Hera Project, via Nymagee

Surface Water Assessment

Prepared by

SEEC

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Surface Water Assessment

Prepared for: R.W. Corkery & Co. Pty Limited
62 Hill Street
ORANGE NSW 2800

Tel: (02) 6362 5411
Fax: (02) 6361 3622
Email: orange@rwcorkery.com

On behalf of: YTC Resources Limited
2 Corporation Place
ORANGE NSW 2800

Tel: (02) 6361 4700
Fax: (02) 6361 4711
Email: office@ytcresources.com

Prepared by: SEEC
PO Box 1098
Suites 9 & 10, Bowral Mall
40 Station Street
BOWRAL NSW 2576

Tel: (02) 4862 1633
Fax: (02) 4862 3088
Email: mpassfield@seec.com.au

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EXECUTIVE SUMMARY

This report constitutes a surface water assessment for the proposed Hera Project. The Project is an underground mining development near Nymagee, NSW, to be operated by YTC Resources Limited. This assessment includes a review of the existing surface water conditions and hydrology within the Project Site and within its local context. It also includes an assessment of the potential impacts of the Project on surface water and recommendations for water management to mitigate or address these impacts.

A water balance is included to determine how surface water sources might meet anticipated water demands, and how any shortfall might be addressed. Three sources of water have been identified for the Project:

- existing bores
- dewatering of groundwater inflows into the void
- capture and reuse of surface runoff in one enlarged existing dam (Pete's Tank) and a proposed new dam (Back Tank East).

The property is located in the Western Division of New South Wales and so the Harvestable Rights Provisions of the *Water Management Act 2000* do not apply. Water may be harvested from second order streams (or less) without a license and there is no limit to the size of dams that may be built on such a stream. Therefore, it is proposed to enlarge the existing Pete's Tank up to 20 ML capacity and build a new dam just upstream for the existing Back Tank, referred to as Back Tank East with a capacity of 90 ML.

Modelling shows a benefit to water supply if these dams were about ten-times their existing capacity; after that there is no significant additional benefit. However, despite the proposal to increase the impoundments, modelling shows surface water cannot be relied on to meet the operational requirements for the Project. The dry climate, high evaporation and erratic rainfall pattern means there is likely to be extended periods when no surface water is available. Therefore, the majority of operational water would be sourced from groundwater and only topped-up from surface water as and when it is available.

During mining the required surface water quality would be assured by implementation of an appropriate Soil and Water Management Plan (SWMP). That plan would meet the requirements of Volumes 1 and 2e of DECCW's *Managing Urban Stormwater* Series (Landcom, 2004 and DECC, 2008a) (The Blue Book) which give design parameters that must be met. Included in this report is an assessment of the potential impacts of the Project, measured against the Water Quality and River Flow Objectives for the Barwon Darling and Far Western Catchments. A monitoring regime is recommended to ensure these objectives are met.

Providing best-practice water management techniques are adopted, we conclude there is a low probability that the Project would negatively impact surface water.

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1. INTRODUCTION

1.1 BACKGROUND

SEEC have been commissioned by R.W. Corkery & Co. Pty Limited on behalf of YTC Resources Limited (the Proponent) to prepare this surface water assessment. It forms part of an *Environmental Assessment* being prepared in support of a project application for the proposed Hera Project (the Project). The Project Site, defined as that area of land which would be impacted upon by the Project, lies wholly within “The Peak” property (Lot 664, DP761702) located approximately 4 km south of Nymagee, NSW. The lease on “The Peak” property is held by YTC Resources Limited under Western Lands Lease No. WLL2455.

The surface water assessment describes the surface water hydrological setting of the Project Site, identifies potential impacts of the Project, recommends best management practices for their mitigation and presents the results of computer modelling to estimate the potential for surface water re-use for ore-processing, related activities, and dust suppression.

For the purposes of this report, the following definitions apply (**Figure 1**):

- The “property” refers to “The Peak” property noted above.
- The “Project Site” refers to an area identified within the property that will be developed and will encompass Project-related disturbance.
- Surface Facilities Area refers to a location within the Project Site that will accommodate the ore processing plant, contractor offices, laydown and workshop areas, car park, power station, fuel tank and refuelling area, run-of-mine (ROM) pad, the temporary Waste Rock Emplacement, and a portal leading to the underground mine via a box cut and a decline.
- Pete’s Tank is an existing dam in the far southwest corner of the property. The Hera Project proposes to expand Pete’s Tank to a total water holding capacity of 20 ML. Back Tank West is an existing dam located approximately central to the southern half of the property.
- Back Tank East is a proposed new surface water storage dam to be constructed to hold 90 ML of water and which will, together with Pete’s Tank, partly meet operational water requirements of the Project.
- The Tailings Storage Facility will be used for the storage of the tailings from the ore processing plant located within the Surface Facilities Area.

2. DOCUMENT ACKNOWLEDGEMENT

2.1 PROJECT OVERVIEW

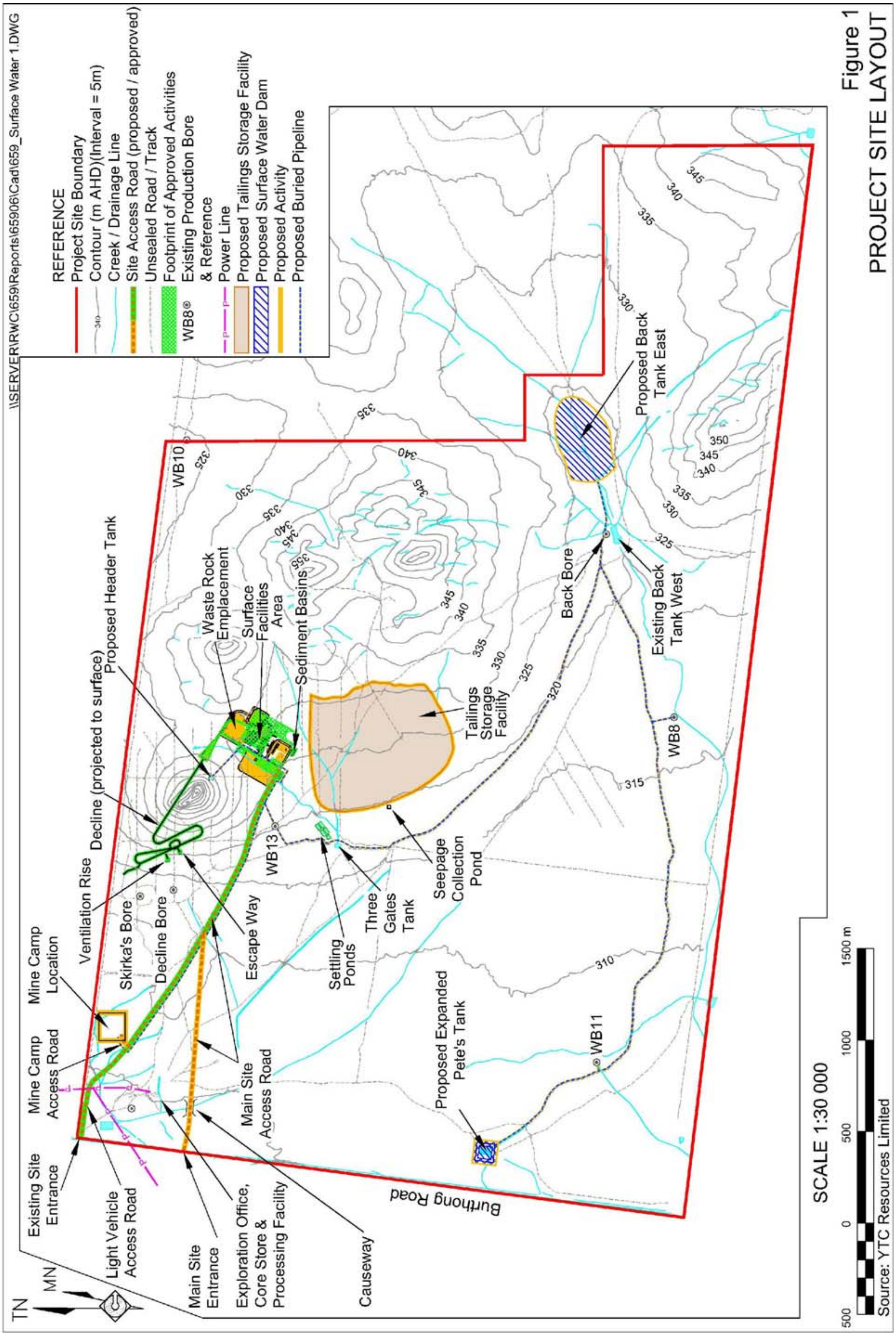
SEEC acknowledge receipt of the Director General’s requirements for the Hera Project (reference 10_0191) and the former DECCW’s (now Office of Environment and Heritage (OEH)) requirements given in their letter dated 23 November 2010. Both those documents require investigations on surface water. The surface water assessment reported in this document addresses issues raised in these two documents (refer to **Appendix 2**).

As identified in Section 1.7 of the *Environmental Assessment*, a number of components of the Hera Project have been previously approved. These include the following (**Figure 1**).

- Construction and use of infrastructure required for an underground mine including a box cut, portal and decline, magazine and ventilation rises.
- Construction and use an integrated ore stockpile area and temporary Waste Rock Emplacement.
- Installation and use of one or more diesel generators within the power station and the associated Fuel Storage and Recycling Area.
- Construction and use of site offices, ablutions facilities, vehicle parking, workshop, laydown area and associated infrastructure.
- Establishment of on-site communications facilities.
- Construction and use of water management structures.
- Construction and use of an access road (referred to in this document as the Light Vehicle Access Road). For the purposes of this application, the Light Vehicle Access Road would be used by light vehicles only.

The Project would include the following activities which would require approval (**Figure 1**).

- Extraction of waste rock and ore material, using underground sublevel open-stope mining methods at the maximum rate of material would be approximately 350 000t per year for approximately 5.5 years.
- Construction and use of a Surface Facilities Area that would incorporate a range of approved infrastructure, including expanded site offices for the Proponent and Contractors, ablutions facilities, vehicle parking, power station, fuel storage, refuelling area, workshop and laydown areas.
- Construction and use of a Processing Plant within the Surface Facilities Area comprising crushing and grinding, gravity separation, flotation, leach and gold recovery circuits and ancillary infrastructure to produce approximately 33 000oz of gold, 74 000oz of silver, 10 000t of lead and 10 000t of zinc per year.
- Construction and use of a temporary Waste Rock Emplacement, incorporating an acid rock drainage encapsulation area and an associated Leachate Management Pond.
- Construction and use of a Tailings Storage Facility with the associated Seepage Collection Pond.
- Construction of a Mine Camp and Mine Camp Access Road for mine personnel.
- Construction and use of a surface water harvesting system, including expansion of Pete’s Tank and construction of Back Tank East and associated water reticulation system.
- Construction and use of the Main Site Access Road and the associated intersection to allow site access from Burthong Road by light and heavy vehicles.
- Transportation of concentrate from the Project Site to the Proponent’s customers via public roads surrounding the Project Site.
- Construction and use of ancillary infrastructure, including soil stockpiles, core storage yards, internal roads and tracks, and sediment and erosion management structures not already approved.
- Construction and rehabilitation of a final landform that would be geotechnically stable and suitable for an end land use of agriculture or nature conservation.


