Champions Quarry Expansion

WATER MANAGEMENT PLAN

Final Report

Version 2.2 (October 2017)

Champions Quarry

"Working with the Environment"

REVISION HISTORY AND APPROVAL OF THE WATER MANAGEMENT PLAN

Version	Date	Description	By	Review
1.0	September 2013	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			Environmental Resources Management Australia (ERM) – Approved Peer Reviewer	Will Weir
			EPA	Completed
			NOW	Completed
1.1	February 2014	Final Report Water Management Plan	DP & I	Requested Amendments
1.2	May 2014	Final Report Water Management Plan	DP & I	Conditional Approval until 30 October 2014
1.3	October 2014	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			Environmental Resources Management Australia (ERM) – Approved Peer Reviewer	Will Weir
1.4	January 2015	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			Environmental Resources Management Australia (ERM) – Approved Peer Reviewer	Will Weir
			DP & I	Requested Amendments
1.5	October 2015	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			Environmental Resources Management Australia (ERM) – Approved Peer Reviewer	Will Weir
			DP & I	Requested Amendments
1.6	January 2016	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			Environmental Resources Management Australia (ERM) – Approved Peer Reviewer	Will Weir
			DP & I	Requested Amendments
1.7	February 2016	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			Environmental Resources Management Australia (ERM) – Approved Peer Reviewer	Will Weir
			DP & E	Approved
2.0	January 2017	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			DP & E	Comments
2.1	March 2017	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			DP & E	Approved
2.2	October 2017	Final Report Water Management Plan	Champions Quarry	Jeff Champion
			DP & E	Approved

This Management Plan has been prepared after due consideration of the Guidelines which seek to ensure that this is an effective and user friendly Plan. It is not a prescriptive or detailed document but provides a broad framework and direction.

This Management Plan is considered a dynamic document and will be reviewed where necessary as part of the annual review process (see Section 8 of the EMS). This Management Plan and any subsequent revisions must be approved by Champions Quarry Management and DP & E. The Management Plan must be prepared in consultation with the NSW Environmental Protection Authority and the DPI (Water) and then be submitted to the Secretary (or a delegate) of the Department of Planning and Infrastructure for approval in accordance with the Project Approval. This Management Plan was prepared by Champions Quarry and peer reviewed by the person designated in the table above. The Peer Reviewer was approved by the Secretary in satisfaction of the requirement that the Water Management Plan be prepared by a suitably qualified and experienced person/s whose appointment has been approved by the Secretary.

A copy of the revised Management plan will be available from the Proponent's website.

REVISION HISTORY AND APPROVAL OF PROJECT APPROVAL (CONDITIONS OF APPROVAL)

Date	Description	By	Review
30 August 2012	Project Approval	Champions Quarry	Jeff Champion
		DP & I	
29 October 2013	Notice of Modification (09_0080 MOD 1)	Champions Quarry	Jeff Champion
		DP & I	
16 September 2016	Notice of Modification (09_0080 MOD 2)	Champions Quarry	Jeff Champion
		DP & E	
9 August 2017	Notice of Modification (09_0080 MOD 3)	Champions Quarry	Jeff Champion
		DP & E	

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REFERENCES

GLOSSARY

AMD	Acid mine drainage
ARI	Average Recurrence Interval
ASS	Acid Sulphate Soils
ASSMAC	Acid Sulphate Soils Management and Advisory Committee
Blue Book	Managing Urban Stormwater – Soils and Construction 'Blue Book' (Landcom, NSW 2004)
Biodiversity Offset Strategy	The conservation and enhancement strategy described in the documents listed in condition 2(a) of Schedule 2, and shown in the figure in appendix 6 of the Project Approval
CoA	Planning and Assessment Commission of NSW Conditions of Approval dated August 30, 2012 (incorporating the Statement of Commitments (SoC)) as amended from time to time
Contractor	Contractor engaged by the Proponent to undertake activities associated with the Project (and includes Subcontractors)
DECCW	Department of Environment, Climate Change and Water
Department	Department of Planning and Environment
DoP	Department of Planning
DP & I	Department of Planning and Infrastructure (previously known as DoP)
DP & E	Department of Planning and Environment (previously known as DP & I)
DPI (Agriculture)	Department of Primary Industries - Agriculture
DPI (Water)	Department of Primary Industries - Water
DRG	Division of Resources and Geoscience within the NSW Department of Planning and Environment
Environment	Surroundings in which the Project operates within including: air, water, land, natural resources, flora, fauna, humans, heritage and their interrelation
Environmental Aspect	Element of organisational activities or products that can interact with the environment
Environmental Impact	Any changes to the environment, whether adverse or beneficial, wholly or partially resulting from an organisational aspect
Extraction Areas	The Central and Southern Extraction Areas, shown on Figure 9 in Appendix 6 of the Project Approval
EA	Champions Quarry Expansion, Environmental Assessment Report prepared by ERM Pty Limited and dated February 2010

EA (MOD 1)	Modification Application MP 09_0080 MOD 1 dated April 2013
EA (MOD 2)	Modification Application MP 09_0080 MOD 2 dated February 2016, the accompanying annexures A and B and the response to submissions dated April 2016
EA (MOD 3)	Modification Application MP 09_0080 MOD 3 dated February 2017, titled Annexure A – Application pursuant to Section 75W of the Environmental Planning and Assessment Act 1979, and the response to submissions dated July 2017
EMS	Environmental Management Strategy prepared in accordance with Schedule 5 Condition 1 of the Project Approval
EPA	NSW Environmental Protection Authority
ERM	Environmental Resources Management Australia
EP & A Act	*Environmental Planning and Assessment Act 1979 (NSW)*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environmental Protection Licence Number 20562 under the POEO Act
Guidelines	The Guidelines for Preparation of Environmental Management Plans (Department of Infrastructure, Planning and Natural Resources, 2004)
Incident	A set of circumstances that: • cause or threaten to cause, material harm to the environment; and/or • breaches or exceeds the limits or performance measures/criteria in the Project Approval
L	Litres
LCC	Lismore City Council
mAHD	Metres Australian Height Datum
Management Plan	Refers to this Water Management Plan
Minister	Minister for Planning, or delegate
MHRDC	Maximum Harvestable Right Dam Capacity
ML	Mega litres
MUSIC Model	Computer modelling software designed to simulate urban stormwater systems
NATA	National Association of Testing Authorities
NHMRC	National Health and Medical Research Council

NOW	NSW Office of Water, within the Department of Primary Industries
OEH	Office of Environment and Heritage
Operational Area	The area identified in Figure 1.2 (Site Layout) below labelled 'Limits of Quarry Operations'
PASS	Potential Acid Sulphate Soils
PASS Risk Mapping	Former Department of Land and Water Conservation Potential Acid Sulphate Soils Risk Mapping (1998)
POEO Act	*Protection and Environment Operations Act 1997*
Preferred Project Report (PPR)	Champions Quarry Expansion, Preferred Project Report prepared by ERM Pty Limited and dated December 2011
Project Approval	Project Approval issued by Planning and Assessment Commission of New South Wales containing the CoA dated 30 August 2012 as amended from time to time
Project Site	The area identified in Figure 1.2 (Site Layout) below and labelled 'Site Boundary'
Proponent	Reavill Farm Pty Ltd and Tucki Hills Pty Ltd and any other entity or person who seeks to carry out the development approved under the Project Approval
Response to Submissions (RTS)	Champions Quarry Response to Submissions, prepared by ERM Pty Limited and dated September 2010
RMS	Roads and Maritime Services
RUSLE model	Revised Universal Soil Loss Equation
Secretary	Secretary of DP & E, or nominee
SWMP	The Soil and Water Management Plan (Soil and Water Management Plan by ERM dated February 2010 forming part of the Environmental Assessment Report dated 25 February 2010 (Appendix I of the EA)
SoC	Statement of Commitment (Appendix 3 of the Project Approval)
SPOCAS Analysis	Suspended Peroxide Oxidation Combined Acidity and Sulphate Analysis
Subcontractor	Any company, body or person who is contracted to the Contractor for the purpose of supplying services or goods.
TPH	Total Petroleum Hydrocarbons
TSS	Total suspended solids

1 BACKGROUND

1.1 OVERVIEW

The Proponent has been granted Project Approval by the NSW Minister for Planning and Infrastructure under Section 75J of the EP & A Act to expand quarrying operations of the quarry known as Champions Quarry located at Tuckurimba (near Lismore) on the Far North Coast of New South Wales (herein referred to as "the Project").

The approved expansion is to increase the extraction rate from a maximum of 29,000m^3 (approximately 64,000 tonnes) of sandstone material to 250,000 tonnes of extractive materials per calendar year until the year 2038. Activities included as part of the expansion include but are not limited to, those activities required for clearing, top soil and over burden removal, extraction of quarry product, processing, stockpiling, loading and transportation of material.

As outlined in the EMS, the Project has undergone a high level of scrutiny as part of a detailed EA and subsequent investigations to evaluate the extent of impact of the proposed quarry expansion on the environment including soil and water resources.

1.2 INVESTIGATIONS INTO SOIL AND WATER MANAGEMENT

A comprehensive assessment of soil and water (surface and subsurface) conditions has been undertaken and as a result a Soil and Water Management Plan ("the SWMP") was developed. Further investigations were carried out, including re-worked sediment pond calculations. The sediment pond calculations are included as Annexure A for a Type D Basin and 60.2mm rainfall event (in accordance with the requirements of the EPL).

It is intended that the SWMP be adopted as the principal water management plan for the Project. The critical elements of the SWMP and sediment pond calculations are reproduced below.

1.3 TOPOGRAPHY AND HYDROLOGY

The Operational Area is located on a ridgeline system running north-south between the Wilsons River to the west and low lying flood plain to the east (refer to Figure 1.1 below). The elevation ranges from approximately 50mAHD in the Southern Extraction Area to approximately 6mAHD at the eastern and north eastern boundary of the Project Site. A gully depression occurs between the southern and central extraction areas draining east, then north along the eastern boundary of the Operational Area. Land to the north of the main Project Site access road area generally slopes to the north toward an ephemeral drainage depression and northeast toward the ephemeral drainage depression on the eastern Project Site boundary.

1.4 GEOLOGY AND SOIL

1.4.1 GEOLOGY

The 1:250,000 geological map of Tweed Heads (SH56-2) shows that the Project Site is underlain by the Jurassic age Kangaroo Creek Sandstone which is described as quartz sandstone and conglomerate. The higher elevations and western portions of the Project Site are overlain by basaltic rocks of the Lismore Basalt, which is a tertiary age member of the Lamington Volcanoes. Site observations of outcrop towards the southern extent of the Project Site indicate that the basaltic rocks are limited to an area west of the Operational Area and as a thin clay soil veneer above RL50m inside the Operational Area. The basal contact of the basalt appears to be sub horizontal, although regional experience indicates that lateral prediction of this contact for any great distance is unreliable.

Geotechnical drilling has demonstrated that the geology of the Champions Quarry expansion area is underlain by Kangaroo Creek Sandstone which is the premier sandstone aggregate parent material in the Far North Coast of NSW. Typically this sandstone contains coarse quartz sandstone and conglomerate of varying characteristics.

