine Reject Disposal Plan) recommended a rehabilitation design for co-disposal areas involving:

- a combined subsoil and topsoil cover of nominal thickness of 0.9m (comprising a 300mm thick topsoil layer underlain by a 600mm thick compacted clay layer);
- separation of the cover from the underlying reject by a suitably well-drained layer of material to act as a capillary breaking layer; and
- a healthy vegetative cover.

SCPL propose to rehabilitate any co-disposal areas where reject material is not recovered by the end of the reclamation operations in accordance with the above design recommendations.

For co-disposal areas where reject has been reclaimed there will be little or no potential for generation of acid drainage nor for elevated salt levels. The following rehabilitation design is proposed for these areas:

- push down any remaining co-disposal dam walls (formed from coarse reject) to create a relatively level landform with maximum slopes on the outer edge designed at 10°;
- spreading of a 150 to 200mm topsoil layer;
- addition of lime and gypsum, as required; and
- re-vegetate with trees, shrubs and grasses.

Pushing down of walls and shaping would be achieved using a bulldozer. Addition of lime and gypsum (where required) would be carried out by a rehabilitation contractor using a small bulldozer/tractor with ancillary plant. As carbonaceous material would have been removed from these areas it is planned for the re-vegetation to include shrubs and possibly trees.

## 8.2 ROSEVILLE, BOWENS ROAD WEST AND STRATFORD MAIN PITS

Gilbert & Associates Pty Ltd conducted an investigation into the requirements for covering the backfilled Roseville and Bowens Road West Pits in March 2002. The following recommendations were made on the basis of that study:

- Reject should not be deposited at levels higher than the final groundwater level which was expected to re-establish at levels similar to the pre-mine case.

- Cover materials should be selected for their suitability as a growing medium for surface vegetation and a long-term growing medium.
- A general minimum cover thickness of 1.5m was recommended.

The Roseville void reject co-disposal area has been rehabilitated according to those recommendations and the following principles:

- fill with coarse reject or other material (if necessary), to create a relatively level landform;
- areas which did not have sufficient coarse reject fill on top of the co-disposed reject had a 600mm thick layer of inert material added;
- spreading of a 150 to 200mm topsoil layer;
- addition of lime and gypsum, as required; and
- re-vegetation with trees, shrubs and grasses.

Revegetation of the rehabilitated co-disposal area consisted of shallow rooting grasses and shrubs, so as not to impact upon the integrity and effectiveness of the cover works to limit water and air movement into the reject. Vegetation types were selected on the basis of the existing approved mine site rehabilitation plan, and included introduced pasture species. Vegetation of the reject area assists in the minimising erosion from the area, as well as leading to increased transpiration rates, thereby reducing potential infiltration into the reject material.

Bowens Road West Pit and the Stratford Main Pit will be rehabilitated to the same principles prior to the end of the mine life as described in the MOP. The Bowens Road West void will be backfilled to approximate the pre-mining surface levels, with reformation of the natural drainage lines within the area. The area would be revegetated for erosive resistance and stability, as well as providing for post-mining land use, such as grazing. The Stratford Main pit will be backfilled with inert overburden materials (rather than coarse reject) to a minimum depth of 2m, sourced from on-going mining operations of other open cuts in the area. A clay layer of 1 to 1.5m would be added to the inert material, followed by a 150 to 200mm topsoil layer, addition of lime and gypsum as required and re-vegetation with trees, shrubs and grasses. Backfilling would occur to 5-10m above pre-mining surface levels, to allow for minor settling which may occur due to the significant depth of deposited reject in the pit. A gradually sloping (less than 10-12$^{0}$) final surface profile would be provided. Stable drainage lines would be incorporated into the final landform design.

# 9 MONITORING AND ASSESSMENT

The performance of the reject and water management is monitored to confirm compliance with the reject disposal and water management plans. Environmental water quality monitoring is also conducted to check for possible effects of mining and processing activities on surface and groundwater. The following monitoring program will be implemented with transfer of reject disposal to the Stratford Main pit (Table 4).