\\SERVER\RWC\659\Reports\65906\Cad\659_Surface Water 1.DWG
REFERENCE
Project Site Boundary
Contour (m AHD)(Interval = 5m)
Creek / Drainage Line
Site Access Road (proposed / approved)
Unsealed Road / Track
Footprint of Approved Activities
WB8 Existing Production Bore & Reference
Power Line
Proposed Tailings Storage Facility
Proposed Surface Water Dam
Proposed Activity
Proposed Buried Pipeline
Figure 1
PROJECT SITE LAYOUT
SCALE 1:30 000
500 0 500 1000 1500 m
Source: YTC Resources Limited
TN
MN
Existing Site Entrance
Light Vehicle Access Road
Main Site Entrance
Exploration Office, Core Store & Processing Facility
Causeway
Mine Camp Access Road
Mine Camp Location
Main Site Access Road
Skirka's Bore
Decline Bore
Ventilation Rise
Escape Way
Decline (projected to surface)
Proposed Header Tank
Waste Rock Emplacement
Surface Facilities Area
Sediment Basins
WB10
WB13
Settling Ponds
Three Gates Tank
Seepage Collection Pond
Tailings Storage Facility
Back Bore
Existing Back Tank West
Proposed Back Tank East
WB8
WB11
Proposed Expanded Pete's Tank
Burthong Road
310
315
320
325
330
335
340
345
350
355

3. PROJECT SITE DESCRIPTION

3.1 CLIMATE

Nymagee and nearby Cobar both have comprehensive rainfall data collected over a period of about 100 years **(Figure 2).** The mean rainfall figures are consistent throughout the year – ranging from about 26 mm/month to 37 mm/month. However **Figure 2** masks the real pattern of rainfall in this area. The rainfall is actually highly variable, both in spatial and temporal distribution **(Figure 3).** Rain is often delivered by infrequent storm events and it can be very localised, often occurring on a sub-catchment scale.

Good pluviograph rainfall data (supplied in six-minute time steps) is available for Cobar, which has a similar rainfall pattern to Nymagee. It covers a period of 48 years from 1962 to 2010 and has been used in the MUSIC modelling (Section 4) for water harvesting **(Figure 4).** Evaporation data has been supplied by the Bureau of Meteorology (BOM). The site has a potential evapotranspiration (PET) of about 1 252mm.

3.2 EXISTING WATERCOURSES

The Project Site has two significant watercourses and one minor one. It also has a number of existing dams (**Figure 1**). The watercourses have been classified using the Strahler stream ordering system as follows:

- Watercourse A enters the far southwest of the site just north of Spains Tank (which is on an adjoining property). It is a second order stream until the Project Site boundary where it is joined by Watercourse B. Therefore, from the site boundary downstream, it is a third order stream. It has a catchment of about 80 km^2 upstream from the northwest corner of the site and flows northwards, roughly parallel to the western boundary.
- Watercourse B that drains most of the property and flows east to west through the existing Back Tank West. This is a second order stream and has a catchment upstream of Back Tank of about 10.1 km^2.
- Watercourse C enters the far south west of the property into Pete's Tank and is also a second order stream. It has a catchment of about 4 km^2.

Generally the watercourses are ill-defined and represented by flood plains. There had been a significant rainfall event just before our inspection and debris was trapped against tree trunks. This gave a good opportunity to gauge flood channel widths.

The property is located in the Western Division of New South Wales and so the Harvestable Rights Provisions of the *Water Management Act 2000* do not apply. However, water may only be drawn from second order streams or less, unless the Proponent seeks a water licence. We understand a licence would *not* be sought for this Project and so surface water may only be harvested from storages located on Watercourses B and C and any small off-line impoundment built for the purpose of trapping sediment.

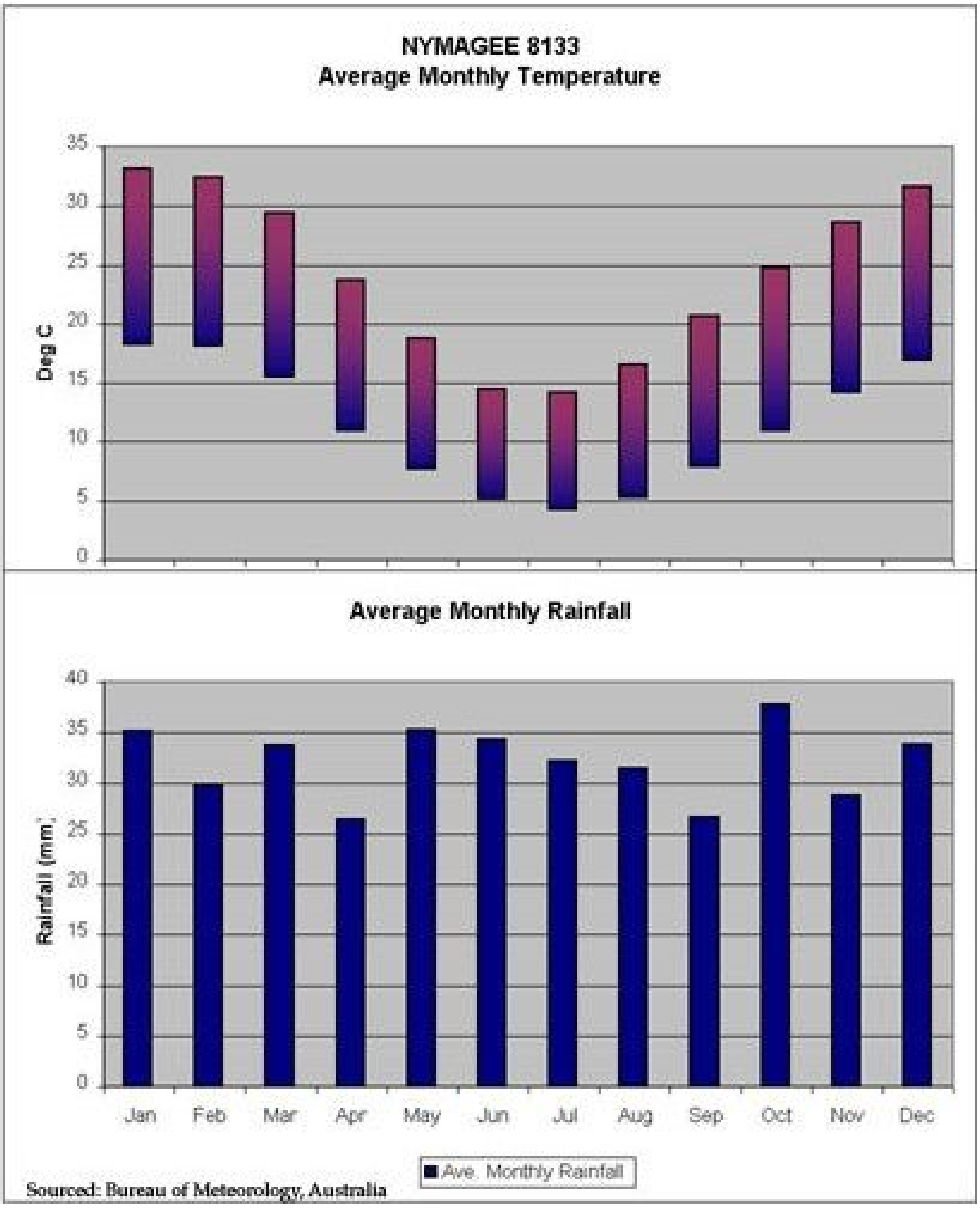


Figure 2 **Mean Monthly Temperature and Rainfall for Nymagee**

Only a small part of the Project Site, in the vicinity of the Surface Facilities Area, drains north onto adjoining lands. The Surface Facilities Area drains southwest, towards an existing dam called Three Gates Tank. It has a catchment of about 1.1 km^2 (**Figure 1**)

Works on, or near, a watercourse will be:

- Enlarging Pete's Tank and constructing Back Tank East (Section 3.3). Both of these dams will be on second-order watercourses.
- Constructing the Main Site Access Road (see Figure 1) that would cross Watercourse A (a third-order watercourse) near the proposed new site entrance located approximately 500 m south of the existing site entrance. The crossing would be a low-level causeway structure, appropriately stabilised up and down stream.