Figure 1.1 – Project Site Location
(Known as Figure 2.1 – Project Site Location extracted from the PPR)

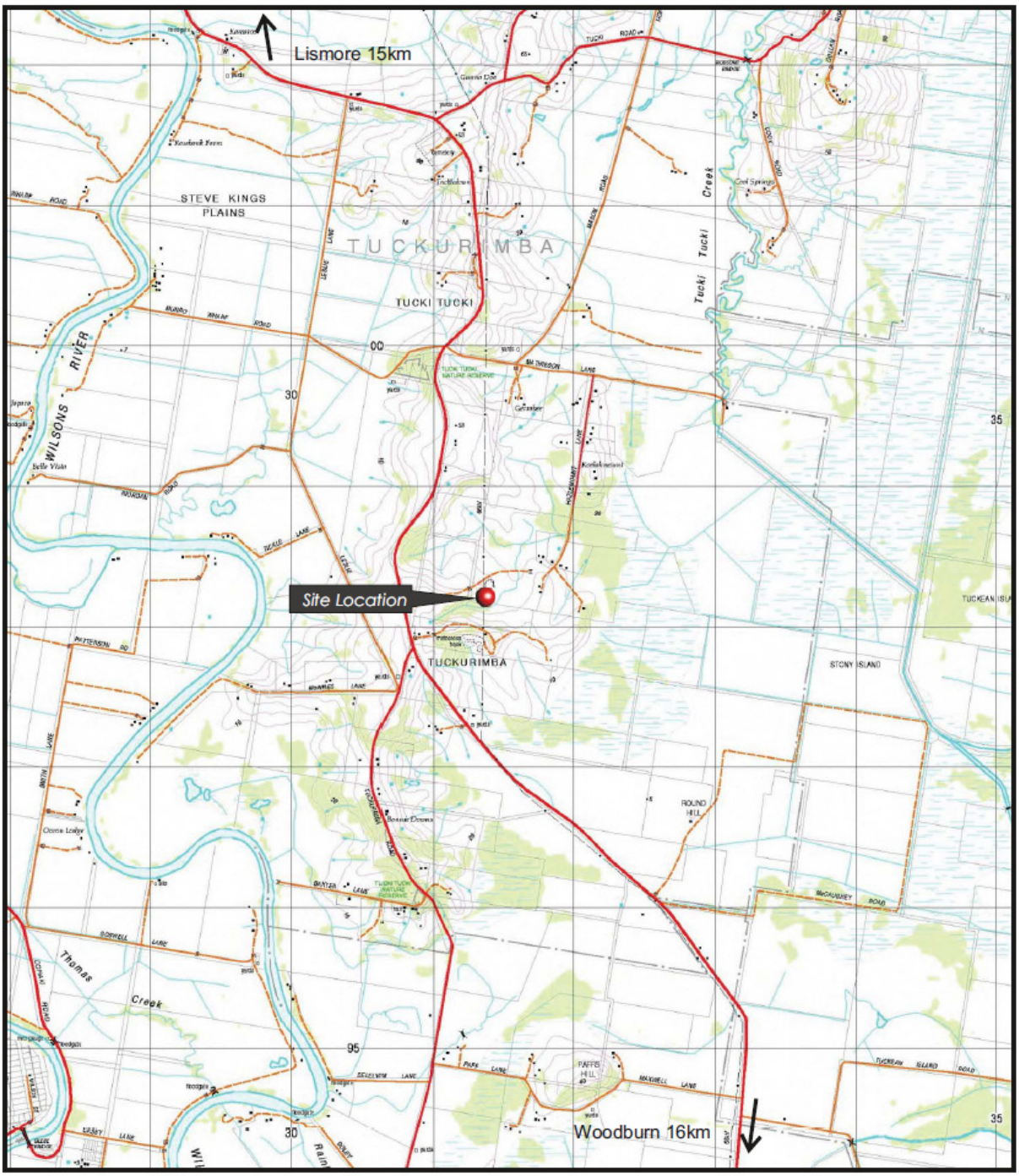

Figure 2.1
Project Site Location

Client:	Champions Quarry		
Project:	Champions Quarry		
Drawing No:	0114049pm_01		
Date:	25/07/11	Drawing size:	A4
Drawn by:	AM	Reviewed by:	WW
Source:	Department of Lands		
Scale:	Refer to Scale Bar		

N

0 0.5 1km

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Figure 1.2 – Project Layout Plans

Known as Appendix 2 Project Layout Plans – Figure 2.2 (amended 1 June 2012) extracted from the Planning and Assessment Commission of NSW Conditions of Approval dated 30 August 2012

APPENDIX 2
PROJECT LAYOUT PLANS

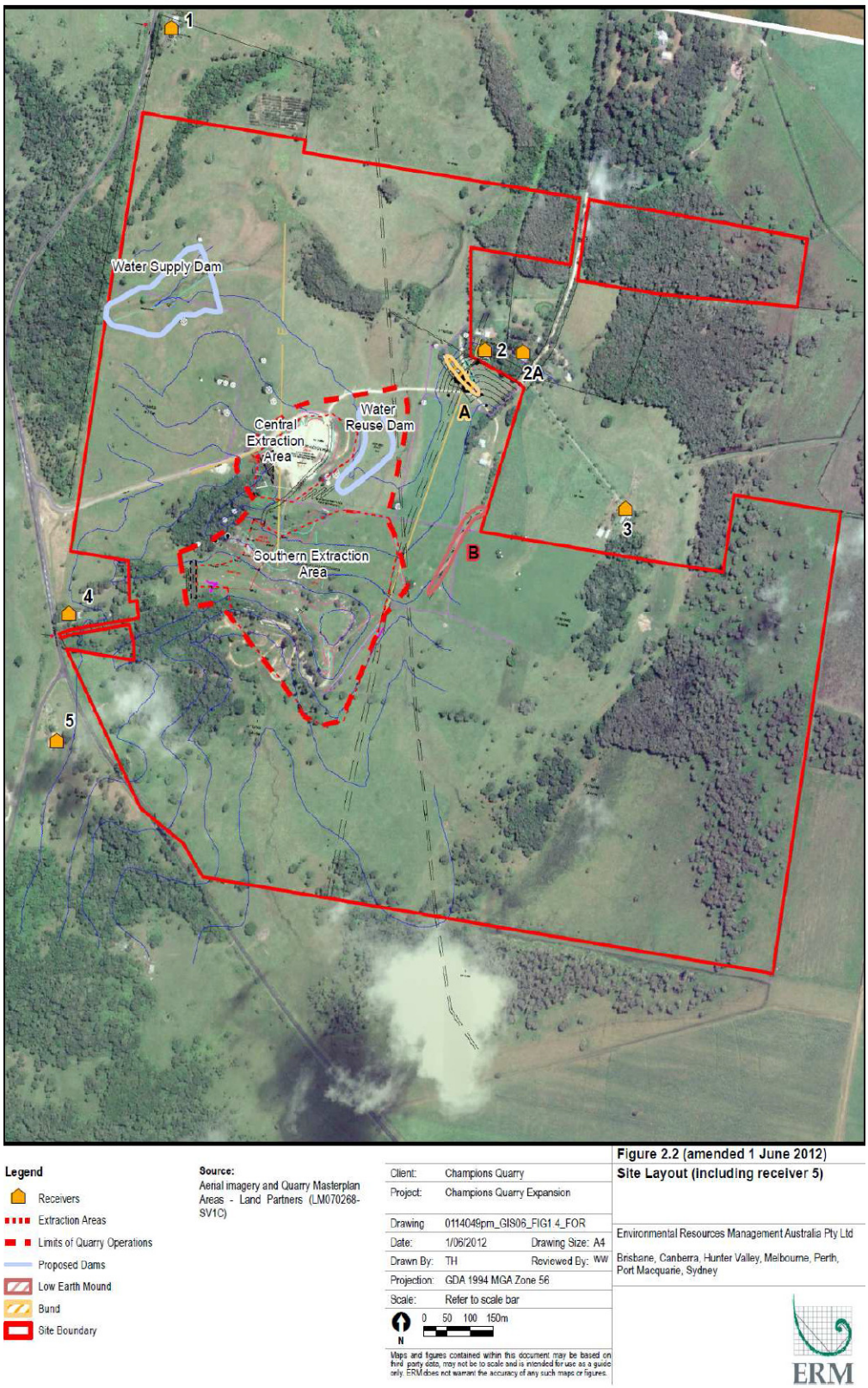

***Figure 2**: Project Site and Nearest Residential Receivers*

1.4.2 SOIL CONDITIONS

The Soil Landscape of the Lismore-Ballina 1:100,000 Sheet (Morand, 1994) identifies two soil landscapes as occurring in the vicinity of the Project Site. These are a variant of the 'Wollongbar' erosional and a variant of the 'Coffee Camp' colluvial landscapes. The erosional 'Wollongbar' soils are typically derived from basalts and are mostly deep (>200cm) Krasnozems and stonier Krasnozems on crest/ upper slope boundaries. The 'Coffee Camp' soil landscape is the dominant soil landscape within the defined Operational Area, which is consistent with the soil types encountered during the geological site investigations. Erosion hazard, soil structural breakdown, or other factors, including climate, are expected to limit the capacity of the land for cultivation.

Geological site investigations indicated that shallow topsoil and residual soil ranges from sand to sandy clay between 0.5 to 1.3 metres depth in the investigation areas. The sandy soil is described as medium grained orange brown with traces of clay and organic materials, while the sandy clay is described as medium plasticity, dark brown firm to stiff.

1.4.3 ACID SULPHATE SOILS

A review of PASS Risk Mapping indicates PASS are not expected to occur within the proposed extends of the expanded quarrying operation.

It is noted that several bores were drilled both within and outside the expanded quarry Operational Area. No pyrite (which oxidation occurs spontaneously in nature and can cause AMD and mine tailing leachate containing heavy metals) was identified within the bores located within the proposed expanded quarry Operational Area. A very small pyrite vein was identified in one bore outside the proposed expanded quarry Operational Area.

If any pyrite was discovered (which it is not expected) simple management measures such as neutralisation and on-site burial would be adopted.

1.5 *EXISTING SURFACE WATER CONDITIONS AND MANAGEMENT*

The Project Site generally drains to the northeast towards low lying flood plain and Tucki Tucki Creek via several ephemeral drainage depressions into an unnamed intermittent water course along the eastern boundary of the Project Site. The flood plain is approximately 1.5 kilometres from the eastern boundary of the Operational Area, which in turn drains into Tucki Tucki Creek approximately 2.5 kilometres from the Operational Area. During flood events site water mixes with flood waters of Tucki Tucki Creek and flows downstream over flood plain land.

An area in the south of the Project Site (known as the motocross track) naturally drains to the south. Proposed extraction activities in this area will result in some diversion of the surface flow back to the north.

A constructed drain exists from the floor of the existing quarry to two small sediment traps to the east of the quarry pit. No large dams are currently present on the Project Site (although large dams are incorporated into the proposed expanded activities).

Tucki Tucki Creek is the primary natural receiving waters for any discharges or runoff from the site. The waterway is affected by variable quality runoff from agricultural and urban sub-catchments.

Preliminary surface water sampling has been undertaken on behalf of the Proponent including collections at Tucki Tucki Creek. The samples were collected at surface water sample locations identified in Figure 1.3 below. The analytical results were typical of a disturbed watercourse within a rural catchment. The pH of the water in the creek is generally slightly acidic (as are the surrounding soils), while the presence of slightly elevated levels of nutrients and ammonia are consistent with what would be expected given the surrounding agricultural (cattle grazing and sugar cane) land usage.