**Table 4**
**Reject Monitoring Program**

| Parameter | Location | Frequency |
|---|---|---|
| Rainfall | Mine site office | Daily |
| Reject solids | CHPP | Monthly totals |
| Reject solids (pH field testing) | Stratford Main Pit – Reject beach | Monthly |
| Water level | Stratford Main pit | Monthly |
| Reject deposit level (bathymetric survey) | Stratford Main pit reject area | Six-Monthly |
| Pumping volumes (inflow and outflow) | Transfer pumps | Monthly totals |
| Pit water quality (pH, EC, Alkalinity) | Stratford Main pit | Monthly |
| Monitoring bores water level and quality | Around Stratford Main pit (refer the Groundwater Management Plan) | Quarterly |
| Receiving surface drainage water quality (pH, EC) | Avondale Creek upstream and downstream of mine (refer to Surface Water Management Plan) | Monthly/Event (>25mm/24hr) |

A trigger action response program (TARP) will be used in conjunction with the reject monitoring program. Key components of the TARP are outlined in Table 5 below.

**Table 5**
**Reject Monitoring Trigger Action Response Program**

| Monitoring Trigger | Action | Response |
|---|---|---|
| Rainfall Events >100mm | Inspect Stratford Main Pit clean water diversions<br>Inspect pit water level | Undertake remedial works if required.<br>Relocate depositional points if required |
| Water level increase greater than modelled | Review weather data, pumping/mine waste inputs, and reject density data. | Revise pit fill model as required. |
| Reject density significantly differs from predicted 1.2 t/m3 | Correlate with CHPP data<br>Confirm survey data | Revise depositional methodology<br>Revise pit fill model as required |

| | | |
|---|---|---|
| Persistent downward trend in water quality results or reject results over three month period. | Investigate source/cause of water quality decline. The investigation would seek to assess presence and extent of any acid generation from exposed reject and quality profile in void water column. Appropriate remedial measures would be implemented based on findings of these investigations. | If source is found to be exposed reject revert to sub-aqueous disposal within safety limitations. Otherwise adopt alternative recommended actions. |

Historical water quality data recorded for the Stratford Main pit will be used as a baseline of comparison for future monitoring with the objective of maintaining existing water quality over the life of the plan. Monitoring results including comparisons against baseline values will be presented in the Stratford AEMR.

Water volume data will be assessed using the water balance simulation model as a basis and reviewed/reported in the AEMR. In the event that the review indicates likely final water volumes in the Stratford Main pit of a magnitude that could compromise rehabilitation, a revision of the reject disposal schedule would be undertaken and a revision to this plan prepared.