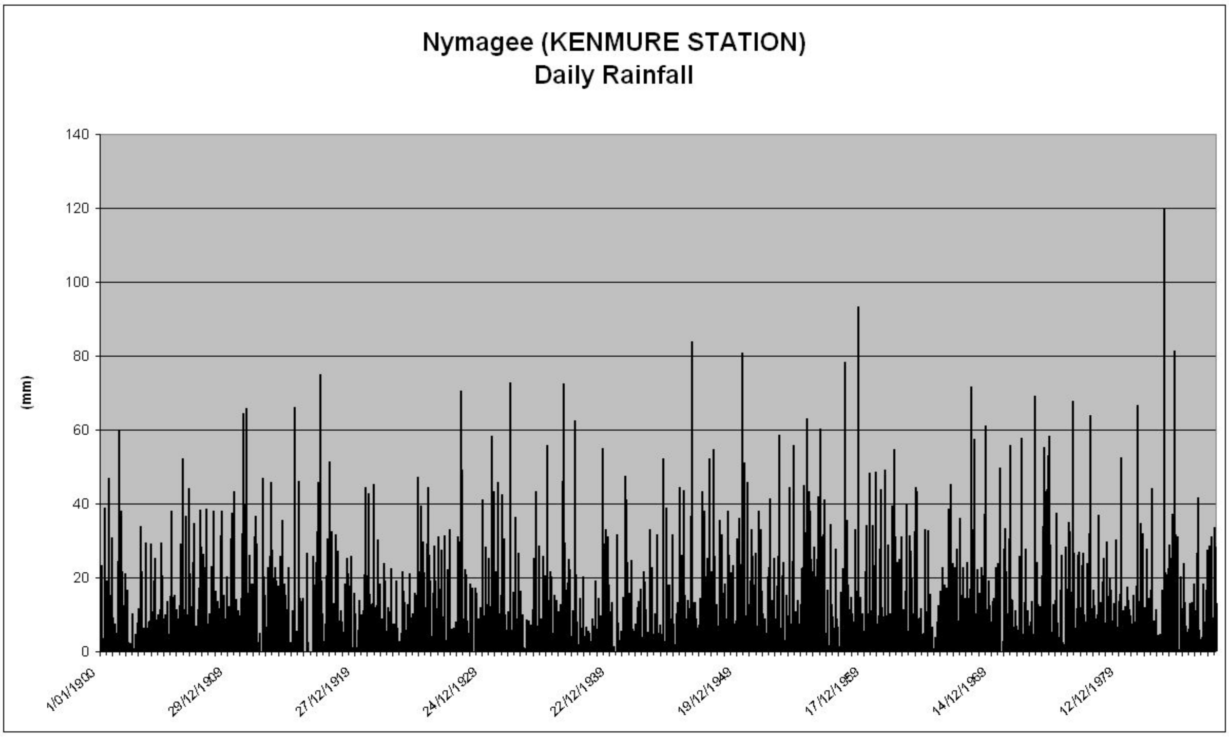


Figure 3 **Daily Rainfall for Nymagee (1900 to 1990) (Source: BOM)**

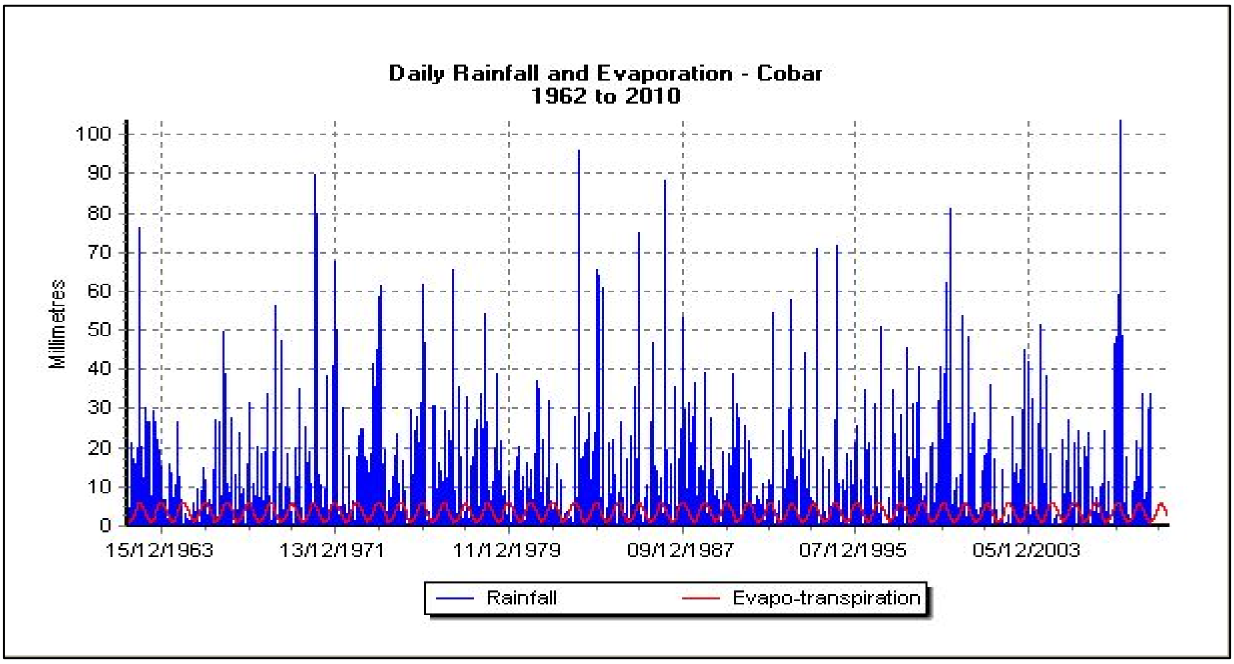


Figure 4 **Daily Rainfall and PET Data from Cobar (1962 to 2010) (Source: BOM)**

3.3 PROPOSED SURFACE WATER HARVESTING STORAGES

It is proposed to harvest surface water from Pete's Tank (existing) and the proposed Back Tank East (**Figure 1**). Pete's Tank will be enlarged to have a 1.7 ha surface area and a volume of 20 ML. Back Tank East will have a surface area of 11.4 ha and a volume of 90 ML. The existing Back Tank will remain (Back Tank West) but it will not be used as a water source. Being natural surface water it would be suitable for use in the mine for processing and dust suppression.

Surface water would also be harvested from the proposed sediment basin and the associated settling ponds (Section 6.1.1). There will also be two dams associated with the Processing Plant located within the Surface Facilities Area (a Raw Water Dam and a Process Water Dam). A leachate collection pond will be located adjacent and downstream from the Tailings Storage Facility. All these dams will be offline from any natural surface water flow as they will contain contaminated water (including salty groundwater).

3.4 PROPOSED GROUNDWATER STORAGE/USE

Groundwater will be pumped to the Raw Water Dam and blended with recycled water (from the process water dam) and stored surface water if it is available. The blended water would be reused almost immediately for processing.

3.5 TOPOGRAPHY, RUNOFF AND INFILTRATION

Most of the Project Site occupies plains with slope gradients less than 2%. The Surface Facilities Area location occupies slightly steeper land, usually up to about 5% but occasionally up to 10%. The soils are permeable but shallow bedrock within the Surface Facilities Area, and a tendency for the soils to cake at the surface in dry periods, means that infiltration is affected by limiting layers (Section 4.1).

4. SURFACE WATER BALANCE

4.1 MODELLING INTRODUCTION

Surface Water Balance modelling has been undertaken using computer software MUSIC (Model for Urban Stormwater Improvement Conceptualisation), developed by the CRC for Catchment Hydrology (now eWater). MUSIC was used because there is a very good set of pluviograph data[1] from nearby Cobar for a period of 48 years. MUSIC is able to model small and large catchments and storage nodes can be easily interrogated to determine their performance. The pluviograph data is available in six-minute time steps, although computer limitations mean that it was converted to daily data.

[1] Pluviograph data is more comprehensive than simple daily rainfall data and can be interrogated in finer detail. In this case the data from Cobar is considered representative of the Nymagee area too.

Only the catchments to Pete's Tank and the proposed new Back Tank West were modelled as Three Gates Tank would be used to temporarily store a blend of groundwater and recycled water from the crusher for almost immediate use. This means it would generally be full and so any inflows of surface water would by-pass through it.

The MUSIC models were first calibrated by adopting soil-storage and soil field capacity values according to Macleod, 2008 (assuming a 0.5m rooting depth, as most of the catchments are sparsely timbered with pasture undergrowth). The models suggested there would be no surface runoff. Clearly this was incorrect as runoff does occur, albeit infrequently.

We then undertook an ILSAX Hydrological Model with:

- an Antecedent Moisture Content (AMC) of 1.59 (calculated from the daily rainfall data in **Figure 2**); and
- Soil type C, i.e. a moderately drained soil that has a limiting layer (in this case a surface crust).

The result was a predicted runoff coefficient of about 3.5%. The infiltration coefficient (a) in the MUSIC models was then changed to provide models that yielded this runoff coefficient. This is considered representative of the local area and it fits well with anecdotal experience. Finally, we cross-referenced using a catchment model known as The Australian Water Balance Model (AWBM)

The dams were modelled fed only by natural rainfall, no top-up from groundwater was assumed. They were also assumed to be sealed (no leakage) and evaporative loss was assumed to be 1.5 x PET (i.e. about 80% of pan evaporation).

4.2 WATER SOURCES AND DEMANDS

4.2.1 Sources

Water would be obtained in priority order from the following sources:

i) Recycled water from the Processing Plant, temporarily stored in the Process Water Dam. The Proponent has advised that about 30% of the processing water demand will be sourced from here.

ii) Groundwater sourced from dewatering operations within the proposed mine.

iii) Stormwater run-off stored in the Three Gates Tank either following treatment in the settling ponds or captured directly.

iv) Stormwater run-off stored in the proposed expanded Pete's Tank or the proposed Back Tank East.

v) Groundwater sourced primarily from four bores located within the Project Site namely, Back Bore and Bores WB8, WB11 and WB13.

As will be shown, water from the surface water storage dams would only be available intermittently. As a result, the Project would rely entirely on water sources i), ii) and v) for all operational water requirements during extended dry periods. However, for the purpose of this report, we have conservatively assumed surface water is the primary source of make-up water.

4.2.2 Demands

The Proponent has advised that their total make-up water demand would be about 167 ML per year. In addition the demand for water used for dust suppression is estimated at an amount equal to the difference between mean rainfall and mean potential evapotranspiration (PET) applied over an area of 20 ha (5 ha of haul road and 15 ha of Surface Facilities Area). The result is an estimated annual demand of 20 ML/year[2] (varying over the year with PET). This means that the total demand for water other than that recycled will be about 187 ML. The combined make-up and dust suppression demands (187ML) would be distributed 18% and 82% to Pete's Tank and Back Tank East, respectively, i.e. 33.6 ML/year and 153.3 ML/year respectively.

4.3 IMPOUNDMENT SIZING

Because dam size is not limited we first ran a series of models with various storage volumes to determine the ideal capacity. The results are shown in **Figures 5** and **6**. They show there would be little benefit in having more than about 110 ML of total storage; even if surface water was used only for dust suppression.

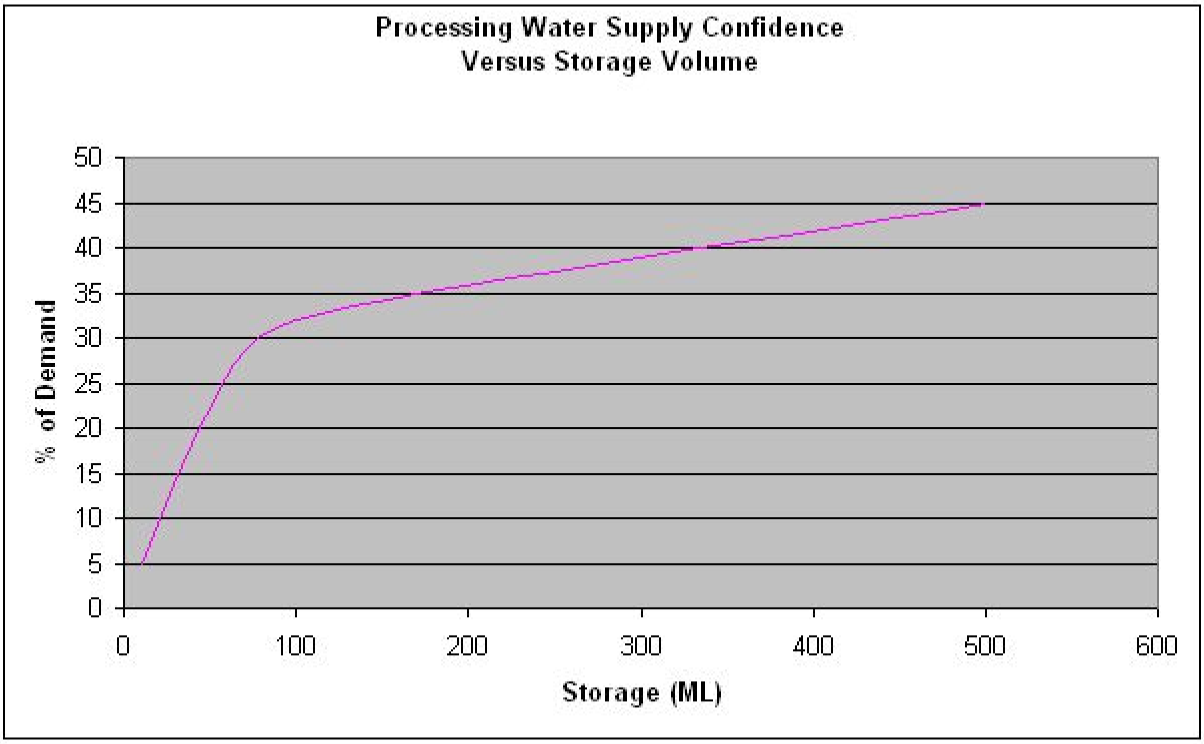


Figure 5 Dam Storage versus Confidence in Total Supply

[2] It is appreciated that this is a "mean" estimation and not a "worst-case". However, as will be seen (Section 4.5) surface water cannot be relied on to supply demand at this site (even just dust-suppression demand).