Figure 1.3 – Surface Water and Groundwater Sampling Locations
(Known as Figure 3.2 – Surface Water and Groundwater Sampling Locations extracted from Appendix I of the EA – Amended)

Legend

— —	Extent of Quarry Extraction and Operations (Project Area)
Bh3	Bore Hole Location
SW3	Surface Water Sample Location
Windmill	Windmill Water Sample Location

Figure 3.2

Surface Water and Groundwater Sampling Locations

Client:	Champions Quarry	
Project:	Champions Quarry Expansion	
Drawing No:	0098287pm_GIS_Boreholes_v2	
Date:	14/08/2009	Drawing size: A4
Drawn by:	AM	Reviewed by: WW
Source:	-	
Scale:	Refer to Scale Bar	

N

0 100 200 300 400 500m

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1.6 OVERVIEW OF WATER MANAGEMENT STRATEGY

The water management strategy has been developed to:

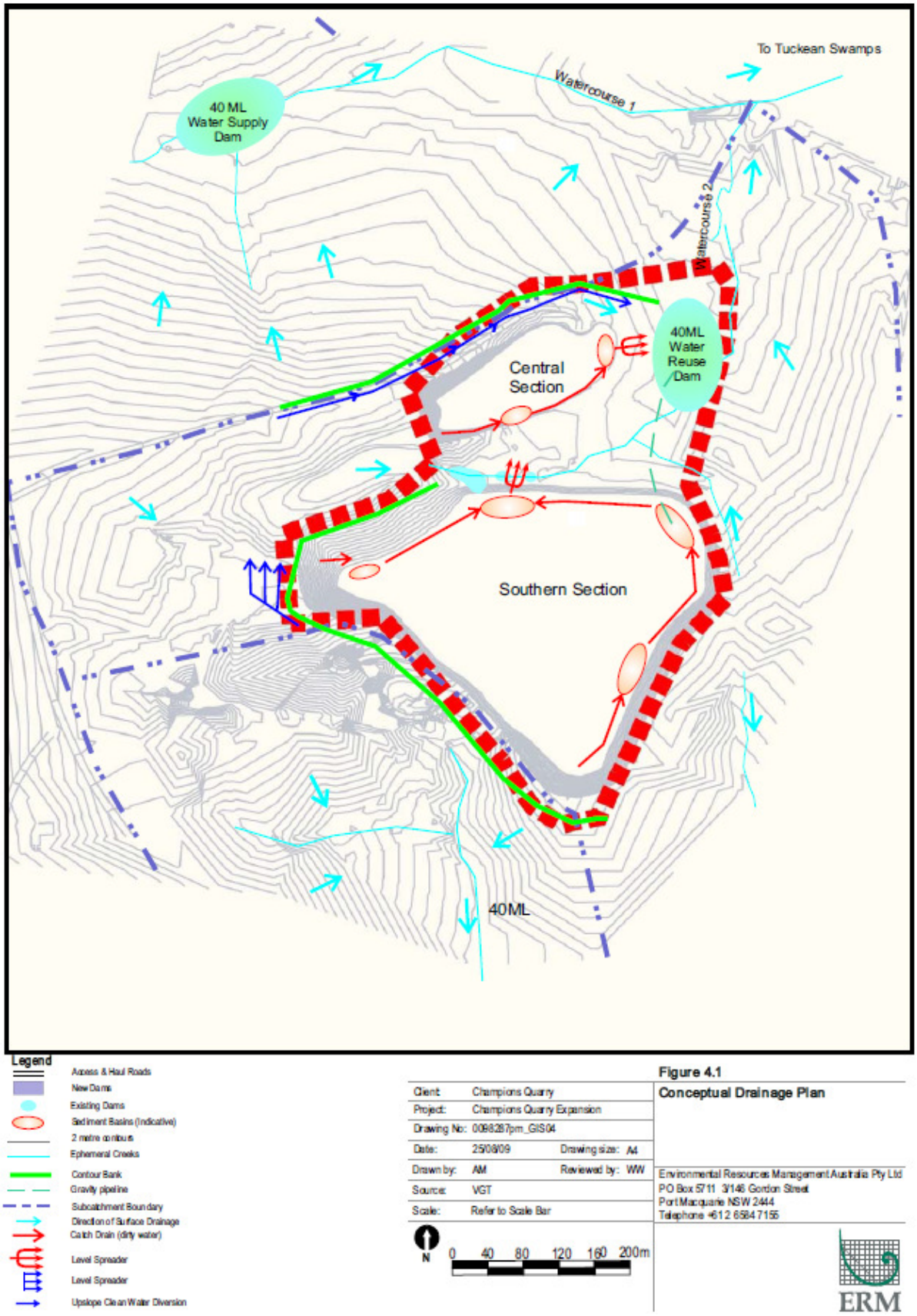
1. Manage on-site quarry water;
2. Safeguard the integrity of downstream watercourses and lowlands; and
3. Ensure adequate water supplies for quarry operations under most climatic conditions.

The proposed site water management measures and catchment characteristics are presented in Figure 1.4. Features of the site water management measures include:

- All water used as part of the quarry and sand washing operations is to be diverted via formed catch drains to a series of linked sediment traps.
- Sediment control devices will be installed between some sediment traps in the form of rock filters.
- Routine maintenance will take place via the removal of sediment from catch drains, adjacent to each rock filter.
- Plant filters and a pond-rifle system of channel design will also be used upslope of the recycling dam.

The development of the plan is discussed in greater detail throughout this Management Plan.

Figure 1.4 – Conceptual Drainage Plan
(Known as Figure 4.1 Conceptual Drainage Plan extracted from Appendix I in the EA)



2 PURPOSE AND OBJECTIVES

2.1 PURPOSE

The primary purpose of this Management Plan is to provide procedures to:

- Describe how the Proponent will manage and control risks associated with soil and water management during the expansion and operation of the Project;
- Ensure the protection of receiving water bodies when carrying out the Project activities;
- Ensure that the EPA, DPI (Water) and the Secretary are consulted in the formulation of this Management Plan;
- Address the requirements of applicable legislation and any ongoing approvals as they are applicable to the Project;
- Meet the Project Approval; and
- Address the requirements of the EA.

This Management Plan provides procedures and actions that may need to be implemented to avoid or minimise the potential impacts of the Project on soils and surface water resources.

2.2 OBJECTIVES

The objectives of the Water Management Plan are to implement appropriate environmental management practices to minimise the Projects impacts on soil and water. This Management Plan's objectives specifically in relation to the Project are to:

- Describe the proposed water management system including:
    - A Site Water Balance Plan;
    - A Surface Water Management Plan; and
    - A Groundwater Management Plan;
- Describe the environmental obligations and legislative requirements applicable to soil and water management during the Project;
- Establishes performance criteria relevant to the Project;
- Describes responses to any exceedance of the performance criteria;
- Demonstrate that quarrying does not adversely impact soil and water quality; and
- Define key roles and responsibilities.
- Measures effectiveness of practices to ensure compliance with the relevant conditions of the Project Approval; and

Further in accordance with Schedule 5 Condition 3 of the Project Approval, this Management Plan includes:

- baseline data;
- a description of:

  - relevant statutory requirements;
  - relevant limits or performance measures/criteria;
  - relevant performance indicators;

- a description of the measures that would be implemented to comply with relevant statutory requirements, limits, or performance measures/criteria;
- a program to monitor and report on:
  - the impacts and environmental performance of this Project:
  - the effectiveness and management measures;
  - a contingency plan to manage any unpredicted impacts and their consequences;
  - a program to investigate and implement ways to improve the environmental performance of the project over time;
  - a protocol for managing and reporting any incidents, complaints, non-compliance with statutory requirements and exceedances; and
  - A protocol for the periodic review of this Management Plan.

3 SOIL AND WATER IMPACTS AND LEGISLATIVE OBLIGATIONS

3.1 ENVIRONMENTAL IMPACTS

The potential impacts on soil and surface water regimes within the Project Site, which in the absence of appropriate mitigation measures could adversely affect soils/water quality include:

- Erosion and sediment laden runoff from the quarry pit, stockpiles and unsealed access roads. It is noted that current quarry operations under similar conditions do not typically show evidence of erosion. Upon completion of quarrying the site is to be rehabilitated for agricultural use.

- Changes to site topography via material extraction and assembly of in-pit and out-of-pit emplacement areas for overburden and excess product. Construction infrastructure (including new internal access roads, processing area, weighbridge and water management structures) will result in minor impacts on landform. These impacts are considered to present low risk with appropriate management as outlined in this Management Plan.

- Changes to water flow and water quality of runoff to Tucki Tucki Creek. Management measures include diverting water from disturbed areas to settling ponds and reed beds are described in this Management Plan. It is noted that as the site is located in the upper reaches of the catchment and as it is a significant distance from Tucki Tucki Creek quarry operations are not expected to cause significant changes to environmental flows in the tributaries that drain to Tucki Tucki Creek.

- Increase in the annual water demand of the quarry. Management strategies will be implemented to offset the increased demand as described in this Management Plan.

- Potential for AMD at the site (considered to be a minor risk). Management strategies will be implemented including containing runoff within the Operational Area (and treatment if required), and identification of significant pyrite veins (if any) for excavation and separate stockpiling and treatment as required.

It is not anticipated that there will be any adverse impacts on groundwater as a result of quarry operations. Notwithstanding this, a groundwater management plan and monitoring program will be implemented as described in this Management Plan.

As outlined above, the identified potential risks/impacts are in the absence of appropriate mitigation measures. By implementing the measures outlined in this Management Plan the risks will be able to be managed to an acceptable level, such that the risks would be considered negligible.

3.2 LEGISLATION AND POLICIES

The applicable legal and other requirements related to noise and environmental management for the Project are outlined in Table 3.1 below

Table 3.1 – Legal and other requirements for Environmental Management

Legislation and Policies
Environmental Protection and Biodiversity Conservation Act 1999
Environmental Planning and Assessment Act 1979
Environmental Planning and Assessment Regulation 2000
Protection of the Environment and Operations Act 1997
Protection of the Environment Operations (General) Regulations 2009
Water Act 1912
Water Management Act 2000
Soil Conservation Act 1938
North Coast Regional Environmental Plan 1988 (NCREP)

Lismore Local Environmental Plan 2012 (Lismore LEP)

3.3 MINISTERS CONDITIONS OF APPROVAL

Pursuant to section 75B(1) of the EP & A Act, the Project was declared to be a project under Part 3A of the Act and project approval has been received from the Minister for Planning.

The primary conditions relevant to soil and water in relation to the Project are contained within Conditions 13 to 17 (inclusive) of Schedule 3 of the Project Approval. These Conditions and other additional clauses that are relevant to soil and water management of the quarry are outlined below.

3.3.1 CONDITION 7 (EXTRACTIVE MATERIAL EXTRACTION) OF SCHEDULE 2 OF THE PROJECT APPROVAL

Condition 7 of Schedule 2 of the Project Approval states:

"The Proponent must not extract extractive materials:

(a) outside the Extraction Areas (other than as required for the approved construction or operation of the Project);

(b) below a level of 12m AHD in the Central Extraction Area; and

(c) below a level of 8m AHD in the Southern Extraction Area."

3.3.2 CONDITION 20 (COMPLIANCE) OF SCHEDULE 2 OF THE PROJECT APPROVAL

Condition 20 of Schedule 2 of the Project Approval states:

"The Proponent must ensure that all employees, contractors and sub-contractors are aware of, and comply with, the conditions of this approval relevant to their respective activities".

3.3.3 CONDITION 13 OF SCHEDULE 3 OF THE PROJECT APPROVAL

Condition 13 of Schedule 3 of the Project Approval states:

"The Proponent must ensure it has sufficient water during all stages of the project, and if necessary, adjust the scale of quarrying operations on site to match its available supply."

3.3.4 CONDITION 14 OF SCHEDULE 3 OF THE PROJECT APPROVAL

Condition 14 of Schedule 3 of the Project Approval states:

"The Proponent must ensure that all surface water discharges from the site comply with the discharge limits in any EPL which regulates water discharges from the site, or with the section 120 of the POEO Act."