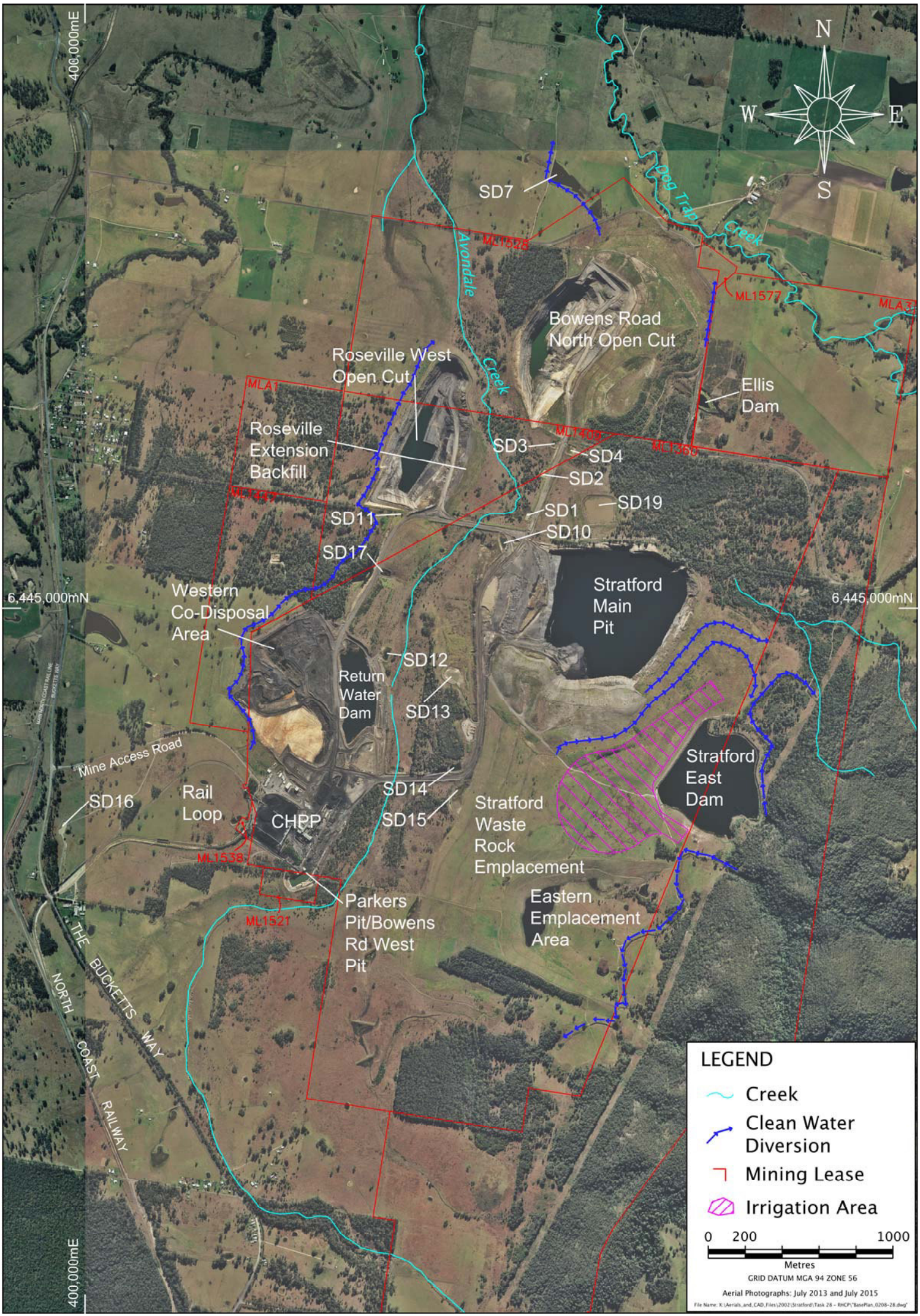
# 10 REVIEW AND UPDATE

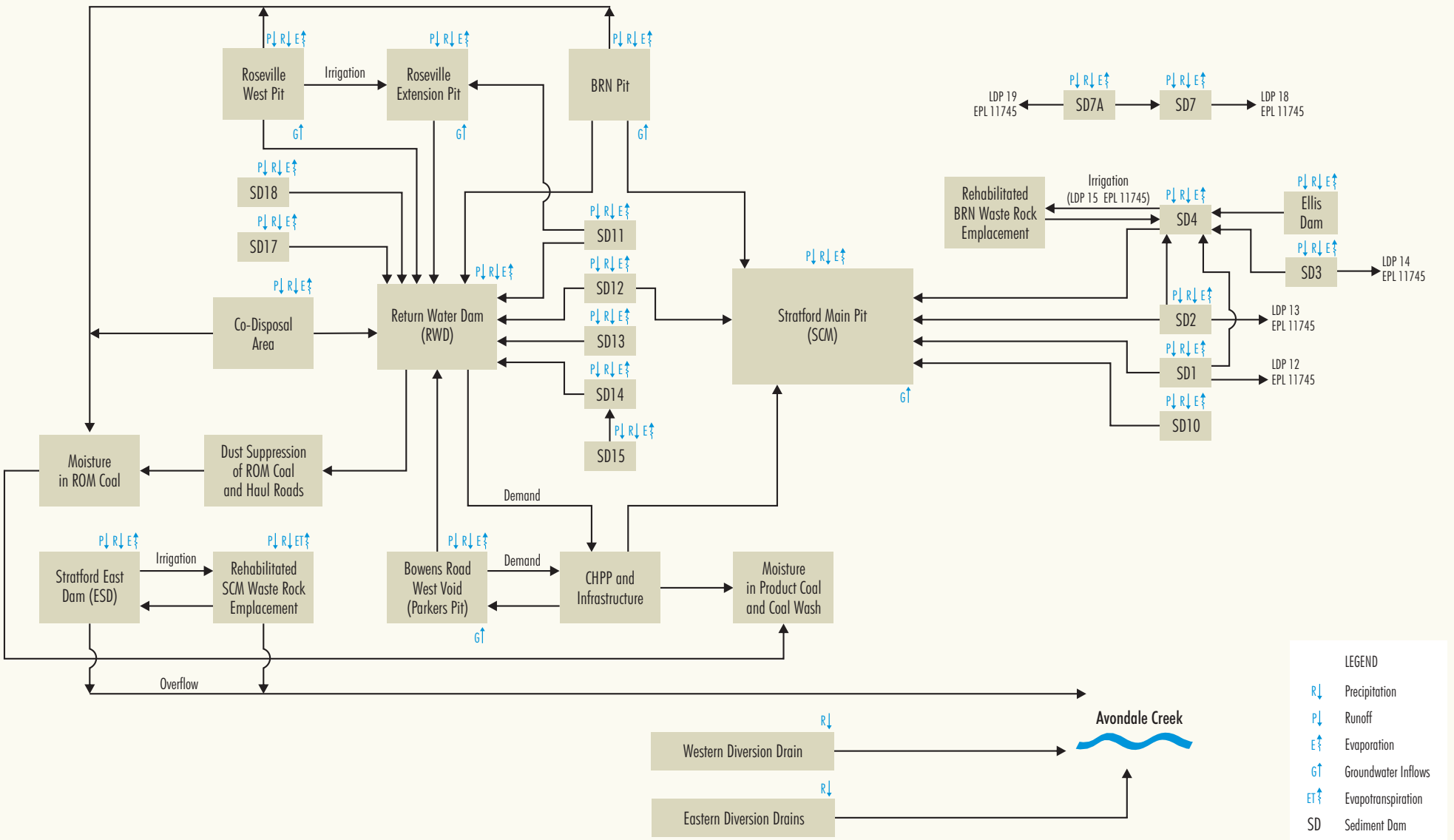
If changes are proposed to the SMC reject emplacement activities this RDP will be revised in accordance with the requirements of the WHS (Mines and Petroleum Sites) Regulation 2014 Schedule 3 High Risk Activities Part 5, Clause 27 Emplacement Areas.

If necessary the RDP will be revised to the satisfaction of the Secretary of the DP&E, to ensure the RDP is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

In accordance with Condition 10, Schedule 5 ‘Access to Information’ of DA 23-98/99, SCPL will make the RDP publicly available on the Stratford Coal website. A hard copy of the RDP will also be maintained at the SCM.

FIGURES


N
W
E
S
400,000mE
6,445,000mN
SD7
Dog Trap Creek
Avondale Creek
ML1528
ML1577
MLA37
Bowens Road North Open Cut
Roseville West Open Cut
MLA1
Ellis Dam
Roseville Extension Backfill
ML1403
ML1365
SD3
SD4
SD2
ML1447
SD19
SD1
SD11
SD10
SD17
Stratford Main Pit
Western Co-Disposal Area
SD12
Return Water Dam
SD13
Mine Access Road
Stratford East Dam
SD14
SD16
Rail Loop
CHPP
SD15
Stratford Waste Rock Emplacement
ML1538
Parkers Pit/Bowens Rd West Pit
ML1521
Eastern Emplacement Area
THE BUCKETTS WAY
NORTH COAST RAILWAY
LEGEND
Creek
Clean Water Diversion
Mining Lease
Irrigation Area
0 200 1000
Metres
GRID DATUM MGA 94 ZONE 56
Aerial Photographs: July 2013 and July 2015