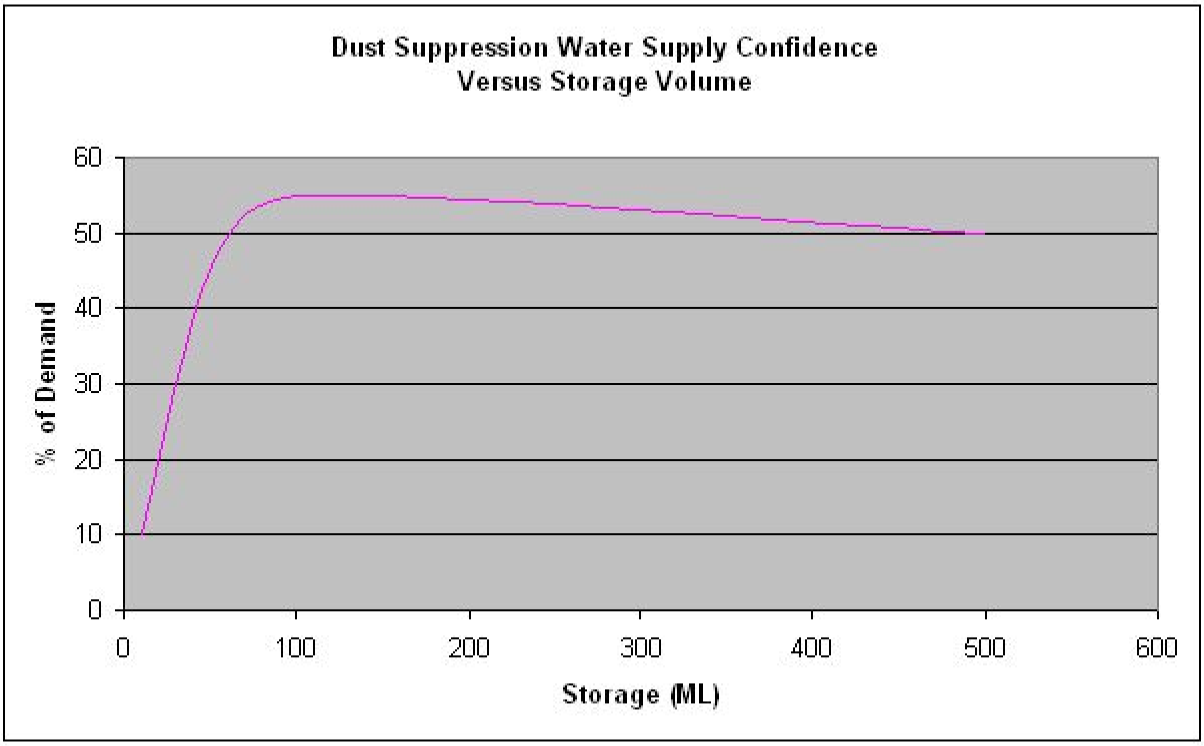


Figure 6 **Dam Storage versus Supply Confidence (Dust Suppression only)**

4.4 SUPPLY CONFIDENCE

Once the storage volume had been decided we ran further models to determine how that volume would perform over time. The results of this modelling are shown in **Figures 7** and **8** which are graphical representations of the estimated storage volumes in Pete's Tank and Back Tank East respectively over about 48 years.

The Project life is approximately 9 years (comprising 7 years of site establishment (1.5 years) and operations (5.5 years), and 2 years of decommissioning and rehabilitation). Within the 48 years of modelling are many 5.5 year-long scenarios ranging from particularly wet periods to extended periods of drought. Because of the erratic nature of rainfall, depending on the prevailing climatic conditions, the graphs show that surface water cannot be relied on to supply demand. Large rainfall events typically produce about 1 year's supply but they cannot be guaranteed to occur every year.

4.5 RECOMMENDATIONS

Regardless of increasing the capacity of existing Pete's Tank and constructing a new 90ML storage dam (Back Tank East) surface water cannot be consistently relied on to supply demand. Based on past rainfall data, there will be extended periods (often more than one year) when surface water will not be available for harvesting. Therefore, we recommend:

- A license is sought to harvest groundwater for the full demand so that supply is assured if surface water is unavailable.
- If necessary, the best way to use harvested surface water is to use it at full demand until the dams are empty. They would then be ready to capture as much of the next rainfall event as possible.

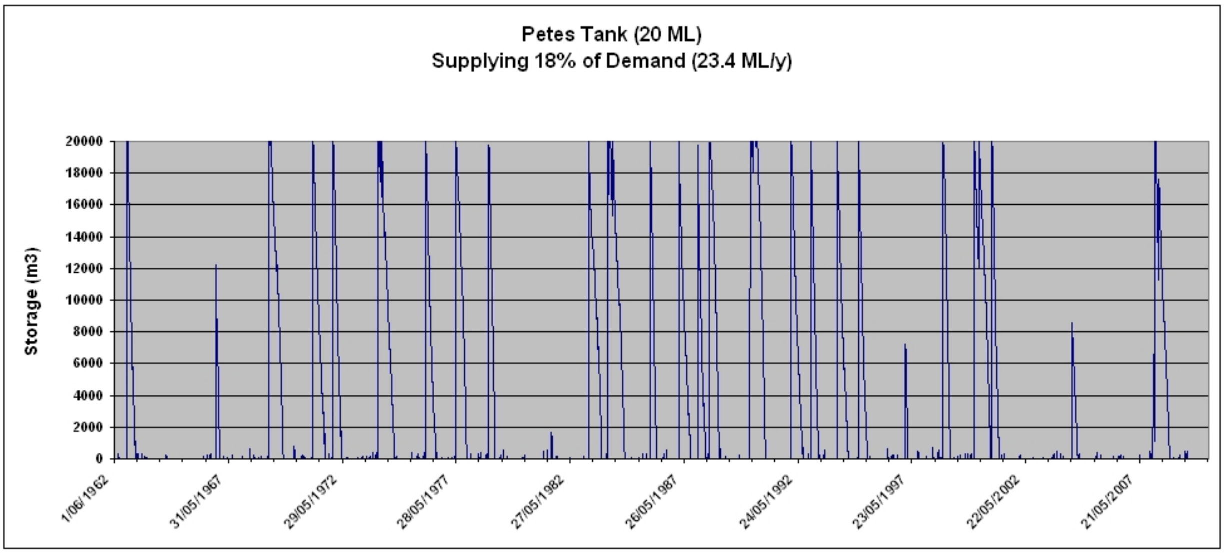


Figure 7 Predicted Storage for Pete's Tank

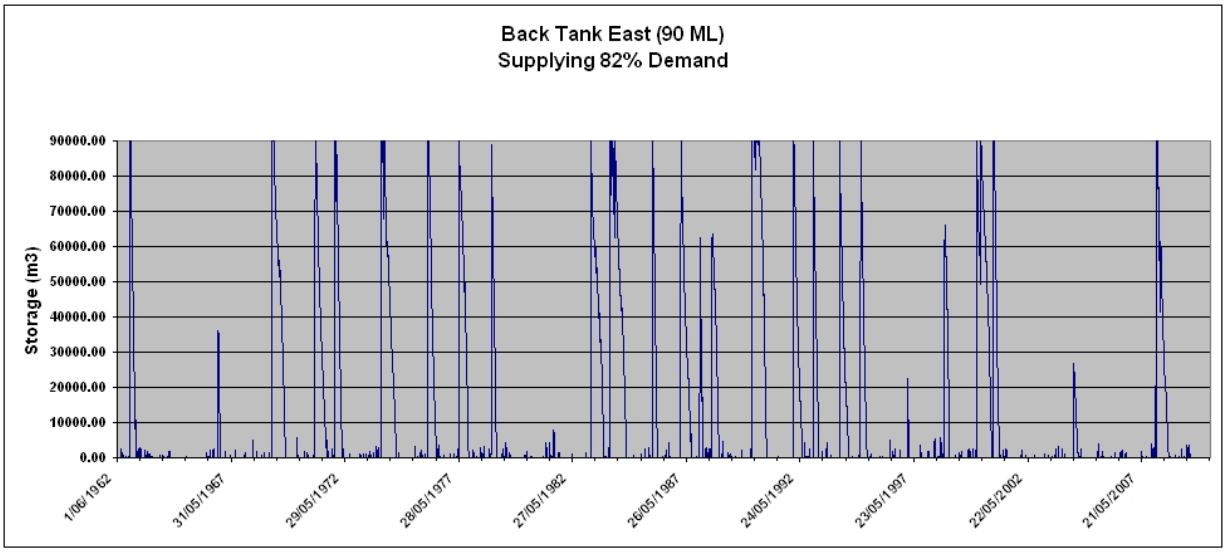


Figure 8 Predicted Storage for Back Tank East

5. EFFECT ON DOWNSTREAM HYDROLOGY

Back Tank East and Pete's Tank would both drain into the third order watercourse (Watercourse A) that drains through the west of the Project Site. To gauge the effect on it (and hence on downstream properties) we have undertaken MUSIC modelling (**Figure 9**) of the entire catchment to a location near the existing site entrance and the House Dam. The total catchment to that location is 92 km^2 including 10.1 km^2 to Back Tank East and 4 km^2 to Pete's Tank.

Figure 9 shows that there is a clear pattern between these two scenarios, with the predicted flow rates nearly always (but not always) slightly lower than the existing flow rates. This is a reflection of the dams' retarding function. However, in terms of *frequency* of flows there would be no change (830 events in 48 years) and the total mean annual *volume* of discharges would be only 3% less (1 500ML/year versus 1 550ML/year). Such a small change would be difficult to identify in this climate.

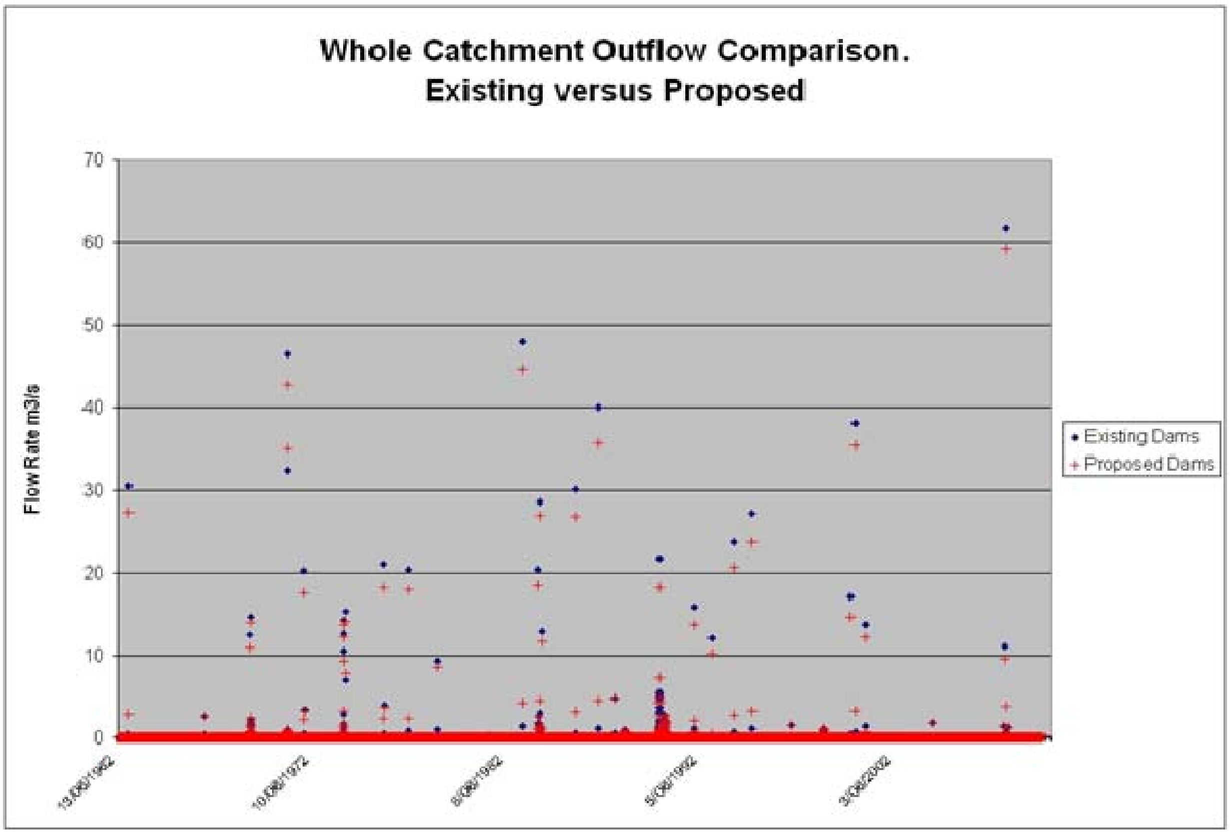


Figure 9 Predicted Changes in Flow Rate

6. SOIL AND WATER MANAGEMENT

6.1 SURFACE FACILITIES AREA

6.1.1 Erosion and Sediment Control during Mining

During mining the required surface water quality would be assured by implementation of an appropriate Soil and Water Management Plan (SWMP). That plan would meet the requirements of Volumes 1 and 2e of DECCW's *Managing Urban Stormwater* Series (Landcom, 2004 and DECC, 2008a) (The Blue Book) which give design parameters that must be met.