3.3.5 CONDITION 14A OF SCHEDULE 3 OF THE PROJECT APPROVAL

Condition 14A of Schedule 3 of the Project Approval states:

"*Prior to operating the sand washing plant, the Proponent must construct a sediment pond with capacity of at least one megalitre to receive all discharges from that plant*."

3.3.6 CONDITION 15 OF SCHEDULE 3 OF THE PROJECT APPROVAL

Condition 15 of Schedule 3 of the Project Approval states:

"The Proponent must manage on-site sewerage to the satisfaction of Council and the EPA. The facility must comply with the requirements of the Environment and Health Protection Guidelines – On-site Sewerage Management for Single Households (1998), or the latest version."

3.3.7 CONDITION 16 OF SCHEDULE 3 OF THE PROJECT APPROVAL

Condition 16 of Schedule 3 of the Project Approval states:

"The Proponent must ensure that all chemicals and/or petroleum products held on site in appropriately bunded areas with impervious flooring and sufficient capacity to contain 110% of the largest container stored within the bund, and in accordance with Australian Standard AS1940-2004, The Storage and Handling of Flammable and Combustible Liquids. The flooring and bund(s) must be designed in accordance with:

- *the requirements of the relevant Australian Standards; and*
- *DECC's Storing and Handling Liquids: Environmental Protection – Participants Manual."*

3.3.8 CONDITION 17 OF SCHEDULE 3 (WATER MANAGEMENT PLAN) OF THE PROJECT APPROVAL

Condition 17 of Schedule 3 of the Project Approval states:

"The Proponent must prepare and implement a Water Management Plan for the Project to the satisfaction of the Secretary. The plan must be prepared in consultation with the EPA and DPI (Water) by suitably qualified and experienced person/s whose appointment has been approved by the Secretary, and be submitted to the Secretary for approval prior to the construction of Bund A and/or Bund D.

In addition to the standard requirements for management plans (see condition 3 of schedule 5), this plan must include a:

(a) Site Water Balance that:

- *includes details of:*
  - *sources and security of water supply, including contingency planning for future reporting periods;*
  - *water use on site;*
  - *water management on site;*
  - *reporting procedures, including comparisons of site water balance each calendar year; and*
- *describes the measures that would be implemented to minimise clean water use on the site;*

(b) Surface Water Management Plan, that includes:

- *detailed baseline data on surface water flows and quality in the water-bodies that could be affected by the project;*
- *a detailed description of the surface water management system on site, including the:*
  - *clean water diversion systems;*
  - *erosion and sediment controls; and*

- *water storages*

- *a plan for extracting, handling, and emplacing any long-term potentially acid forming material identified on site;*

- *detailed plans, including design objectives and performance criteria, for:*

  - *water storage dams;*

  - *reinstatement of drainage lines on the rehabilitated areas of the site;*

  - *control of water pollution from rehabilitated areas of the site;*

- *performance criteria, including trigger levels for investigating any potentially adverse impacts, for:*

  - *the water management system;*

  - *surface water quality of local water ways and the Tuckean Swamp and associated wetland; and*

  - *ecosystem health of local water ways and the Tuckean Swamp and associated wetland;*

- *performance criteria for surface water quality attributes relevant to water quality impacts on biological diversity and aquatic ecological integrity, including salinity, heavy metals, sediment load, pH, hardness and biological oxygen demand;*

- *a program to monitor:*

  - *the effectiveness of the water management system;*

  - *surface water flows and quality in local water ways and the Tuckean Swamp and associated wetland; and*

  - *ecosystem health of local water ways and the Tuckean Swamp and associated wetland;*

- *a plan to respond to any exceedances of performance criteria, and mitigate and/or offset any adverse surface water impacts of the project; and*

(c) Groundwater Management Plan which includes:

- *detailed baseline data on groundwater levels, yield and quality in the area, that could be affected by the project;*

- *a program to augment the baseline data of the Southern Extraction Area prior to the commencement of quarrying operations in the area;*

- *groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;*

- *a program to monitor:*

  - *groundwater inflows to the quarrying operations;*

  - *the impacts of the project on:*

    - *the local alluvial aquifer;*

- *any groundwater bores on privately owned land that could be affected by the project; and*
- *groundwater dependent ecosystems;*

- *seepage/leachate from water storages or backfilled voids on site;*
- *any interaction between water from the re-use dam and the local aquifer identified within nearby alluvial sediments; and*

- *a plan to respond to any exceedances of the groundwater assessment criteria."*

The Proponent must implement the approved management plan as approved from time to time by the Secretary."

3.3.9 CONDITION 38 OF SCHEDULE 3 OF THE PROJECT APPROVAL

Condition 38 of Schedule 3 of the Project Approval states:

"The Proponent must ensure that the project has no greater than negligible environmental consequences on the Tuckean Swamp and associated wetland."

3.3.10 CONDITION 3 OF SCHEDULE 5 OF THE PROJECT APPROVAL

Condition 3 of Schedule 5 of the Project Approval more broadly states the following in relation to the preparation of management plans:

"The Proponent must ensure that the Management Plans required under this *approval are prepared in accordance with any relevant guidelines, and include:*

(a) detailed baseline data;

(b) a description of:

- *the relevant statutory requirements (including any relevant approval, licence or lease conditions);*
- *any relevant limits or performance measures/criteria; and*
- *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;*

(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;

(d) a program to monitor and report on the:

- *impacts and environmental performance of the project; and*
- *effectiveness of any management measures (see (c) above);*

(e) a contingency plan to manage any unpredicted impacts and their consequences;

(f) a program to investigate and implement ways to improve the environmental performance of the project over time;

(g) a protocol for managing and reporting any:

- *incidents;*
- *complaints;*
- *non-compliance with statutory requirements; and*
- *exceedances of the impact assessment criteria and/or performance criteria; and*

(h) a protocol for periodic review of the plan.

Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans."

3.3.11 CONDITION 7 OF SCHEDULE 5 OF THE PROJECT APPROVAL

Condition 7 of Schedule 5 of the Project Approval states:

"The Proponent must immediately notify the Secretary and any other relevant agencies of any Incident. Within 7 days of the date of the Incident, the Proponent must provide the Secretary and any relevant agencies with a detailed report on the Incident, and such further reports as may be requested."

3.4 ENVIRONMENTAL PROTECTION LICENCE (EPL) CONDITIONS

An Environmental Protection Licence (EPL) has been obtained for the operations – EPL 20562.

3.5 RELATED MANAGEMENT PLANS

This Management Plan forms part of an overarching environmental management system for the Project. Where relevant reference should be made to the other plans for the Project listed in Table 3.2.

Table 3.2 – Environmental Management Plan Requirements

Number	Environmental Plan	Condition[1]
EMP 1	Noise Management Plan	9
EMP 2	Air Quality Management Plan	12
EMP 4	Transport Management Plan	31
EMP 5	Waste Management Plan	33
EMP 6	Heritage Management Plan	36
EMP 7	Landscape Management Plan	45

3.6 STANDARDS, POLICIES, GUIDELINES AND MODELLING

The standards, policies, guidelines and modelling that have been used in the preparation of this Management Plan and that relate to the Project are listed in Table 3.3.

[1] Environmental Performance Conditions, Schedule 3 of the Project Approval

Table 3.3 – Environmental Standards, Policies, Guidelines and Modelling

Environmental Risk Issue	Standards, Policies, Guidelines and Modelling
Soil and Water	Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom) (2004b)
	Managing Urban Stormwater: Soil and Construction Volume 2E Mines and Quarries (Landcom) (2008)
	Environment and Health Protection Guidelines – On-site Sewerage Management for Single Households (1998)
	Australian Standard AS1940-2004, The Storage and Handling of Flammable and Combustible Liquids
	DECC's Storing and Handling Liquids: Environmental Protection – Participants Manual
	Australian and New Zealand Guidelines for Fresh and Marine Waters Quality (ANZECC and ARMCANZ) (2000)
	ASSMAC Guidelines for Sampling and Analysis of Lowland Acid Sulphate Soils (ASS) in NSW (1998)
	National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B(3) – Guidelines on Laboratory Analysis of Potentially Contaminated Soils
	NHMRC (2004) Australian Drinking Water Guidelines

3.7 CROSS REFERENCING REQUIREMENTS OF MANAGEMENT PLANS AND RELEVANT CHAPTERS/PARAGRAPH

Table 3.4 – Cross Referencing Requirements of Management Plans and Relevant Chapters/Paragraph

Relevant Condition	Statement of Project Approval	Paragraph/Chapter Dealing with Condition
Condition 17(a) – Schedule 3	Site Water Balance that includes details of sources and security of water supply, including contingency planning for future reporting periods.	Paragraph 6.2
Condition 17(a) – Schedule 3	Site Water Balance that includes details of water use on site.	Paragraph 6.1
Condition 17(a) – Schedule 3	Site Water Balance that includes details of water management on site.	Paragraph 6.3
Condition 17(a) – Schedule 3	Site Water Balance that includes details of reporting procedures, including comparisons of site water balance each calendar year.	Paragraph 6.4
Condition 17(a) – Schedule 3	Site Water Balance that describes the measures that would be implemented to minimise clean water use on the site.	Paragraph 6.5
Condition 17(b) – Schedule 3	Surface Water Management Plan that includes detailed baseline data on surface water flows and quality in the water-bodies that could be affected by the project.	Paragraph 7.2
Condition 17(b) – Schedule 3	Surface Water Management Plan that includes a detailed description of the surface water management system on site, including the: • clean water diversion systems; • erosion and sediment controls; and • water storages.	Paragraph 6.2.1, 6.2.2, 7.3

Condition 17(b) – Schedule 3	Surface Water Management Plan that includes a plan for extracting, handling, and emplacing any long-term potentially acid forming material identified on site.	Paragraph 7.4
Condition 17(b) – Schedule 3	Surface Water Management Plan that includes detailed plans, including design objectives and performance criteria, for: • water storage dams; • reinstatement of drainage lines on the rehabilitated areas of the site; and • control of water pollution from rehabilitated areas of the site.	Figure 1.4, 7.4 and 7.5 Paragraph 6.2.1, 6.2.2, 7.5, 7.6, 7.7
Condition 17(b) – Schedule 3	Surface Water Management Plan that includes performance criteria, including trigger levels for investigating any potentially adverse impacts, for: • the water management system; • surface water quality of local water ways and the Tuckean Swamp and associated wetland; and • ecosystem health of local water ways and the Tuckean Swamp and associated wetland.	Paragraph 7.2
Condition 17(b) – Schedule 3	Surface Water Management Plan that includes performance criteria for surface water quality attributes relevant to water quality impacts on biological diversity and aquatic ecological integrity, including salinity, heavy metals, sediment load, pH, hardness and biological oxygen demand.	Paragraph 7.2
Condition 17(b) – Schedule 3	Surface Water Management Plan that includes a program to monitor: • the effectiveness of the water management system; • surface water flows and quality in local water ways and the Tuckean Swamp and associated wetland; and • ecosystem health of local water ways and the Tuckean Swamp and associated wetland.	Paragraph 7.2
Condition 17(b) – Schedule 3	Surface Water Management Plan that includes a plan to respond to any exceedances of performance criteria, and mitigate and/or offset any adverse surface water impacts of the project.	Paragraph 7.8
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes detailed baseline data on groundwater levels, yield and quality in the area that could be affected by the project.	Paragraph 8.2 and 8.3
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes a program to augment the baseline data of the Southern Extraction Area prior to the commencement of quarrying operations in the area.	Paragraph 8.4
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts.	Paragraph 8.3
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes a program to monitor groundwater inflows to the quarrying operations.	Paragraph 8.7
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes a program to monitor the impacts of the project on the local alluvial aquifer.	Paragraph 8.6
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes a program to monitor the impacts of the project on any groundwater bores on privately owned land that could be affected by the project.	Paragraph 8.7
Condition	Groundwater Management Plan which includes a program to	Paragraph 8.8

17(c) – Schedule 3	monitor the impacts of the project on groundwater dependent ecosystems.	
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes a program to monitor seepage/leachate from water storages or backfilled voids on site.	Paragraph 8.9
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes a program to monitor any interaction between water from the re-use dam and the local aquifer identified within nearby alluvial sediments.	Paragraph 8.6
Condition 17(c) – Schedule 3	Groundwater Management Plan which includes a plan to respond to any exceedances of the groundwater assessment criteria.	Paragraph 8.11

4 ROLES AND RESPONSIBILITIES

All quarry personnel and Contractors are accountable through conditions of employment or contracts with each individual responsible for ensuring that their work complies with the EMS procedures. An organisational structure for the Project is provided in Section 6 of the EMS.