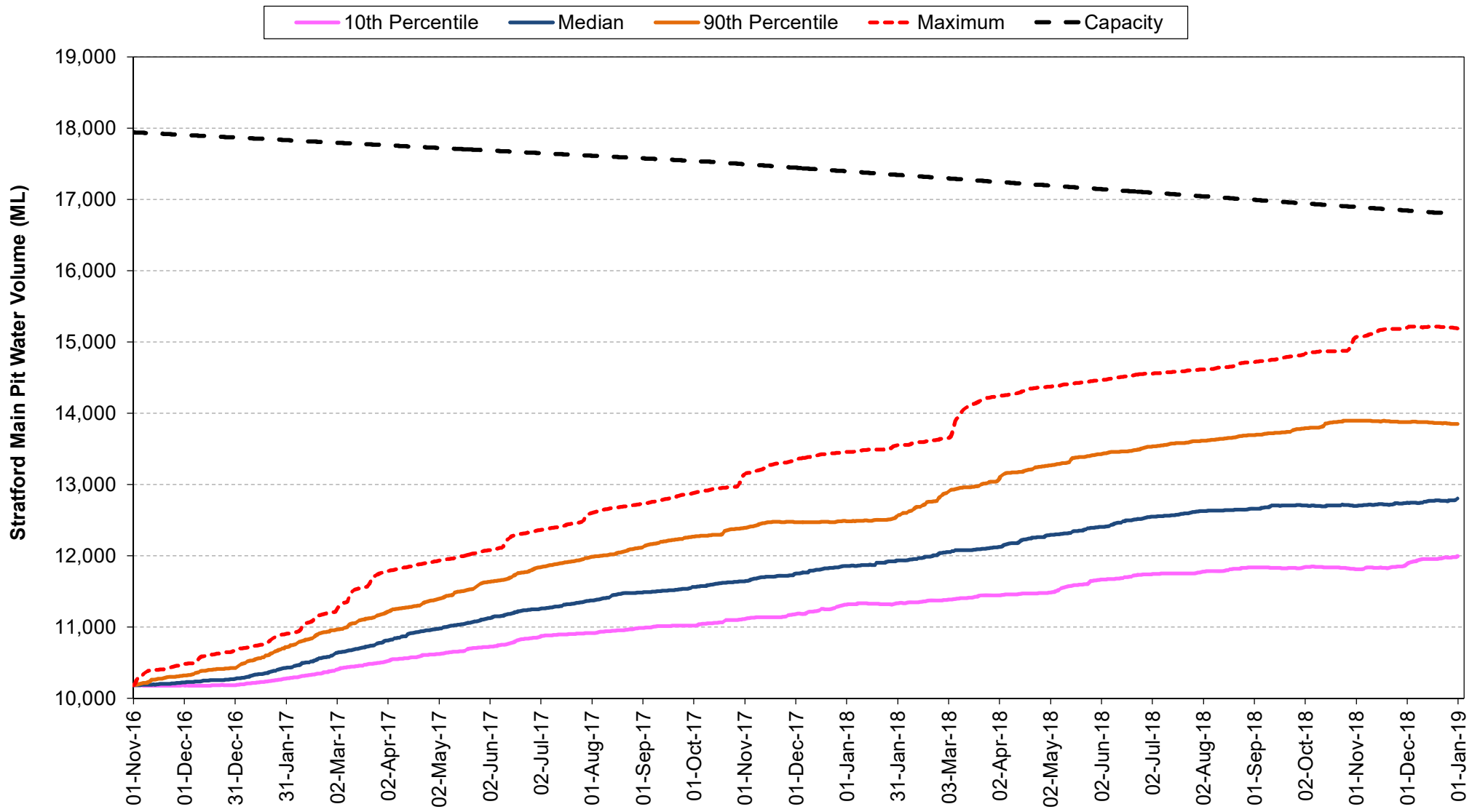



**LOM REJECTS DISPOSAL PLAN**

**FIGURE 2**
Water Management Schematic

GLOUCESTER BASIN
Part of Gloucester Coal

GCL-12-20_LRDP_001A




| Date | Revision | File Name | Drawn | Checked |
|---|---|---|---|---|
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| | |
|---|---|
| Client Name | Stratford Coal Pty Ltd |
| Job Title | 2016 Reject Disposal Plan |
| Figure Title | Predicted Stratford Main Pit Water Volume |