One of those requirements is that runoff from disturbed surfaces must be collected in a sediment basin before it is either re-used on site or treated and released to receiving waters. The sediment basin must be designed to store runoff from a rainfall event up to the five-day 90th percentile rainfall depth (33.8 mm). It is permissible for surface water derived from a rainfall event that exceeds this to be directed to receiving waters, although all drainage structures must be stable in flows up to the 100-year ARI storm event to do this without causing erosion.

The Surface Facilities Area covers an area of approximately 15 ha and would be accessed by a road approximately 2.5 km long. The Surface Facilities Area would comprise (**Appendix 1** – SEEC Drawing 10000076-SWMP-01):

- Fuel storage and Refuelling Area
- A Waste Rock Emplacement
- Site offices, laydown and workshop areas
- Car parks
- Processing Plant area
- Leachate Management Pond associated with the Waste Rock Emplacement
- ROM pad
- Sediment basins
- Box cut

The whole of the 15 ha Surface Facilities Area would be cleared of native vegetation and formed on the natural, shallow, rocky soils "Lithosols" (refer to the soil assessment by SEEC). Despite their gravely nature these soils are highly erodible (K-Factor = 0.053) and they are significantly dispersible (Type D).

The R-Factor is 1 150 (Landcom 2004). The required design rainfall depth[3] is 33.8 mm and the predicted slope is 2%. The predicted slope length is taken as 80m, as surface flow would be interrupted by tracks and structures. The required wet-type sediment basin volume is approximately 2,820 m^3 (minimum) of which 230 m^3 would be for sediment storage. This would be provided in one or, if preferred by the client, two sediment basins.

The basin(s) would require de-watering whenever their combined settling zone volume drops to less than 2,590 m^3. De-watering must occur within five days to ensure sufficient volume is available to capture the next design rainfall event.

The dirty water would be transferred to the settling ponds (that will have a combined capacity at least equal to the sediment basin(s) for immediate re-use or, if sufficient volume was not available there, it would be flocculated and released to receiving waters. We expect the latter to be a rare occurrence. Flocculated water must achieve less than 50 mg/L of suspended solids. Most likely alum would be used, taking care to dose it at the manufacturer's recommendations.

The Surface Facilities Area is located on land that naturally slopes to the southwest. Clean water diversion drains should be built upslope to divert clean water away from the disturbed area and dirty water drains should be built southeast of the disturbed areas to convey dirty water to the sediment basin(s). Trapped sediment removed from the basins may be spread out and vegetated or added to stockpiles. Peak-flow overflows from the sediment basin(s) would drain to the nearby natural watercourse via a stabilised outlet(s) designed for the 100-year ARI storm event.

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[3] 90th percentile 5-day rainfall depth per DECCW, 2008.

Detailed design of the sediment dams, diversion drains etc. should be provided in a future Soil and Water Management Plan prepared to the requirements of Landcom, 2004 and DECC, 2008a. That plan should also include a regular monitoring regime to be undertaken by the Mine's Manager.

The unpaved access roads (Main Site Access Road and Light Vehicle Road) should be built with a crowned surface to shed water onto surrounding land. Where necessary mitre drains should be installed every 100 m (**Figure 10**) to reduce concentrated flow. The road should be gravel-sheeted using crushed waste rock. Dust suppression should be done as and when required by a water tanker. Soil-stabilising additives should be added to the water used for dust suppression, if required.

6.2 FINAL LANDFORMS

The former Surface Facilities Area would, as far as possible, be re-instated to reflect the existing topography. This means the area would be reinstated with a gentle slope to the southwest (Appendix 1 SEEC Drawing 10000076-FL-01). Catchments here would essentially return to those pre-mining. The main haul road would be re-vegetated, after the surface soils are rehabilitated. The box cut would be sealed and would become internally drained. Water collecting in the rehabilitated box cut would slowly drain back into the mine or be evaporated.

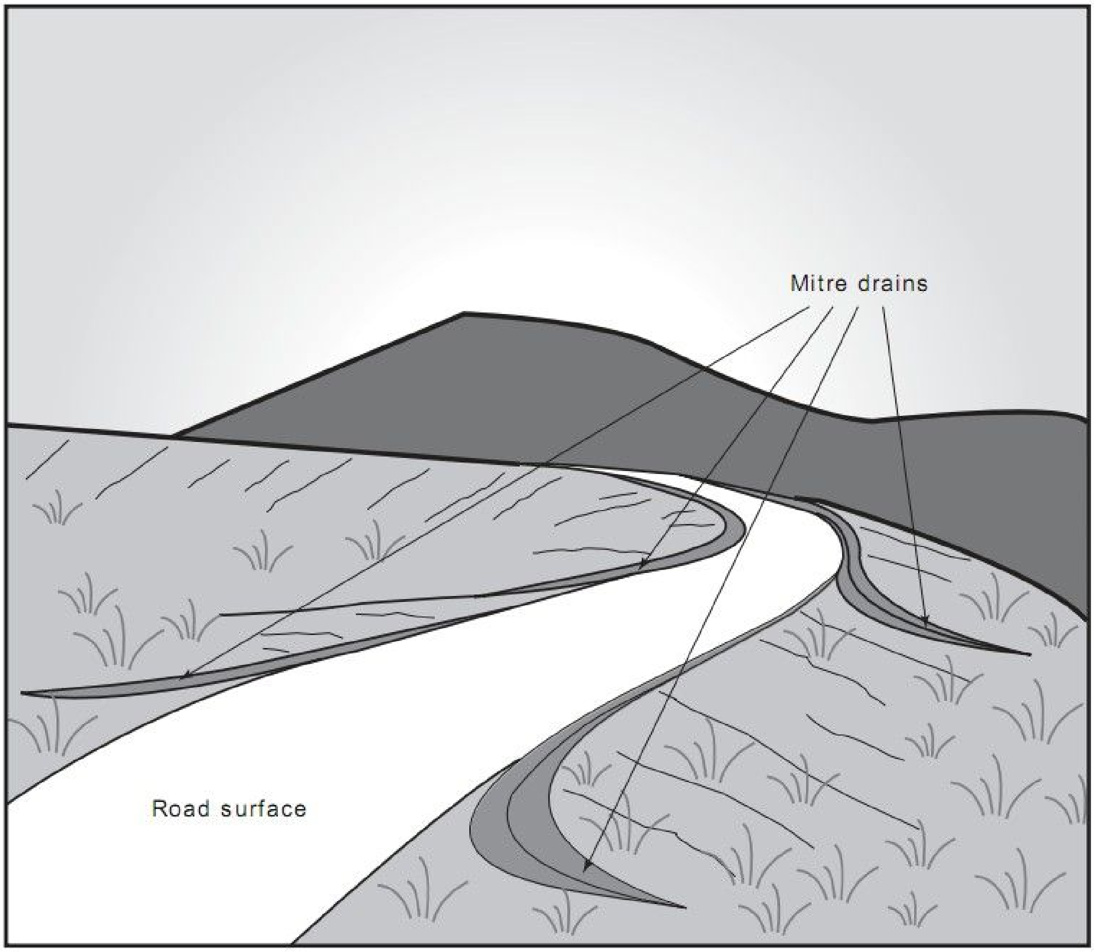

Figure 10 Mitre Drains to Control Road Drainage (DECC, 2008a)

The former Tailings Storage Facility would be contoured such that a raised plateau with a catchment area of about 45 ha would be created. It would have a shallow domed profile so that water is shed from its surface as sheet flow without concentration. Some of that flow would be towards the raised dam walls and so there would be an appropriate number of engineered, wide, drop structures to safely transfer that water down to original ground level (see Appendix 1). Windrows of soil placed along the top of the dam wall would direct the flow into the structures. Having many of these structures would reduce the volume of water each has to take and so reduce the risk of erosion at each one. The exact details of the drop structures would be the subject of a future engineering design.

Clean water diversion drains CD6 and CD13-CD19, installed as part of site establishment activities for the Project, would remain in place to deflect upslope water away from the former Tailings Storage Facility and to collect surface drainage from it. The drains are designed to be stable in the 100 year ARI storm event (even with their increased catchments). Refer to Appendix 1, Drawing number 10000076-FL-01.

A Soil and Water Management Plan will be developed to accompany the capping works at the former Tailings Storage Facility. That plan will reflect the exact nature of the capping procedure.

The two main soil types that exist within the Project Site (Red Earths and Lithosols) should be used to rehabilitate land commensurate with their source (SEEC, 2010b). This means the gravely Lithosols would be used to rehabilitate slopes from 3 to 10% and the Red Earths would be used to rehabilitate slopes up to 3% (e.g. to cap the tailings within the Tailings Storage Facility). With re-vegetation the rehabilitated land would reflect the existing landscape's erosivity. The steeper slopes, if more than 20 m in length, should have a slightly concave profile (Landloch, 2005).

Embankments greater than 10% should be confined to minor rock emplacements, the former Tailings Storage Facility and the water storage dams. These slopes should be stabilised with rock pitching over suitable geotextile fabric (Bidim A44 or equivalent).

Back Tanks East and West and Pete's Tank will remain after mining ceases. They would be a source of water for rehabilitation. However, an agronomist should advise on irrigation supply, as it will be important that the vegetation does not become too reliant on it.

All the previously disturbed areas (Tailings Storage Facility, Surface Facilities Area, Mine Camp, and Exploration Office/Core Store Area, the Box Cut) would be stabilised and revegetated. The principles of replacing topsoil and vegetating in Landcom, 2004 (The Blue Book) and DECC, 2008a should be followed. The sediment basin, and the diversion drains feeding it, should remain in place until the former Surface Facilities Area is sufficiently stabilised. When it is, these structures would be removed.

7. OTHER POLLUTANTS

Potential pollutants (other than sediment) that might be used or generated within the Surface Facilities Area include the following:

- Reagents used in the processing of ore material.

- Fuels and oils within the Processing Plant and machinery.
- Tailings and associated leachate from the processing of ore.

Potential water quality impacts could occur in the event of a chemical spill or leakage. To mitigate this risk, appropriate best-management techniques would be employed for the handling and storage of potentially-polluting chemicals.