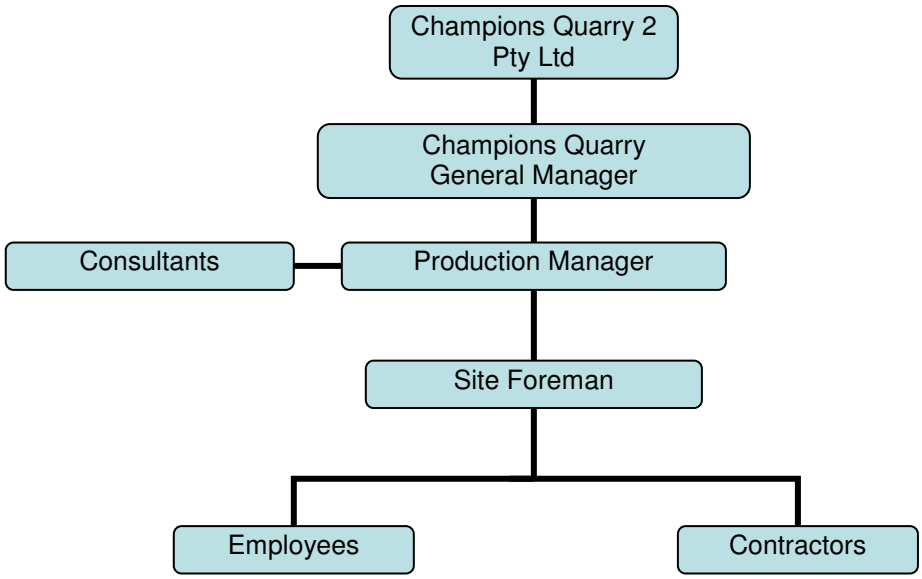
This section of the Management Plan designates the responsibilities of the Proponent's personnel and Contractors in implementing this Management Plan as it is relevant.

Table 4.1 – Champions Quarry Roles and Responsibilities

PRODUCTION MANAGER		
Action Number	**Responsibility and Authority**	**Timing**
SWMP.PM.01	Ensuring the Project Approval, Project Commitments and any other relevant licences and approvals are adhered to.	At all times
SWMP.PM.02	Prepare the Management Plan in consultation with the EPA and DPI (Water) and submit the Management Plan to the Secretary for approval.	Prior to the earlier of the construction of Bund A and Bund D
SWMP.PM.03	Apply for any additional EPL's if required	When and if required
SWMP.PM.04	Ensure all staff and Contractors receive appropriate and relevant induction training regarding the significance of soil and water and management as it applies to their activities and ensuring staff and Contractors are aware of agreed management and mitigation measures as they are applicable to the individual's circumstances.	At all times
SWMP.PM.05	Respond to any complaints from the public in regard to soil and/or water impacts.	When and if required
SWMP.PM.06	Co-ordination of any site investigations in relation to soil and/or water impacts.	When and if required
SWMP.PM.07	Ensuring all monitoring and sampling commitments made as part of this Management Plan are executed.	As detailed in this Management Plan
SITE FOREMAN		
Action Number	**Responsibility and Authority**	**Timing**
SWMP.SF.01	Ensuring the Project Approval, Project Commitments and any other relevant licences and approvals are adhered to.	At all times
SWMP.SF.02	If a complaint is received in regard to soil and/or water impacts notify the Production Manager immediately.	At all times
SWMP.SF.03	Ensure directions associated with the EMS, this Management Plan and approvals (if required) are adhered to the satisfaction of the Production Manager.	At all times

QUARRY EMPLOYEES AND CONTRACTORS		
Action Number	**Responsibility and Authority**	**Timing**
SWMP.EC.01	Employees and Contractors must notify the Site Foreman and/or the Production Manager of any significant soil and/or water impact.	At all times
SWMP.EC.02	Ensure approval has been given by the Site Foreman and/or Production Manager prior to undertaking any works outside the quarry Operational Area.	Prior to commencement of works
SWMP.EC.03	Maintain erosion and sediment controls.	At all times

Figure 4.1 – Environmental Management Strategy Organisational Chart as it applies to the Water Management Plan (extracted from the EMS)



5 MANAGEMENT AND MITIGATION STRATEGIES

5.1 PRINCIPAL MEASURES IN THE WATER MANAGEMENT SYSTEM

The water management system has been designed taking into account the regional setting and climatic conditions, the Project Site and Operational Area conditions, operational factors and consideration of the relevant guidelines, policies and legislation. A conservative approach was taken throughout the design process particularly with regard to the control and detainment of on-site water. The design underwent verification modelling and remodelling to confirm it will be adequate to meet the water quality and supply requirements for the Operational Area. Following is a summary of the system attributes:

- The Water Storage Dam will only collect 'clean' water (ie not from the Operational Area) for the purpose of supplementing quarry operational water needs during drier periods, and as such will be treated as any other on-farm harvestable rights dam;

- The Water Reuse Dam will only collect water from the disturbed quarry and operational areas, including all water harvested from the smaller sedimentation traps located in the Central Extraction Area and Southern Extraction Area;

- The water balance and verification modelling undertaken demonstrates that water demand of the quarry for the majority of the recorded range of local annual rainfall can be met via water collected in the Water Reuse Dam, which is to be further supplemented by the Water Supply Dam;

- In accordance with "Managing Urban Stormwater – Soils and Construction 'Blue Book' (Landcom, NSW 2004), the Water Reuse Dam has been designed for primary treatment for the removal of sediment up to the 95th percentile, 5 day rainfall event. The performance of the Water Reuse Dam is to be optimised via the utilisation of preliminary sedimentation traps and by removing sediment as required from the Water Reuse Dam;

- The water levels in the Water Reuse Dam will be managed via operational reuse (including processing and dust suppression), and also via land application on the Project Site during favourable climatic conditions. This will be undertaken as required to ensure a minimum 6ML of freeboard is available to receive stormwater runoff from the operational site. Under most operating conditions all operational site water is expected to be detained on-site for reuse or for land application; and

- If water quality objectives are satisfied then it is appropriate for water to be discharged to the environment (if required).

The system for treating the Operational Area runoff has been conservatively modelled and designed assuming at least 14ha of disturbed area. It is noted that in early operational stages and as quarry cells are progressively rehabilitated that the actual disturbed area is likely to be significantly less at any one time. Runoff from undisturbed or rehabilitated sections of the Operational Area will be diverted where possible around water management systems.

5.2 STAKEHOLDER CONSULTATION

This Management Plan was submitted to the EPA and DPI (Water) in draft format for consultation purposes. The final Management Plan following consideration and any comments from the EPA and DPI (Water) will be submitted to the Secretary for final comment and approval. A revision history is provided in the prelude to this Management Plan. A summary of the concerns and comments of EPA and DPI (Water) (if any) are outlined in Table 5.1.

Table 5.1 – Stakeholder Consultation

Group	Documents Sent	Concern/Comment	Response
EPA	Water Management Plan Version 1.0 (September 2013)	Nil	N/A
DPI (Water)	Water Management Plan Version 1.0 (September 2013)	Groundwater monitoring frequency	Addressed prior to Project Approval being granted

5.3 APPROVAL REQUIREMENTS

An Environmental Protection Licence (EPL) has been obtained for the operations – EPL 20562.

The Proponent is also required to obtain any necessary water licences for the Project under the Water Act 1912 and/or Water Management Act 2000.

5.4 TRAINING AND AWARENESS

As part of the general site induction process, all Project employees and Contractors will be made aware of the importance of managing soil and water impacts as they are relevant to their position. This may include being made aware of some or all of the following:

- The importance of correct storage and handling of dangerous or hazardous goods including chemicals and/or hydrocarbons (ie. fuel, oils); and
- Identification of pyrite and pyrite veins to enable it, where practicable, to be separated, excavated and stockpiled for treatment.

Awareness will be raised as part of the toolbox talk process and that on receipt of any water or soil related complaints the Production Manager and/or Site Foreman is to be immediately advised so that appropriate action can be taken.

6 SITE WATER BALANCE

6.1 WATER USE ON SITE

Total water demand is conservatively estimated at approximately 53.5ML/year. This will be required for:

- Employee use – Including a toilet and hand basin averaging 50L per person per working day. A workforce of 10 will have a demand of 0.25ML/year.

- Process Water – Including water used in the processing plant during screening and washing, for dust suppression at conveyor transfer points. Conservative estimated of process water consumption are set out in Table 6.1 (below) at 44ML/year. It should be noted a high recycle percentage (estimate 90% efficiency) is achievable by collecting, treating and reusing wash water and is included in the water balance. See note below.

- Dust Suppression – Including as required on internal access roads, haul roads and stockpiles. Conservative estimates are water required for dust suppression to be 6.6ML/year based on:

    - Total area requiring dust control equals 11,000m2 (7,000m2 of road and 4,000m2 of stockpiles);

    - 200 days requiring dust control per year (worst case scenario);

    - Use of a water truck with boom sprays, making 3 passes per day; and

    - Water truck applying approximately 1mm of water per pass (3L/m2/day).

- Product Moisture – Some material may require addition of moisture. Worst case scenario in the event that the material dries out and requires moisture is 2.5ML/year.

- Truck Washing Facilities – Conservative allowance of 10,000 litres/month equalling 0.12 ML/year.

The 53.5ML/year of water will be in two forms:

1. Potable (drinkable quality water) – estimated 0.12ML/year for domestic and employee uses sourced from roof water collection tanks or purchased. Note the Proponent is not currently connected to mains water supply, however mains water is available if required;

2. Non-potable (poorer quality water) – estimated 53.38ML/year for all other uses will be supplied from on-site storages, both sediment traps and a large clean water catchment Water Reuse Dam. Groundwater may be sourced from an existing bore in situations where supply of non-potable water is low (ie during extended dry weather periods).

NOTE: The site water balance and the estimated total process water demand/consumption (including Table 6.1) was prepared after taking into consideration consumption as a result of conducting sand washing activities on-site. The Proponent acknowledges that final design and operation of a sand washing plant at the Project Site was subject to separate approval by DP&E (Modification 3).