| Job Number | Drawing | Figure |
|---|---|---|
| 0208/30 | | 3 |


| Date | Revision | File Name | Drawn | Checked |
|---|---|---|---|---|
| 14-12-16 | A | "0208-30_Figure4.xls" | DNF | TSM |
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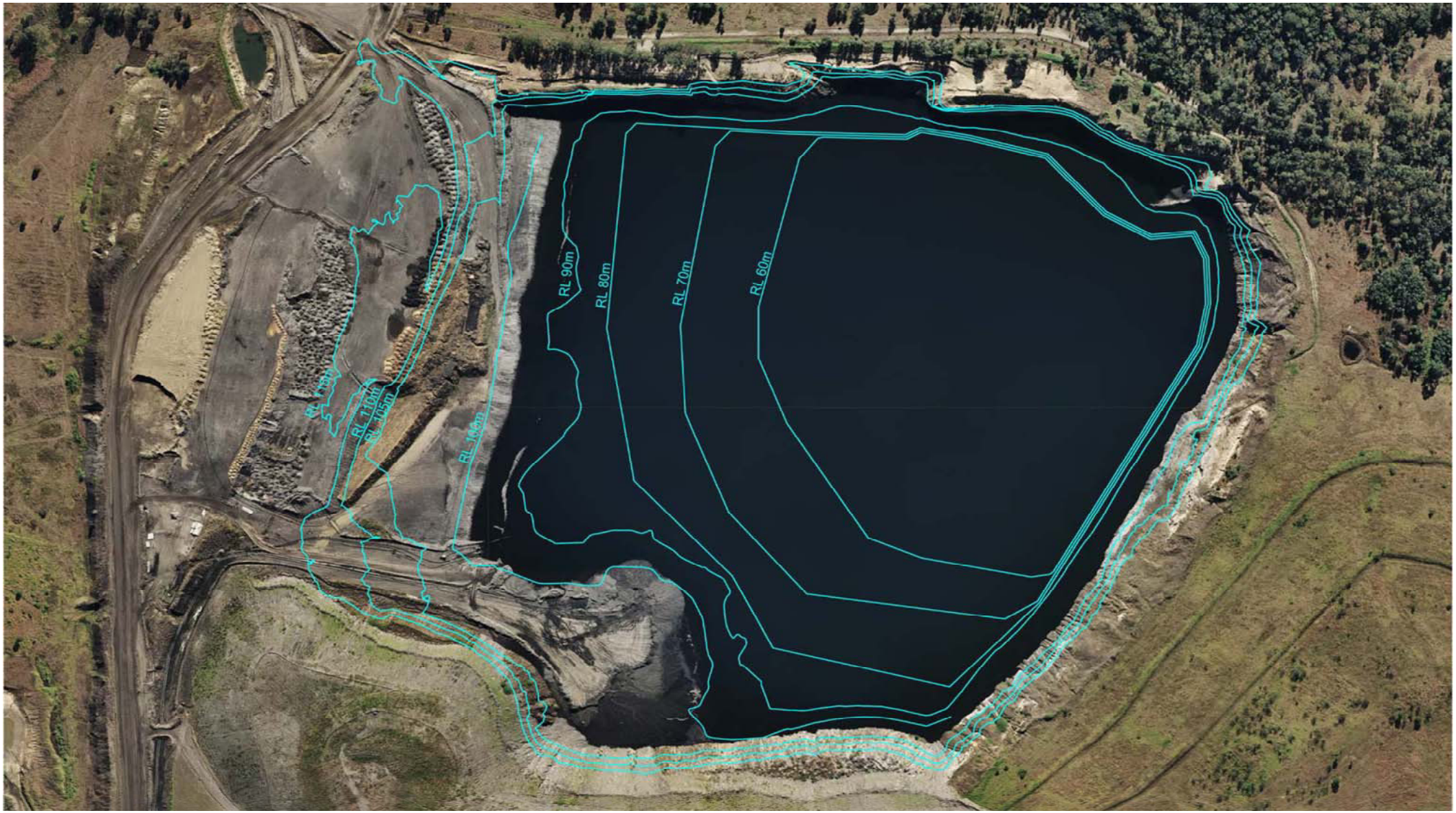
|---|---|---|---|
| **Client Name** | Stratford Coal Pty Ltd | | |
| **Job Title** | 2016 Reject Disposal Plan | | |
| **Figure Title** | November 2016 Surveyed Stratford Main Pit Tailings Levels | | |
| **Job Number** | | **Drawing** | **Figure** |
| 0208/30 | | | 4 |