The Tailings Storage Facility would be required for the management of the wastewater from the processing of ore. It would be sized appropriately and designed to minimise the risk of any discharge to downstream receiving waters. This is described elsewhere in the *Environmental Assessment* but, in brief:

- The Tailings Storage Facility should be effectively sealed to prevent leakage into the underlying substrate. This includes sealing the bund wall to be built around the Tailings Storage Facility.
- The Tailings Storage Facility should have a diversion bund constructed around it to completely divert any upslope run-on around it. This bund would be stabilised to effectively convey the 100-year ARI, time-of-concentration flow from the upstream catchment.
- A collection drain would be installed below the dam wall. It will drain to a lined seepage collection pond from where the collected water would be pumped to the Process Water Dam.

In addition:

- All fuel and chemical storage, delivery and handling areas should be bunded to 110% of the size of the largest receptacle.
- Any header tanks for the storage of fuels or chemicals should have a return-line and/or an alarm fitted to minimise the risk of overflows causing a pollution event.
- Pumps and fluid lines for the delivery of chemicals or fuels should be bunded and/or protected. Transfer volumes are to be monitored to quickly identify any leaks.
- There will be a number of internal bunds and sumps to ensure contaminated fluids cannot mix with ‘natural’ clean or dirty water. These are discussed in Section 2.2.4 of the *Environmental Assessment*.

8. SURFACE WATER QUALITY

8.1 WATER QUALITY OBJECTIVES

The Project Site ultimately drains to Box Creek and that ultimately drains to Crowl Creek and then that drains to Sandy Creek. These creeks are uncontrolled streams in the Barwon Darling and Far Western Catchments.

According to OEH guidelines the main environmental concerns in these rangeland areas are:

- To protect (with appropriate water quality) aquatic ecosystems (allowing for their ephemeral or intermittent nature) and stock water.
- Reduce chemical and sediment loads.

Therefore, the adopted Trigger Values from the ANZECC, 2000 guidelines are:

- Phosphorous (TP) 25 µg/L
- Total nitrogen (TN) 500 µg/L
- Chlorophyll–a 5 µg/L
- Turbidity 6 – 50 NTU
- Salinity 125 – 2200 µS/cm
- Dissolved oxygen 85 – 110%
- pH 6.5 – 8.5
- Chemical contaminants or toxicants[4]

If any of these triggers are exceeded at a nominated monitoring location a suitably qualified consultant should be employed to investigate, report, liaise with OEH and suggest remedial measures, if required. Note it could be that the existing catchment exceeds one or more of these triggers already – refer to the next section.

8.2 MONITORING

The catchment to the proposed Back Tank East is almost entirely within the Project Site boundary. It does not include the Surface Facilities Area, will not be fed from groundwater and would continue to have a low-intensity land use. Therefore, it provides an opportunity for use as an on-going baseline water quality monitoring pond. Initially baseline water quality data monitoring should be undertaken from (existing) Back Tank West before mining commences.

A second monitoring point should be located within the House Tank, as it represents the receiving water (Watercourse A) just before it leaves the site and it is downstream of the proposed Surface Facilities Area. Whenever there is a significant rainfall event (but no more than four times a year) samples should be taken from it and from the Back Tank East. They should be sent to an independent NATA registered laboratory within the technical holding times and tested for the suite of indicators given in Section 8.1, as well as hydrocarbons and aluminium (if Alum is used for flocculation).

Initially, if the pollutant concentrations in the samples from House Tank exceed those from Back Tank East *and* the trigger values given in Section 8.1, a suitably qualified consultant would be engaged to investigate, report, liaise with OEH and suggest remedial measures, if required.

[4] For Protection of Aquatic Ecosystems in NSW, the ANZECC 2000 Guidelines provide default trigger values for major physico-chemical stressors in Tables 3.3.2 and 3.3.3 (pages 3.3-10 & 11) and for Toxicants in Table 3.4.1 (page 3.4-5)

As time progresses water quality data from Back Tank East should become more reliable - *as long as the catchment remains unchanged and there is no inflow from the underground mine or groundwater*. Once there a statistically valid number of data available (we recommend at least 10) a trigger for further investigation would be deemed to occur when the median concentration of an indicator taken from House Tank exceeds the eightieth (80) percentile of the same indicator from Back Tank East. If this trigger is exceeded a suitably qualified consultant should be engaged to investigate, report, liaise with OEH and suggest remedial measures if and as required.

9. ONSITE DOMESTIC WASTEWATER MANAGEMENT

Wastewater would be produced within the Surface Facilities Area and at the Mine Camp. It would be treated in Aerated Wastewater Treatment Systems and the secondary-treated effluent should be disposed in a dedicated, vegetated, irrigation areas. The existing house has a septic tank system.

10. CONCLUSION – IMPACT ASSESSMENT

It is proposed to mine a gold deposit at “The Peak” property 4 km south of Nymagee. The Hera Project will be managed by YTC Resources Limited and the design life of the mine is about 9 years (including 1.5 years of site establishment, 5.5 years of operations and 2 years of decommissioning/rehabilitation activities). 187 ML per year make-up water is required for processing (mean 167 ML per year) and for dust suppression (estimated at 20 ML per year).

The Project Site, wholly within the Peak property, is in far western NSW and is subject to a dry climate with high evaporation and an erratic rainfall pattern. Given these climatic conditions this assessment has found that surface water cannot be relied on to supply the mine’s water demand with certainty. Depending on prevailing climatic conditions, the Project might experience a long dry period when no surface water would be available at all. However, it is equally likely that there would be periods when surface water is available. For the purpose of this report we have conservatively assumed that, if surface water is available, it will be drawn at full demand until the dams are dry and then supply would revert to groundwater supply.

Modelling showed there was no benefit in having more than 110 ML of surface water storage and so that is what is proposed. Assuming the Project attempts to draw 187 ML/year from this storage volume, the modelling predicts:

- The mean annual flow *volume* in Watercourse A (the third order receiving watercourse) will be slightly lower (about 3%) than the existing flow rate. However, given the short life of the Project, such minor changes would be difficult to identify because of the erratic climate.
- Flow *rates* will be slightly lower than existing flow rates because the proposed expansion of Pete’s Tank to 20 ML capacity and the creation of Back Tank West (90 ML capacity) will retard them. However, given the short life of the Project, such minor changes would be difficult to identify because of the erratic climate.
- The *frequency* of flows would be unchanged.

Best management practices would be adopted to manage erosion, sediment and chemical pollutants. This includes sediment basins being designed for the 90th percentile 5-day rainfall event (33.8 mm). Trapped stormwater would be sent directly to one of the storages for later re-use, as this negates the need for offsite discharge. However, in the rare event that it is not possible, the trapped water would be flocculated to achieve less than 50 mg/L suspended solids before it was released to the receiving waters.

Offsite discharges of contaminated water would not occur. Processing/tailings water would be contained within a closed loop. Domestic wastewater will be secondary-treated and disposed in a correctly-sized irrigation areas at least 40 m from the nearest watercourse.

A water quality monitoring regime would be instigated to ensure any impact on downstream water quality is quickly identified and addressed. If any of the triggers are exceeded at the monitoring location a suitably qualified consultant would be employed to investigate, report, liaise with OEH and suggest remedial measures, if required.

After mining activities cease the disturbed land would be rehabilitated using on-site soils. The soils would be used to re-habilitate landforms that are commensurate with their source (SEEC, 2010) and they would be placed carefully and in their correct stratigraphical order. Restored landforms would be quickly re-vegetated using local species and, if necessary, aided by using irrigation from the storage dams that remain.

11. REFERENCES

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Macleod, A.P. (2008). "MUSIC Calibration Based on Soil Conditions." In Proceedings of Stormwater08; NSW and Qld Stormwater Industry Association Conference, Gold Coast, 2008.

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Appendices

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Appendix 1

SEEC Drawings 10000076-SWMP-01 and 10000076-FL-01

(Total No. of pages including blank pages = 8)