Table 6.1 – Process Water Consumption

(Known as Table 4.1 – Process Water Consumption extracted from Appendix I of the EA)

Process Description	Annual Production Rate*	Production rate	Water Use	Water Use	Water Use	Water Throughput Annually	Re-Use	Water Usage Annually
	(t)	(t/hr)	(L/hr)	(L/min)	(L/t)	(L/year)	%	(L/year)
Washed Sand Screening Dampening	87500	120	10800	180	90	7875000	0.9	787500
Washed Sand Screen Head Washing	87500	120	36000	600	300	26250000	0.9	2625000
Washed Sand Bucket and Spiral Washing	62500	86	428571	7143	5000	312500000	0.9	31250000
Washed Oversize Screen Discharge Dampening	3000	34	7800	130	228	684000	0	684000
TOTAL						**347309000**		**35346500**
Loam Screening Feed Dampening	18750	150	10800	180	72	1350000	0	1350000
Loam Screen Discharge Dampening 1	12500	100	7800	130	78	975000	0	975000
Loam Screen Discharge Dampening 2	6250	50	7800	130	156	975000	0	975000
TOTAL						**3300000**		**3300000**
Soil Screen Feed Dampening	37500	200	10800	180	54	2025000	0	2025000
Soil Screen Discharge Dampening 1	25000	133	7800	130	59	1475000	0	1475000
Soil Screen Discharge Dampening 2	12500	67	7800	130	117	1462500	0	1462500
TOTAL						**4962500**		**4962500**

NOTE: The site water balance and the estimated total process water demand/consumption (including Table 6.1) was prepared after taking into consideration consumption as a result of conducting sand washing activities on-site. The Proponent acknowledges that final design and operation of sand washing plant at the Project Site was subject to separate approval by DP&E (Modification 3).

6.2 SOURCES AND SECURITY OF WATER SUPPLY

The main water source is stormwater runoff collected by the 40ML Water Reuse Dam which has a catchment of area of approximately 13ha. As modelling has shown (below), even in a dry year the 40ML Water Reuse Dam will meet almost all demand with little requirement to draw on other sources of water. Notwithstanding this, sediment traps will be constructed (being approximately 3-6ML) and there will be recycling of process water from the central and southern extraction areas.

No contingencies for water supply have been advanced as it is anticipated that the Water Reuse Dam will meet almost all demand. In any event any water supply problem could be overcome by constructing the Water Supply Dam (which will be constructed as the Project develops as needed) which has a catchment of area of approximately 19ha.

Figure 1.4 is a conceptual drainage plan for the site incorporating the indicative locations of the Water Supply Dam and Water Reuse Dam in relation to the Operational Area.

6.2.1 WATER STORAGE DAMS AND SEDIMENT BASINS

Two major storage dams are proposed:

1. Water Supply Dam – Approximately 27.2ML capacity dam constructed on the basis that Reavill Farm Pty Ltd has a MHRDC of 27.2ML. The Dam has the ability to become a 40ML capacity dam if additional water licences are purchased. The Water Supply Dam will be situated within a natural drainage path comprising largely undisturbed (clean water) catchments and will be constructed as the quarry develops over time.

2. Water Reuse Dam – Approximately 40ML capacity dam which is an off stream dam positioned down hydraulic gradient of the central extraction area. This dam's construction was completed in May 2014.

Additional storage may be provided by quarry pit sediment traps, whose number and size will vary throughout the operation of the quarry. At any one time there may be between 3ML and 6ML of storage available in sediment traps.

6.2.2 DAM FUNCTIONS AND CONSTRUCTION

Water Supply Dam

The Water Supply Dam is to be constructed at the confluence of two intermittently flowing first order streams to the north of the main access road. The opportunity exits to construct a contour bank around the hillside to the north of the Dam to increase its catchment area. This work may be undertaken in the future should the need arise.

Harvested water would be delivered from the Water Supply Dam to the Water Reuse Dam either by gravity pipeline, if levels permit, or if necessary by pumping using a high flow diesel pump or similar.

Water Reuse Dam

The function of the Water Reuse Dam is to collect and recycle process water and stormwater runoff from the central and southern extraction areas. Process water for the crushing and washing plants and for dust suppression would be pumped from the Water Reuse Dam to the processing plant.

This dam's construction was completed in May 2014.

If needed a contour bank will be constructed around the hillside down slope of the main access road and central extraction area, to the northwest of the Water Reuse Dam. This will capture and divert into the Central Extraction Area the water that overflows from the Central Extraction Area sediment traps. The Water Reuse Dam will then provide primary sediment

capture and water quality control, particularly during peak storm events that may exceed the collection and treatment capacity of the preliminary sediment traps. The sediment traps and associated sediment control devices will provide the preliminary means of sediment capture and water control quality.

A gravity contour bank and pipeline would be constructed between the sediment traps at the lower end of the Southern Extraction Area and the Water Reuse Dam. Water collected in the traps will undergo preliminary settlement prior to draining through a series of sediment control devices comprising rock filters and plant filter strips for additional water quality control prior to reaching the Water Reuse Dam. Water levels will be managed via reuse and irrigation to maintain freeboard for peak rainfall events such that the smaller sediment traps will drain to the Water Reuse Dam and not discharge into water courses.

6.2.3 WATER SOURCES AND CATCHMENT YIELDS

As part of the SWMP catchment yields were estimated for the Water Reuse Dam and Water Supply Dam for dry, normal and wet years using long term annual rainfall statistics from Lismore. The results are summarised in Table 6.2 below.

Table 6.2 – Catchment Yields for Major Storages

	Water Supply Dam	Water Reuse Dam	Total
Catchment Area (ha)	19	13	32
Annual Runoff Coefficient (Cv)	0.09	0.2	
Catchment Yields (ML)			
10%ile rain year (900mm)	15.4	23.4	38.8
50%ile rain year (1270mm)	21.7	33.0	54.7
90%ile rain year (1922mm)	32.9	50.0	82.8

6.3 WATER MANAGEMENT ON SITE

6.3.1 SITE WATER BALANCE

An initial annual site water balance was conducted as part of the SWMP to compare the quarry water demands with the volume of water which could be realistically collected with the Project Site. This water balance utilised the MUSIC model for two scenarios:

1. During early expansion at approximately half the proposed open quarry area (ie. 4.5ha of disturbed land); and

2. At the maximum proposed open quarry area (ie. 9ha).

The two scenarios were modelled using three Bureau of Meteorology rainfall data sets in six minute time steps as follows:

1. Lismore (2003) – a relatively dry year with 761mm of rainfall;

2. Lismore (2004) – a relatively normal year with 945mm of rainfall; and

3. Alstonville (1979) – to represent a wet year of 1,474mm of rainfall.

MUSIC modelling was undertaken and this was subsequently tested and confirmed by adopting the RUSLE model. Attached as Annexure A is a copy of the revised sediment pond calculations utilising the RUSLE model for a Type D Basin based on a 95 percentile rainfall event (exceeding the 60.2mm rainfall event in accordance with the requirements of the EPL).

It was concluded that the 40ML Water Reuse Dam will meet almost all demand with little requirement to draw on other sources of water. The Water Reuse Dam is to comprise 34ML of permanent storage and 6ML of temporary detention. The 6ML of temporary detention is the approximate requirement for capturing Project Site runoff from the 95 percentile 5-day rainfall depth. The water supply confidence is summarised as follows:

- 88% in a dry year when the quarry is only half open;
- 98% in a dry year when the quarry is fully open;
- 97% in a mean rainfall year when the quarry is only half open;
- 100% in all other modelling scenarios.

6.3.2 WATER DISCHARGES FROM THE PROJECT SITE

The MUSIC model predicts that the Water Reuse Dam would only be expected to overflow on very rare occasion assuming a minimum 6ML of freeboard is maintained for temporary storage. The dry and mean models demonstrate no weir overflow at all, with all discharge being via the low-flow orifice only. In terms of flow rates there will be little change from the half developed quarry to the fully open quarry area.

The modelling also indicates that there is expected to be a clear beneficial effect in terms of mean annual pollutants loads in all models from the predevelopment runoff from agricultural grazing lands. The pollutant loads are predicted to be less or no worse than under existing conditions. Appropriate site management will prevent other potential contaminants such as heavy metals or hydrocarbons from occurring in runoff from the Operational Area.

It is noted that field observations made both during and immediately after high rainfall events have demonstrated that flows from the original approved extraction area is significantly less turbid than the nearest receiving water confluence at the culvert in Hazlemount Lane.

Figure 6.1 – MUSIC Modelling Predicted Discharge Volumes and Pollutant Loads (SEEC)

(Known as Figure 4.6 MUSIC Modelling Predicted Discharge Volumes and Pollutant Loads (SEEC) extracted from Appendix I of the EA)

Dry fully open	**Pre**	**Pre**	**Post**	**Post**
	Flow (ML/yr)	19.20	Flow (ML/yr)	4.39
	Total Suspended Solids (kg/yr)	4760.00	Total Suspended Solids (kg/yr)	58.40
	Total Phosphorus (kg/yr)	11.00	Total Phosphorus (kg/yr)	0.40
	Total Nitrogen (kg/yr)	48.90	Total Nitrogen (kg/yr)	4.85
Dry half open	**Pre**	**Pre**	**Post**	**Post**
	Flow (ML/yr)	19.20	Flow (ML/yr)	0.00
	Total Suspended Solids (kg/yr)	2720.00	Total Suspended Solids (kg/yr)	0.00
	Total Phosphorus (kg/yr)	10.40	Total Phosphorus (kg/yr)	0.00
	Total Nitrogen (kg/yr)	54.60	Total Nitrogen (kg/yr)	0.00
Mean fully open	**Pre**	**Pre**	**Post**	**Post**
	Flow (ML/yr)	20.00	Flow (ML/yr)	25.50
	Total Suspended Solids (kg/yr)	2600.00	Total Suspended Solids (kg/yr)	365.00
	Total Phosphorus (kg/yr)	10.60	Total Phosphorus (kg/yr)	2.39
	Total Nitrogen (kg/yr)	51.00	Total Nitrogen (kg/yr)	31.30
Mean half open	**Pre**	**Pre**	**Post**	**Post**
	Flow (ML/yr)	20.00	Flow (ML/yr)	12.30
	Total Suspended Solids (kg/yr)	2000.00	Total Suspended Solids (kg/yr)	160.00
	Total Phosphorus (kg/yr)	9.89	Total Phosphorus (kg/yr)	1.13
	Total Nitrogen (kg/yr)	53.00	Total Nitrogen (kg/yr)	14.20
			Gross Pollutants (kg/yr)	0.00
Wet fully open	**Pre**	**Pre**	**Post**	**Post**
	Flow (ML/yr)	70.40	Flow (ML/yr)	65.00
	Total Suspended Solids (kg/yr)	10000.00	Total Suspended Solids (kg/yr)	1540.00
	Total Phosphorus (kg/yr)	44.70	Total Phosphorus (kg/yr)	6.56
	Total Nitrogen (kg/yr)	225.00	Total Nitrogen (kg/yr)	82.60
Wet half open	**Pre**	**Pre**	**Post**	**Post**
	Flow (ML/yr)	70.40	Flow (ML/yr)	48.50
	Total Suspended Solids (kg/yr)	10000.00	Total Suspended Solids (kg/yr)	1150.00
	Total Phosphorus (kg/yr)	44.80	Total Phosphorus (kg/yr)	4.88
	Total Nitrogen (kg/yr)	213.00	Total Nitrogen (kg/yr)	60.60

6.3.3 SEDIMENT DETENTION

In order to meet the requirements of Volume 2E of Managing Urban Stormwater (DECC, 2008), 6ML of freeboard capacity will need to be available to capture the required 95th percentile, 5-day rainfall depth (95.3mm). The extended detention was set in the MUSIC model to drain in 5 days via the 150mm orifice pipe. To ensure settlement of entrained sediments a management regime including flocculation may be required. The extended detention volume in the Water Reuse Dam could be increased to extend the residence time if necessary. This will be achievable on the basis of ample water supply for operations from the Water Supply Dam. In the event that flocculation is required, water can be discharged at a slower rate via an automatic flocculater or a smaller-volume flocculation pond could be integrated into the Water Reuse Dam design.