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| 14-12-16 | A | "0208-30_Figure5.xls" | DNF | TSM |
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|---|---|---|---|
| **Client Name** | Stratford Coal Pty Ltd | | |
| **Job Title** | 2016 Reject Disposal Plan | | |
| **Figure Title** | End of 2018 Projected Stratford Main Pit Tailings Levels | | |
| **Job Number** | | **Drawing** | **Figure** |
| 0208/30 | | | 5 |

# APPENDIX A

# GUIDELINES ON LIMESTONE ADDITION RATES FOR CO-DISPOSED REJECT

| | |
|---|---|
| TO: | Stratford Coal Pty Ltd |
| ATTENTION: | Tony Dwyer |
| FROM: | Warwick Stewart and Stuart Miller |
| DATE: | 18 September, 2009 |
| SUBJECT: | Guidelines on limestone addition rates for co-disposed rejects and tailings placed in the Stratford Pit |

This memorandum provides guidelines on limestone addition rates for co-disposed rejects and tailings placed in the Stratford Pit to account for proposed modifications in the disposal system.

It is understood that the current wet disposal system in which co-disposed rejects and tailings are placed immediately below water will be modified for more efficient placement and utilisation of available storage space. The rejects/tailings will be deposited from an advancing deposition head, progressing across the Stratford void at about 2-3m above the pit void water level. The beach will be trafficable, improving access and facilitating repositioning of the discharge point. The rejects/tailings will be progressively flooded as the pit fills.

Inundation of the rejects/tailings effectively halts pyrite oxidation and generation of acid rock drainage (ARD), and at closure all deposited rejects/tailings will be below water, providing long term ARD control. The exposed beach represents the smaller portion of the deposition face, with most rejects/tailings depositing below the water level. Inundation of any given placed beach materials is expected to occur approximately 6 months after deposition, based on an average expected annual water level rise of 5-6m. It is recommended that limestone treatment be used to control ARD generation in the exposed beach materials during the exposure period.

The following previous work by EGi was used to provide an indication of appropriate limestone addition rates:

> EGi Document No 6902/1/280, "Duralie, Coal Project, Environmental Geochemistry of Mine Rock and Coal Reject. Implications for Mine Operation and Waste Management – Final Report", June 1996.
>
> EGi Document No 6903/332, "Stratford Coal Mine, Geochemical Assessment of Coal Reject Disposal Options, Stage 1: Geochemical Characterisation of Coal Reject and Spoil", November 1997.

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Environmental Geochemistry International Pty Ltd ABN 12003 793 486

EGi Document No 6903/362, "Stratford Coal Mine, Geochemical Assessment of Coal Reject Disposal Options, Stage 2: Leaching Behaviour of Coal Reject", July 1998.

EGi Document No 6902/800, "Geochemical Assessment of Deposited Rejects from the Duralie/Stratford Disposal Area", March 2008.