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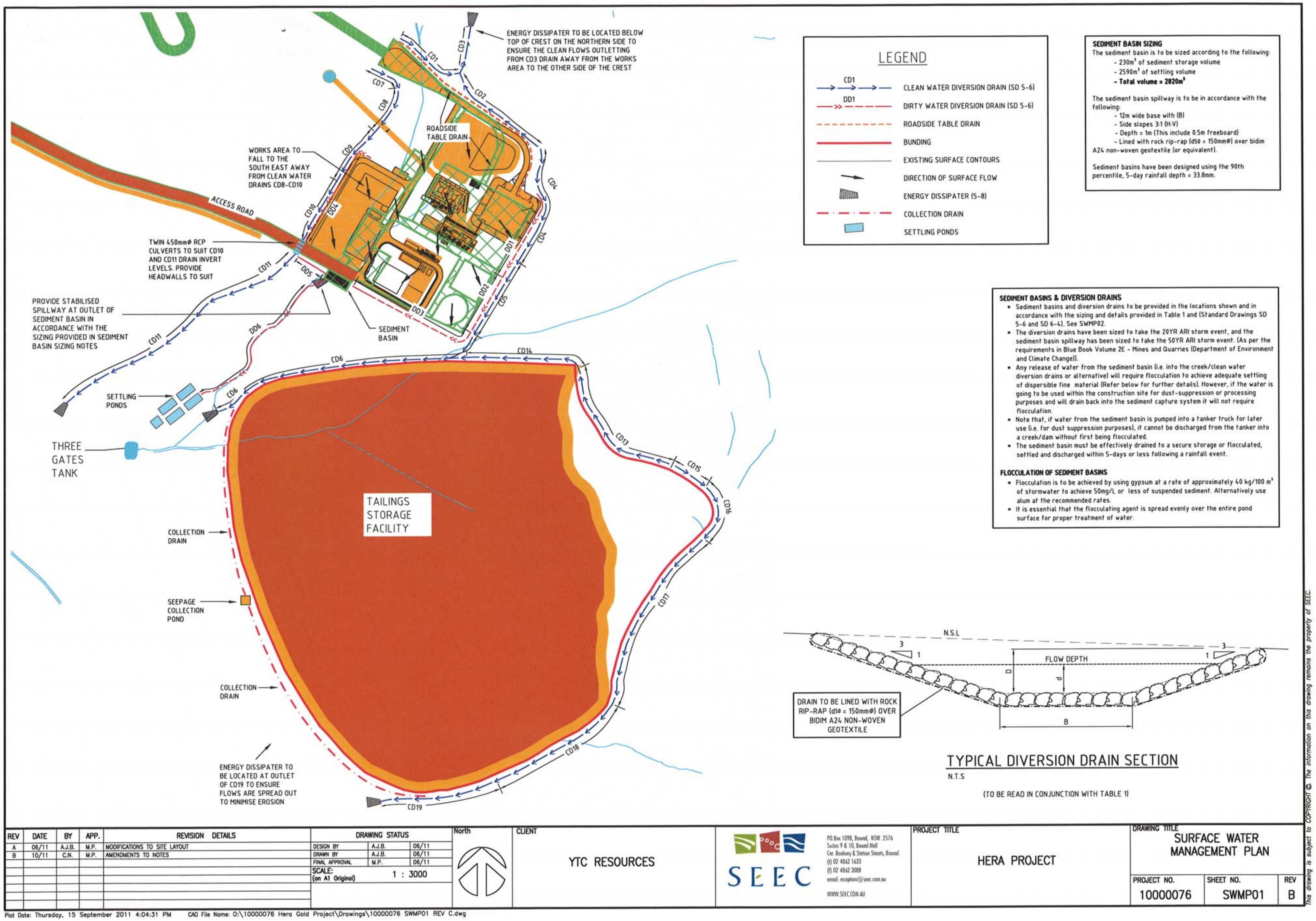
ENERGY DISSIPATER TO BE LOCATED BELOW TOP OF CREST ON THE NORTHERN SIDE TO ENSURE THE CLEAN FLOWS OUTLETTING FROM CD3 DRAIN AWAY FROM THE WORKS AREA TO THE OTHER SIDE OF THE CREST
LEGEND
CD1 CLEAN WATER DIVERSION DRAIN (SD 5-6)
DD1 DIRTY WATER DIVERSION DRAIN (SD 5-6)
ROADSIDE TABLE DRAIN
BUNDING
EXISTING SURFACE CONTOURS
DIRECTION OF SURFACE FLOW
ENERGY DISSIPATER (5-8)
COLLECTION DRAIN
SETTLING PONDS
SEDIMENT BASIN SIZING
The sediment basin is to be sized according to the following:
- 230m³ of sediment storage volume
- 2590m³ of settling volume
- Total volume = 2820m³
The sediment basin spillway is to be in accordance with the following:
- 12m wide base with (B)
- Side slopes 3:1 (H:V)
- Depth = 1m (This include 0.5m freeboard)
- Lined with rock rip-rap (d50 = 150mmø) over bidim A24 non-woven geotextile (or equivalent).
Sediment basins have been designed using the 90th percentile, 5-day rainfall depth = 33.8mm.
ROADSIDE TABLE DRAIN
WORKS AREA TO FALL TO THE SOUTH EAST AWAY FROM CLEAN WATER DRAINS CD8-CD10
ACCESS ROAD
TWIN 450mmø RCP CULVERTS TO SUIT CD10 AND CD11 DRAIN INVERT LEVELS. PROVIDE HEADWALLS TO SUIT
PROVIDE STABILISED SPILLWAY AT OUTLET OF SEDIMENT BASIN IN ACCORDANCE WITH THE SIZING PROVIDED IN SEDIMENT BASIN SIZING NOTES
SEDIMENT BASIN
SEDIMENT BASINS & DIVERSION DRAINS
Sediment basins and diversion drains to be provided in the locations shown and in accordance with the sizing and details provided in Table 1 and (Standard Drawings SD 5-6 and SD 6-4). See SWMP02.
The diversion drains have been sized to take the 20YR ARI storm event, and the sediment basin spillway has been sized to take the 50YR ARI storm event. (As per the requirements in Blue Book Volume 2E - Mines and Quarries (Department of Environment and Climate Change)).
Any release of water from the sediment basin (i.e. into the creek/clean water diversion drains or alternative) will require flocculation to achieve adequate settling of dispersible fine material (Refer below for further details). However, if the water is going to be used within the construction site for dust-suppression or processing purposes and will drain back into the sediment capture system it will not require flocculation.
Note that, if water from the sediment basin is pumped into a tanker truck for later use (i.e. for dust suppression purposes), it cannot be discharged from the tanker into a creek/dam without first being flocculated.
The sediment basin must be effectively drained to a secure storage or flocculated, settled and discharged within 5-days or less following a rainfall event.
FLOCCULATION OF SEDIMENT BASINS
Flocculation is to be achieved by using gypsum at a rate of approximately 40 kg/100 m³ of stormwater to achieve 50mg/L or less of suspended sediment. Alternatively use alum at the recommended rates.
It is essential that the flocculating agent is spread evenly over the entire pond surface for proper treatment of water.
SETTLING PONDS
THREE GATES TANK
TAILINGS STORAGE FACILITY
COLLECTION DRAIN
SEEPAGE COLLECTION POND
COLLECTION DRAIN
ENERGY DISSIPATER TO BE LOCATED AT OUTLET OF CD19 TO ENSURE FLOWS ARE SPREAD OUT TO MINIMISE EROSION
N.S.L
FLOW DEPTH
DRAIN TO BE LINED WITH ROCK RIP-RAP (d50 = 150mmø) OVER BIDIM A24 NON-WOVEN GEOTEXTILE
TYPICAL DIVERSION DRAIN SECTION
N.T.S
(TO BE READ IN CONJUNCTION WITH TABLE 1)
REV DATE BY APP. REVISION DETAILS
A 06/11 A.J.B. M.P. MODIFICATIONS TO SITE LAYOUT
B 10/11 C.N. M.P. AMENDMENTS TO NOTES
DRAWING STATUS
DESIGN BY A.J.B. 06/11
DRAWN BY A.J.B. 06/11
FINAL APPROVAL M.P. 06/11
SCALE: (on A1 Original) 1 : 3000
North
CLIENT
YTC RESOURCES
SEEC
WWW.SEEC.COM.AU
PROJECT TITLE
HERA PROJECT
DRAWING TITLE
SURFACE WATER MANAGEMENT PLAN
PROJECT NO. 10000076
SHEET NO. SWMP01
REV B
This drawing is subject to COPYRIGHT © The information on this drawing remains the property of SEEC.
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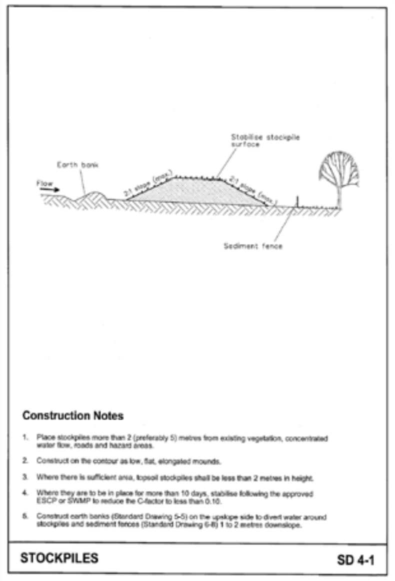

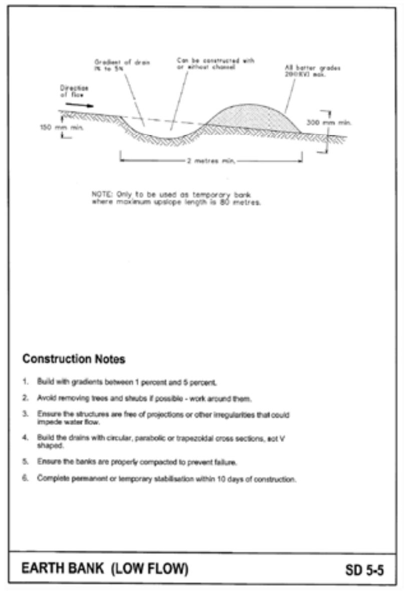

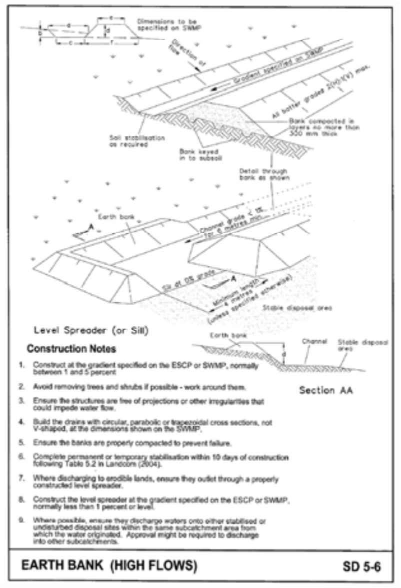

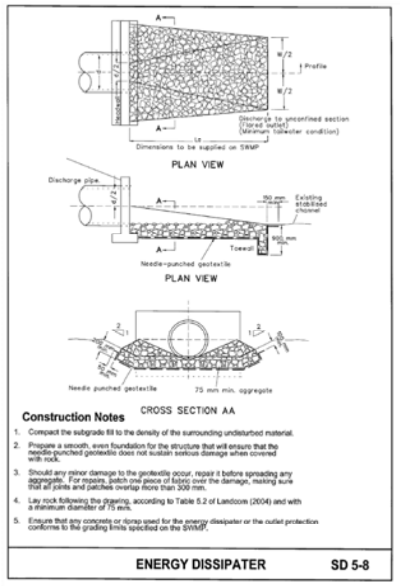

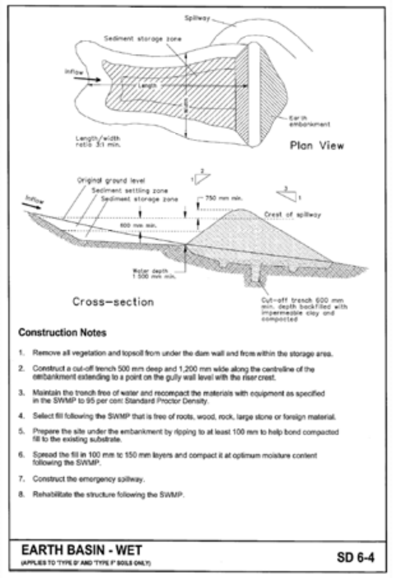

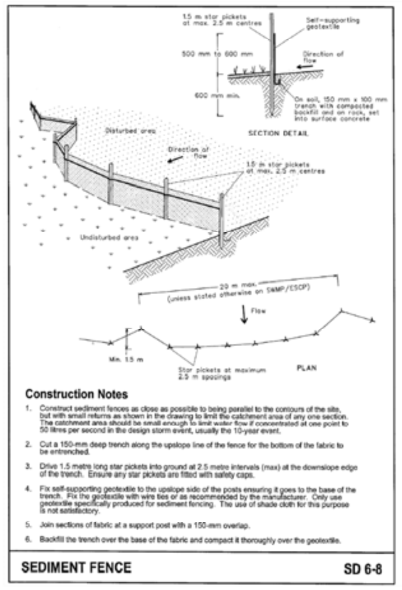

TABLE 1 – DIVERSION DRAIN SIZING AND DETAILS

Drain	Channel Slope (S) (%)	Flowrate (Q) (m3/s)	Depth of Flow (d) (m)	Velocity (V) (m/s)	Base Width (B) (m)	Channel Depth (D) (m)	Side Slopes (H:V)	Safety (dV)	Lining Material
CD1	2.80	0.07	0.12	0.70	0.50	0.5	3	0.08	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD2	3.00	0.27	0.22	1.02	0.50	0.6	3	0.22	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD3	1.00 (Min)	0.45	0.27	0.74	1.50	0.6	3	0.20	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD4	2.50	0.25	0.23	0.94	0.50	0.6	3	0.22	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD5	1.70	0.41	0.26	0.90	1.00	0.6	3	0.23	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD6	1.80	1.56	0.3	1.17	3.50	0.6	3	0.35	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD7	5.00	0.08	0.11	0.89	0.50	0.5	3	0.10	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD8	1.70	0.24	0.24	0.81	0.50	0.6	3	0.19	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD9	1.40	0.37	0.26	0.84	1.00	0.6	3	0.22	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD10	2.20	0.43	0.3	1.03	0.50	0.6	3	0.31	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD11	1.60	0.94	0.28	1.02	2.50	0.6	3	0.29	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD12	1.00 (Min)	13.23	0.87	2.02	6.00	1.2	3	1.76	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD13	1.50	0.29	0.27	0.81	0.50	0.6	3	0.22	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD14	1.90	0.42	0.25	0.94	1.00	0.6	3	0.24	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD15	1.00 (Min)	0.11	0.19	0.54	0.50	0.5	3	0.10	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD16	1.00 (Min)	1.49	0.37	0.97	3.00	0.7	3	0.36	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD17	1.00 (Min)	1.66	0.4	1.00	3.00	0.7	3	0.40	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD18	1.90	2.00	0.37	1.32	3.00	0.7	3	0.49	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD19	2.00	2.14	0.38	1.37	3.00	0.7	3	0.52	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
DD1	3.50	1.98	0.37	1.72	2.00	0.7	3	0.64	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
DD2	2.00	2.30	0.39	1.40	3.00	0.7	3	0.55	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
DD3	1.00 (Min)	3.29	0.48	1.16	4.50	0.8	3	0.56	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
DD4			Low flow diversion mound (see SD 5-5).						
DD5	1.00 (Min)	0.66	0.29	0.8	2.00	0.6	3	0.23	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
DD6	1.60	4.87	0.58	1.59	3.50	0.9	3	0.92	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)