Finally, it is noted that excess water is proposed to be applied over land within the Project Site during favourable climatic conditions (ie dry ground). This will enable water to be disposed appropriately while maximising freeboard storage. Given that the verification modelling did not include any input from the proposed Water Supply Dam there exists adequate surety of supply to enable a range of options to be considered for the final design of the Water Reuse Dam for the treatment and disposal of any water emanating from the Operational Area.

6.3.4 SPILL RESPONSE

It is important that all potentially contaminating materials used or stored on the Project Site during quarrying activities should be prevented from entering the groundwater or surface water systems. This will be achieved through storage in designated bunded areas.

Provision of spill kits and training of quarry personnel in their use will ensure that in the event of any spills appropriate action can be taken rapidly to prevent and minimise impacts to surface water or groundwater. Wherever possible, activities that have potential for spills will be located in areas that drain to the pit; otherwise appropriate safeguards and spill containment facilities will be installed.

6.3.5 POTABLE WATER SUPPLIES

The Proponent is not currently connected to mains water supply, however it is available if required.

6.3.6 SEWERAGE EFFLUENT

A toilet is available for use by employees located at a residence adjacent to the quarry. It is anticipated that in the future either a composting or on-site septic disposal system, will be provided in the vicinity of the quarry office.

6.4 ANNUAL SITE WATER BALANCE COMPARISONS

It was concluded in the modelling that water supply confidence can mostly be achieved with the 40ML Water Reuse Dam. Accordingly, it is not anticipated that the Proponent will require an in-depth annual site water balance rather the Proponent will report on the following factors each year (to be included in any updated Water Management Plan):

- Whether the 40ML Water Reuse Dam satisfied the non-potable water demands of the quarry in the previous year;
- In the event that the Water Reuse Dam did not satisfy all non-potable water demands what other non-potable water supplies were utilised (ie Water Supply Dam) in the previous year;
- The meteorological impacts affecting water consumption during the previous year;
- Any unanticipated and significant water demands (both potable and non-potable) in the previous year; and
- Possible variations to water demand and supply that are required to be adopted in the upcoming year to maintain a satisfactory site water balance.

6.5 MEASURES TO MINIMISE CLEAN WATER USE ON SITE

The measures that will be adopted to collect and minimise clean water use on site include the following:

- The Water Supply Dam will collect 'clean' water for the purpose of supplementing quarry operational water needs during dryer periods;
- The Water Reuse Dam will collect water from the disturbed quarry and operational areas, including all water harvested from the smaller preliminary sedimentation traps (at the indicative locations depicted in Figure 1.4) which are located in the Central Extraction Area and Southern Extraction Area;
- Water demand for the quarry will be met for the majority of the time by the water contained within the Water Reuse Dam alone (which can be further supplemented by the Water Supply Dam if and when required);

- Process water consumption of approximately 44ML/year will have a high recycle percentage (estimate 90% efficiency) by collecting, treating and reusing wash water; and

- All Project employees and Contractors will be made aware of the importance of minimising clean water use on site and utilising water storages from the Water Reuse Dam.

6.6 ENSURING SUFFICIENT WATER AND ADAPTING ACTIVITIES

The Proponent acknowledges that as at May 2014, the 40ML Water Reuse Dam has been completed.

The site water balance in this chapter clearly shows that even in a dry year the 40ML Water Reuse Dam will meet almost all demand (including those associated with sand washing of which the final design and operation are subject to further approval) with little requirement to draw on other sources of water. Notwithstanding this, preliminary sediment traps will be constructed (being approximately 3-6ML) and there will be recycling of process water from the central and southern extraction areas. Hence, the Proponent shall have sufficient water for all stages of the Project. In any event, if the Proponent encounters continual water shortfalls, the Proponent may construct a Water Supply Dam of 27.2ML capacity (but up to 40ML capacity if additional licences are purchased).

In the event of extreme and adverse conditions, in order to maintain an appropriate site water balance, the Proponent proposes to if necessary, construct the approved Water Supply Dam to ensure the demand for quarry product in the Project Approval is maintained. This will ensure the scale of quarrying operations on-site is always matched to its available water supply.

6.7 SEDIMENT POND CAPACITY FOR SAND WASHING PLANT

Prior to operating the sand washing plant, the Proponent must construct a sediment pond with capacity of at least one megalitre to receive all discharges from that plant.

7 SURFACE WATER MANAGEMENT PLAN

7.1 SURFACE WATER MONITORING LOCATIONS AND FREQUENCY

Monitoring should initially be undertaken on a quarterly basis (where water levels permit) for an initial period of 3 years in order to collect baseline water quality data. After the initial monitoring period of 3 years, provided water quality meets the performance criteria, monitoring frequency will be reduced to half yearly. pH levels will initially be monitored weekly and ultimately on a fortnightly basis. Controlled discharge from the Water Reuse Dam will be monitored prior to being actively discharged to the receiving watercourses.

Given the ephemeral nature of the on-site drainage channel, sampling at located SW3 and SW4 will be targeted following rainfall event when flow is present.

Water quality monitoring is proposed to be undertaken as outlined below. The monitoring will be reviewed and refined where necessary based on the results of previous monitoring events and with consideration of ongoing quarry operations. The monitoring locations are set out below:

1. A point immediately upstream of Tucki Tucki Creek (SW1);
2. A point immediately downstream of Tucki Tucki Creek (SW2);
3. A point of the onsite watercourse (SW3);
4. Downstream of the Operational Area (and downstream of SW4);
5. Discharge point of the Water Reuse Dam;
6. Stormwater overflow monitoring point for the Water Reuse Dam; and
7. Water Reuse Dam (pH levels only).

Table 7.1 – Overview of Surface Water Monitoring Locations and Frequency

Monitoring Point	Type of Monitoring Point	Type of Discharge Point	Description of Location	Initial Monitoring Frequency	Ultimate Frequency
1	Surface water monitoring – upstream	NA	SW1 on Figure 1.3	3 monthly	6 monthly
2	Surface water monitoring – downstream	NA	SW2 on Figure 1.3	3 monthly	6 monthly
3	Surface water monitoring – on-site watercourse	NA	SW3 on Figure 1.3	3 monthly (where water levels permit)	6 monthly (where water levels permit)
4	Surface water monitoring – downstream of operational quarry	NA	Downstream of SW4 on Figure 1.3	3 monthly (where water levels permit)	6 monthly (where water levels permit)
5	Water Reuse Dam	Dam discharge point	Near Water Reuse Dam discharge point	3 monthly	6 monthly
6	Discharge Quality	Recycling Dam effluent discharge point – final reed bed	Stormwater overflow monitoring point for Water Reuse Dam	Prior to being actively discharged to receiving watercourses and daily	Prior to being actively discharged to receiving watercourses and daily

				while discharging	while discharging
7	Water Reuse Dam (pH only)	NA	Water Reuse Dam	Weekly	Fortnightly

Laboratory quality assurance and quality control procedures will be undertaken in accordance with National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B(3) – Guidelines on Laboratory Analysis of Potentially Contaminated Soils and will comprise matrix spikes, method blanks and laboratory control samples.

7.2 SURFACE WATER MONITORING PARAMETERS

7.2.1 BASELINE DATA ON SURFACE WATER FLOWS

EAL Laboratories of Lismore have undertaken preliminary surface water sampling on behalf of the Proponents during 2008, with samples collected from Monitoring Point 1 (SW1), Monitoring Point 2 (SW2), Monitoring Point 3 (SW3) and Monitoring Point 4 (SW4). An overview of the analytical results is provided in Annexure C. The complete results/reports are provided in Annexure H of the SWMP

The Proponent will collect surface water quality samples from Monitoring Points 1 to 7 (where water levels permit) (in relation to the parameters set out in Table 7.2 below) prior to commencing quarry operations in the Southern Extraction Area.

Table 7.2 – Surface Water Quality Parameters and Assessment Criteria

Parameters Analysed	Unit	ANZECC 2000 Trigger Values for Freshwater[1]
MONITORING POINTS 1-6		
pH (units)	-	6.5-8.5 [2]
Conductivity	(dS/m)	1.5
Nitrate (NO_3)	(mg/L)	0.7
Aluminium (Al)	(mg/L)	0.055
Total Arsenic (As)	(mg/L)	0.024
Cadmium (Cd)	(mg/L)	0.0002
Total Chromium (Cr)	(mg/L)	n/s[5]
Copper (Cu)	(mg/L)	0.0014
Mercury (Hg)	(mg/L)	0.0006
Nickel (Ni)	(mg/L)	0.011
Oil and Grease	(mg/L)	No visible sheen or detectable odour
Total Suspended Solids	(mg/L)	50[3]
Lead (Pb)	(mg/L)	0.0034
Zinc (Zn)	(mg/L)	0.008
ADDITIONAL ITEM AT MONITORING POINT 6		
Turbidity[4]	NTU	10-20
MONITORING POINT 7		
pH (units)		6.5-8.5[2]

Notes:
1. ANZECC (2000) default trigger level for slightly disturbed ecosystem in in south eastern Australia for upland and lowland rivers.
2. pH level determined in accordance with SoC 7 and to be reviewed following monitoring.
3. Maximum level once the stormwater management system is constructed and operational. Exceedance permitted at overflow point for duration of overflow when wet weather overflow is occurring due to stormwater events ≥ 60.2mm in total falling over any consecutive 5 day period (in accordance with the requirements of the EPL).
4. As set out in section 7.2.3 turbidity levels will be recorded alongside TSS at Monitoring Point 6 for a period of 3 years or until such time required to evaluate a site specific correlation. Turbidity levels measured in-situ will then be used to estimate TSS levels.
5. ANZECC (2000) default trigger levels do not specify a trigger value for Total Chromium (Cr) due to insufficient data.

There is currently insufficient data available to calculate statistically derived site specific trigger levels for the proposed range of analytes. Given the ephemeral nature of the on-site drainage lines and the inherent difficulty of collecting representative samples during flood events it is expected that it may take some time to collect a representative data set for statistical assessment of proposed trigger values. On this basis, and given the assessed low potential

for impact on surface water from future quarrying operations, it is proposed to initially compare the data against Surface Water Quality Parameters and Assessment Criteria provided in ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Statically derived site specific trigger levels will be reviewed after 3 years of operations and routine sampling, or once sufficient data becomes available. As previously discussed, this will be dependent on the availability of surface water flow and/or accessibility to on-site drainage lines for sampling.

Surface water quality monitoring samples will be collected in accordance with a NATA specifications and/or comprise sample collection and testing by a NATA registered laboratory.

The parameters and initial assessment criteria for Monitoring Points 1-7 are set out in Table 7.2.

7.2.2 REVIEW OF PARAMETERS (ie. pH LEVELS) FOLLOWING ONGOING MONITORING (ALL MONITORING POINTS)

Specific parameters (ie pH) may need to be reviewed during the monitoring program to evaluate the optimum outcome for the water quality of discharge waters.

Specifically it is noted that the pH of nearby soil and receiving waters are mildly acidic pH 4.5-pH5.3. The natural acidic soil conditions encountered at the Project Site and subsequent influence on runoff may require that maintenance of ambient condition is the preferred water quality goal. Hence, adjusting the pH to neutral conditions may result in unintended impacts on downstream aquatic ecosystems.

7.2.3 TURBIDITY AND TSS CORRELATION (S6)

Turbidity levels will be recorded alongside TSS at Monitoring Point 6 for a period of 3 years or such longer time as it takes to determine a site specific correlation. Turbidity levels measured in-situ will then be used to estimate TSS levels once sufficient data has been collected to determine the correlation.

7.3 SURFACE WATER MANAGEMENT SYSTEM

During construction and operation of the quarry, drainage facilities will convey water from areas of disturbed ground to preliminary sediment traps which will drain to the Water Reuse Dam to prevent sediment laden or potentially contaminated runoff leaving the Operational Area (refer to Figure 1.4).