Leach column testing was carried out between 1995 and 1998 on unblended and limestone blended co-deposited beach rejects/tailings from Stratford and laboratory generated rejects/tailings from Duralie. The testing was carried out for approximately 6 months, and showed that addition of -4mm limestone at a rate of 10kg CaCO3/t to the rejects/tailings from Stratford (0.8%S) maintained circum-neutral pH for over 6 months, but the last collection showed a slight pH drop, indicating the lag before acid conditions develop may not extend to 12 months. The Duralie rejects/tailings had higher S (2.3%S) and were much more reactive, and addition of -4mm limestone at the same rate failed to provide any lag.

More recent testing by EGi on deposited beach rejects from the Stratford disposal facility (March 2008, EGi Document No 6902/800) indicates that the combined rejects from Duralie and Stratford have total S values closer to the Stratford column than the Duralie Column (average 0.8%S from 24 samples tested).

There has not been any direct kinetic testing on the currently deposited rejects, and the variation of the ARD potential has not been comprehensively defined. However, based on the previous work, application of -4mm limestone at a rate of 20kg $CaCO_3$/t is likely to provide sufficient buffering to maintain a lag for at least 12 months.

Most of the rejects/tailings in the deposition front will be immediately inundated during deposition, and only the 2-3m portion above the water level needs be treated with limestone. It is understood that the preferred method of limestone addition by Coal Handling and Preparation Plant (CHPP) operators is to surface broadcast or spread limestone on beach surfaces and incorporate this into the rejects/tailings material by ripping with appropriate equipment. The alternative of blending limestone into the washery waste stream would not be practical or economical, since the deposition method will not allow selective treatment of the beach portion without also treating the portion that will be immediately inundated.

The deposited materials on the beach exposures at the Stratford Pit appeared to be relatively fine grained and reasonably well graded, and it is expected that diffusion, rather than convection or advection, will be the main mechanism controlling oxidation in these materials after deposition. Diffusion control will result in a gradually downward migrating oxidation front as pyritic materials are progressively consumed, rather than deep penetration of oxygen into all materials above water. Since diffusion is likely to be the main oxidation mechanism, it is not expected to be necessary to incorporate limestone into the full 2-3m beach. Blending limestone into the surface 300-500mm should provide sufficient control of ARD from exposed materials until they are inundated. In addition to

direct neutralisation of acid generated in the blending zone, the limestone may also provide a source of alkalinity for deeper portions of the lift as infiltrating water passes through the limestone. The mechanisms, efficiency and rates of reaction of limestone blending for these materials under the proposed beach deposition system has not been directly assessed, but it is understood that the management of these materials can be readily modified if required, and it is suggested that limestone blending of the surface be trialled in conjunction with monitoring to check performance. Surface conditioning (such as traffic compaction) may be required after ripping to ensure that any open zones produced by ripping do not lead to increased oxidation rates.

An initial treatment rate of 80 t $CaCO_3$/ha as -4mm limestone is recommended for each lift, which is equivalent to a rate of 20kg $CaCO_3$/t (as suggested by previous leach column testing) incorporated in the surface 300mm and assuming a density of 1.3 t/m$^3$. Surface field pH measurements (approximately 1 part solid to 2 parts deionised water) of deposited rejects should be carried out regularly for varying durations of exposure after deposition to check for evidence of acid formation. Values of less than pH 5.5 indicate the limestone dosage rate may be insufficient or the surface incorporation method ineffective. The pH and alkalinity of the free water alongside the beach should also be monitored. It is recommended that an alkalinity value of at least 30 mg $CaCO_3$/L is maintained in the pond. If the alkalinity decreases below 30 mg $CaCO_3$/L it may be necessary to modify the limestone treatment strategy and/or directly lime dose the pond. Possible considerations to improve ARD mitigation performance if required include:

- reducing lift heights;
- increasing limestone dosage rates;
- increasing blending depth;
- optimising limestone incorporation methods;
- use of more direct effort in control of convection/advection (such as compaction); and
- blending of limestone into the process stream in addition to surface treatment.

On-going characterisation of deposited rejects would be useful to better define the geochemical variation of the rejects and confirm the validity of the treatment rates. Leach column testing of blended rejects materials could also be considered to help determine optimal treatment rates, and help demonstrate the adequacy of the management approach.

Regards,

Warwick Stewart