REV	DATE	BY	APP.	REVISION DETAILS
A	06/11	A.J.B.	M.P.	MODIFICATION TO SITE LAYOUT

DRAWING STATUS		
DESIGN BY	A.J.B.	06/11
DRAWN BY	A.J.B.	06/11
FINAL APPROVAL	M.P.	06/11
SCALE: (on A1 Original)	N/A	

North

CLIENT: YTC RESOURCES

SEEC

P.O.Box 1098, Bowral, NSW, 2576
Suites 9 & 10, Bowral Mall
Cnr. Boolwey & Station Streets, Bowral.
(t) 02 4862 1633
(f) 02 4862 3088
email: reception@seec.com.au
WWW.SEEC.COM.AU

PROJECT TITLE: HERA PROJECT

DRAWING TITLE: STANDARD DETAILS AND DIVERSION DRAIN DETAILS

PROJECT NO.	SHEET NO.	REV
10000076	SWMP02	A

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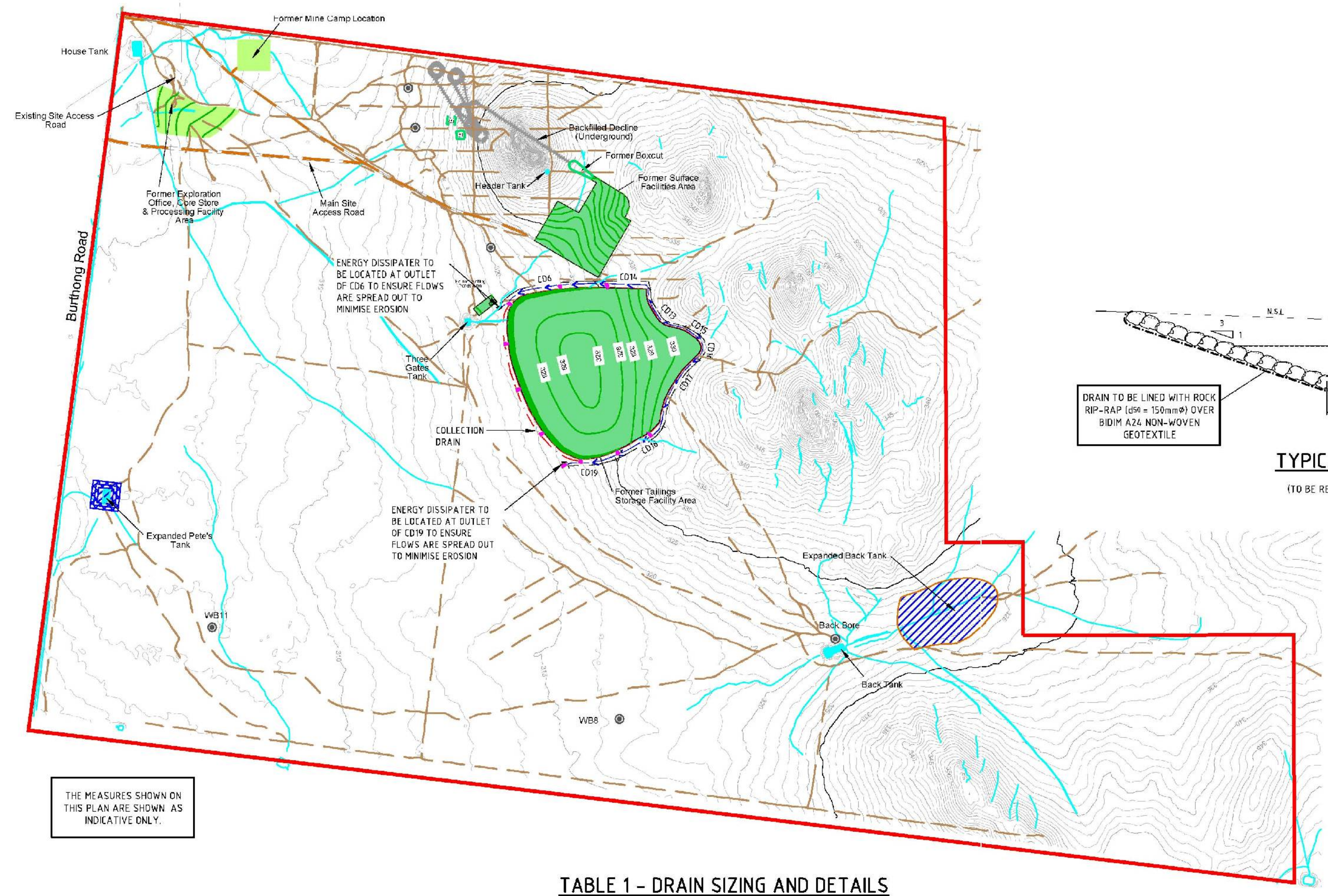
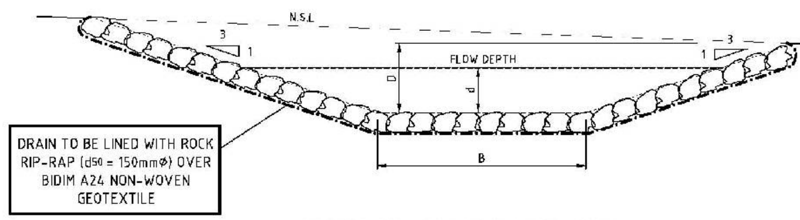


LEGEND

- CD1 — CLEAN WATER DRAIN
- BUNDING
- EXISTING SURFACE CONTOURS
- DIRECTION OF SURFACE FLOW
- ENERGY DISSIPATER
- COLLECTION DRAIN



TYPICAL DRAIN SECTION

N.T.S
(TO BE READ IN CONJUNCTION WITH TABLE 1)

THE MEASURES SHOWN ON THIS PLAN ARE SHOWN AS INDICATIVE ONLY.

TABLE 1 – DRAIN SIZING AND DETAILS

Drain	Channel Slope (S) (%)	Flowrate (Q) (m3/s)	Depth of Flow (d) (m)	Velocity (V) (m/s)	Base Width (B) (m)	Channel Depth (D) (m)	Side Slopes (H:V)	Safety (dV)	Lining Material
CD6	1.80	1.56	0.3	1.17	3.50	0.6	3	0.35	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD13	1.50	0.29	0.27	0.81	0.50	0.6	3	0.22	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD14	1.90	0.42	0.25	0.94	1.00	0.6	3	0.24	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD15	1.00 (Min)	0.11	0.19	0.54	0.50	0.5	3	0.10	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD16	1.00 (Min)	1.49	0.37	0.97	3.00	0.7	3	0.36	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD17	1.00 (Min)	1.66	0.4	1.00	3.00	0.7	3	0.40	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD18	1.90	2.00	0.37	1.32	3.00	0.7	3	0.49	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)
CD19	2.00	2.14	0.38	1.37	3.00	0.7	3	0.52	Rock underlaid with bidim A24 non-woven geotextile (Mannings = 0.045)

NOT FOR CONSTRUCTION

REV	DATE	BY	APP.	REVISION DETAILS
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DRAWN BY	A.J.B.	06/11
FINAL APPROVAL	M.P.	06/11
SCALE: (on A1 Original)	1 : 10000	

North

CLIENT: YTC RESOURCES

SEEC
P.O.Box 1098, Bowral, NSW 2576
Suites 9 & 10, Bowral Mall
Cnr. Boolwey & Station Streets, Bowral
(t) 02 4862 1633
(f) 02 4862 3088
email: reception@seec.com.au
WWW.SEEC.COM.AU

PROJECT TITLE: HERA PROJECT

DRAWING TITLE: FINAL LANDFORM

PROJECT NO.	SHEET NO.	REV
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Appendix 2

DIRECTOR GENERAL'S REQUIREMENTS

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Table A2.1
Director-General's Requirements (related to water)
(Department of Planning – Hera project 10_0191)

Paraphrased Requirement	Relevant Section(s)
SOIL AND WATER	
Including: • a detailed site water balance: • a detailed groundwater model; • potential water quality impacts on the environment and other land users; and • a description of the final landform water management.	Sections 4 to 8, plus the Groundwater Assessment (Part 2)

Table A2.2
DECCW EA Requirements (related to water)

Paraphrased Requirement	Relevant Section(s)
WATER	
The environmental outcomes of the project in relation to water should be that:	
• There is no pollution of waters (including surface and groundwater).	Sections 6, 7 & 8
• Polluted water (including process waters, wash-down waters, polluted stormwater or sewage) is captured onsite and collected, treated and beneficially re-used.	Sections 6, 7 & 9
• The project is assessed in relation to the relevant NSW Water Quality Objectives and against ANZECC 2000 water quality criteria.	Section 8
The EA should document the measures that will achieve the above outcomes in the construction, operation and post operation phases of the development. Construction activities will need to demonstrate best practice sediment and erosion control and management in accordance with the reference document *Managing Urban Stormwater: Soils and Construction (NSW Landcom 2004).*	Sections 6 & 7
The EA should identify potential impact on watercourses and the management/mitigation measures that will be implemented where works are conducted in the vicinity of watercourses.	Sections 5, 6 & 8
The EA should demonstrate how the project will contribute to achieving the most current government endorsed Water Quality and River Flow Objectives for each of the relevant catchments and should utilise the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000).	Section 8
A detailed water balance must be prepared to model water management through the life cycle of the mine.	Section 4
Where an offsite discharge is proposed, the EA will need to identify: • Details regarding proposed discharges i.e. treatment requirements, infrastructure to enable a discharge etc. • All proposed discharge points; • Estimates of the frequency and volume of discharges; and • Likely water quality to be discharged:	Section 5 & 6

Table A2.3
NOW Requirements

Watercourse/Riparian issues	
• The assessment is required to consider the impact of the proposal on any watercourses and associated riparian vegetation within the site and provide the following:	Sections 5 & 8
• Identify the sources of surface water.	Sections 3 & 4
• Details of stream order (using the Strahler System).	Section 3.2
• Details of any proposed surface water extraction, including quantity, purpose, location of existing pumps, dams, diversions, cuttings and levees	Sections 3.3 & 4
• Details of available surface water licenses that could be purchased to account for any proposed extractions.	Section 3.2 (no licence required)
• Detailed description of any proposed development or diversion works including all construction, clearing, draining, excavation and filling.	Section 2 of the *Environmental Assessment*
• An assessment of the impacts of the proposed methods of excavation, construction and material placement on the watercourse and associated vegetation.	Section 6
• A detailed description of all potential water related environmental impacts of any proposed development in terms of riparian vegetation, sediment movement, water quality and hydrologic regime.	Sections 5, 6 & 8
• A description of the design features and measures to be incorporated into any proposed development to guard against anything more than minimal long term actual and potential environmental disturbances, particularly in respect of maintaining the natural hydrologic regime and sediment movement patterns and the identification of riparian buffers.	Sections 6, 7 & 8
• Details of the impact on water quality and remedial measures proposed to address more than minimal adverse effects.	Sections 7 & 8