Sediment control devices will be installed between the preliminary sediment traps in the form of rock filters (refer to Figure 7.1). This will allow the removal of sediment from the catch drains, adjacent to each rock filter as part of routine maintenance.

Plant filters and a pond-riffle system of channel design will also be used upslope of the Water Reuse Dam (refer to Figure 7.2).

7.3.1 SURFACE DRAINAGE FROM UNDISTURBED AREAS

Diversion Elements

In general, clean water runoff from undisturbed areas will be diverted around areas disturbed or affected by quarry activities. This will reduce the potential for clean runoff to be polluted by quarry activities. Diversion of clean water will be affected by diversion drains, contour drains and where necessary, bunds, and pipe culverts designed in accordance with "Managing Urban Stormwater – Soils and Construction 'Blue Book' (Landcom, NSW 2004)". Examples of construction methods including temporary erosion sediment control measures that may be adopted by the quarry are set out in Annexure B.

Diversion drains and contour drains will be constructed as channels and/or banks depending on topography. Where practical, drains will be lined or vegetated and longitudinal gradients will be limited to 1% to minimise the risk of erosion. Where necessary, check dams and

preliminary sediment traps will be constructed at intervals along diversion drains at locations with greater erosion potential. At points of concentrated or high velocity flows, spreaders, lining and dissipaters will be constructed. See Figure 1.4 for the conceptual drainage plan.

It should be noted in regards to drainage from undisturbed areas, that treated water from the primary sediment basin (the Water Reuse Dam) will be discharged either by overland flow (ie via level spreaders), or by water directing into the proposed on-site recycling water storage for reuse on-site.

Permanent Diversion Elements

Diversion elements that will be in place for more than 2 years should be considered "permanent". All permanent diversion elements will be designed with capacity to convey critical flows from a 1 in 20 year ARI storm event.

Temporary Diversion Elements

Temporary drains may be designed for smaller storm events depending on their design life – typically, elements that will be in place for less than 6 months would be designed for a 1 in 5 year ARI storm.

Figure 7.1 – Indicative Proposed Sediment Control System

(Known as Figure 3.3 - Indicative Proposed Sediment Control System extracted from the EA)

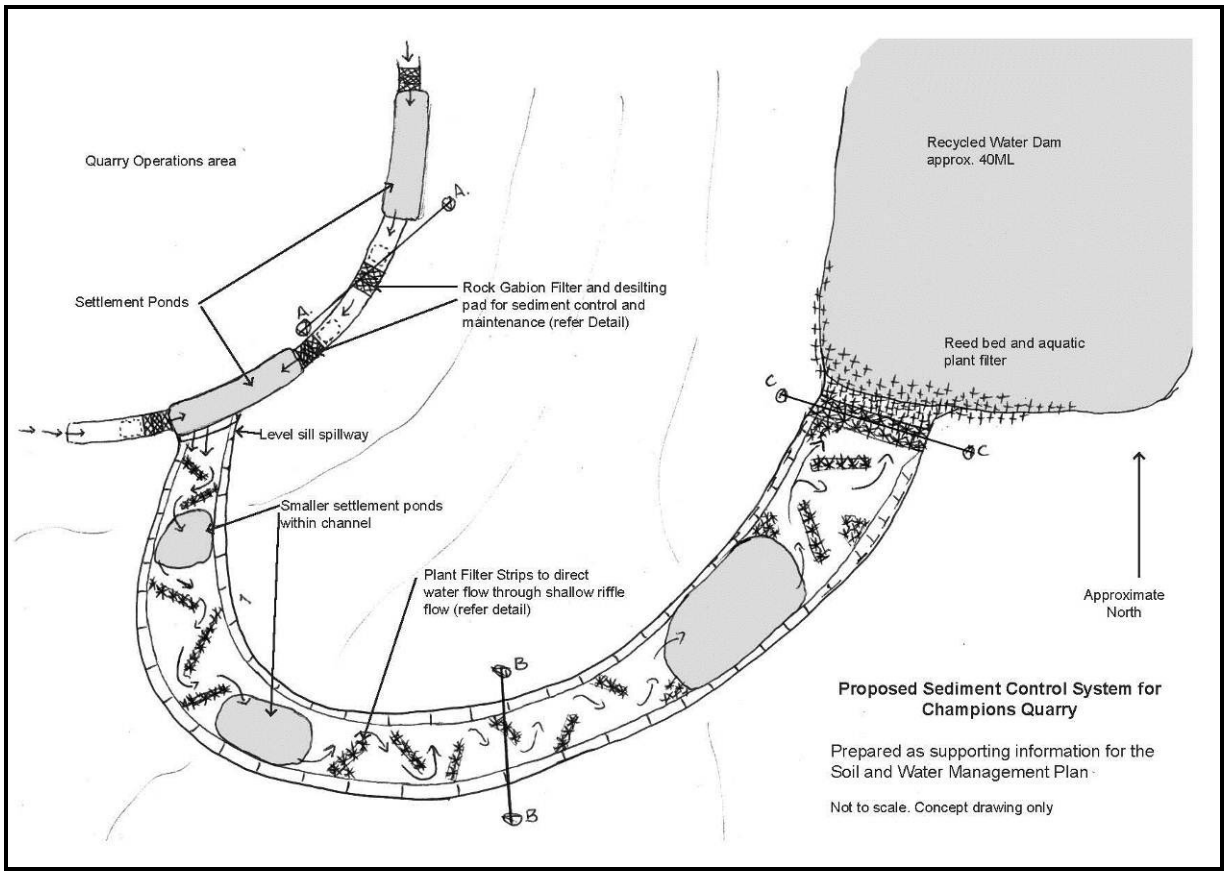
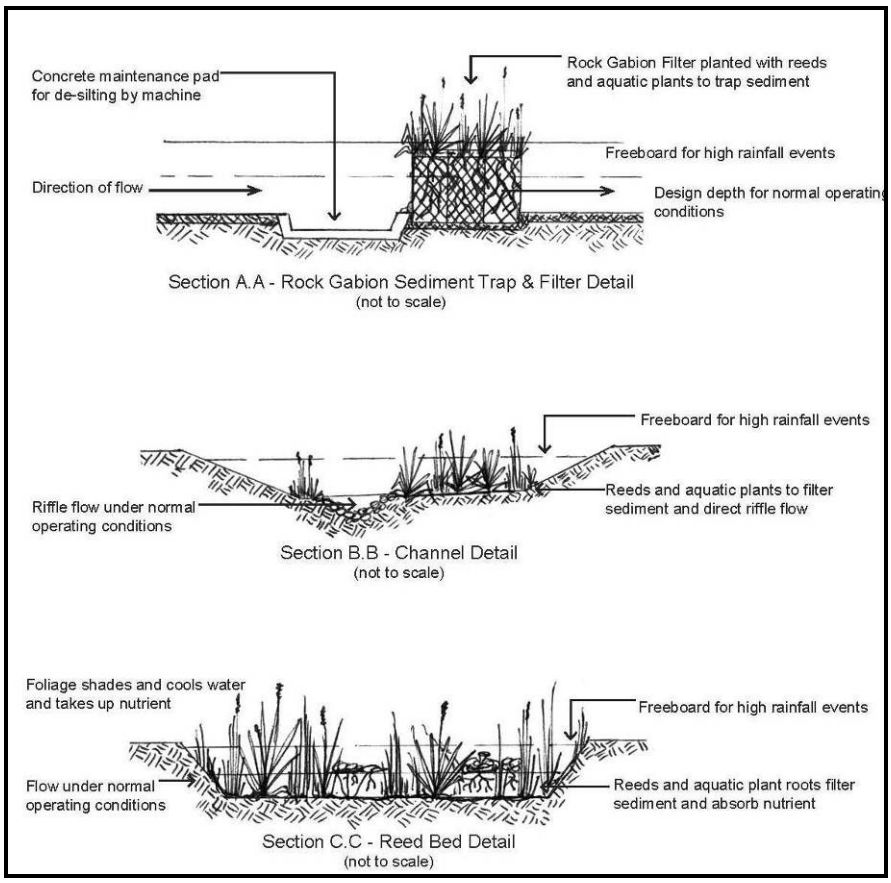


Figure 7.2 – Indicative Proposed Plant Filters

(Known as Figure 3.4 - Indicative Proposed Plant Filters extracted from the EA)



7.3.2 PIT WATER AND RUNOFF FROM DISTURBED AREAS

Sediment Basins

As far as possible, all water runoff within the quarry pit, including any minor seepage groundwater inflow, will be directed to a series of preliminary sediment traps to be constructed in the bottom of the active quarry pit.

In accordance with Managing Urban Stormwater: Soils and Construction Volume 1 “Blue Book” including Volume 2E Mines and Quarries, the capacity of the sediment basin to control runoff from 9 hectares of disturbed area has been assessed (Refer Annexure A for sediment basin calculations).

Soil Loss calculations using the RUSLE model were used to estimate the required sediment storage volumes. For sizing the settling zone capacity, the design rainfall event was nominated as the 5-day, 95th percentile rainfall event. It is assumed 100% of the modelled catchments would be disturbed. The sediment basin volumes were calculated assuming conservative conditions (ie Type F Soils) to account for topsoil stripping and sand washing. While soils and quarry material are not anticipated to be dispersible (ie Type D), allowance is made to employ relevant techniques in the management of sediment basins if required (ie flocculation).

Based on these conservative assumptions, Table 7.3 below sets out the total sediment basin volume required per one and three hectares of disturbed area.

Table 7.3 – Sediment Basin/Pond Volume Calculations

Total Disturbed Catchment Area (ha)	Settling Zone Volume (m^3)	Sediment Storage Volume (m^3)	Total Basin Volume (m^3)
9	2338	475	2813

Features of the Water Reuse Dam (primary sediment basin):

- The Water Reuse Dam is the primary sediment basin and be constructed primarily in accordance with Figure 7.3 below.
- Due to the size of the Water Reuse Dam (40ML) and its role as the primary sediment basin, it is unlikely that any additional sediment basins will be required as a result of increasing the total disturbed catchment area. Notwithstanding this, the Proponent may construct and maintain preliminary sediment traps to assist in sediment detention.
- The lower level of the settling zone in the Water Reuse Dam will where possible be identified with a peg or other marker that will clearly show the level above which the design capacity is available.
- The Water Reuse Dam will be de-silted (as required) to ensure that the stored sediment does not in the ordinary course of business encroach into the settling zone.
- The frequency of de-silting of the Water Reuse Dam will be dependent on operating conditions, the size of the sediment basin compared to the total disturbed catchment area.
- Sediment removed from the Water Reuse Dam will be disposed in places that will not result in a future erosion or pollution hazard.

Features of the preliminary sediment traps:

- The Proponent may construct and maintain preliminary sediment traps to assist in sediment detention of the Water Reuse Dam.
- The sediment traps will be regularly de-silted (as required) to ensure that they are operating effectively. The frequency of de-silting will be dependent on operating conditions, the size of the sediment trap compared to the total disturbed catchment area.
- Sediment removed from the preliminary sediment traps will be disposed in places that will not result in a future erosion or pollution hazard.

The Water Reuse Dam as the primary sedimentation basin will be monitored and maintained as follows:

- The Water Reuse Dam will be visually inspected by the Site Foreman minimally 2-3 times per week for capacity, maintenance requirements and discharges.
- The Water Reuse Dam will be inspected weekly to determine capacity, assess any intentional and unintentional discharge and assess any maintenance requirements.
- Weekly inspections of the Water Reuse Dam will be increased to daily monitoring while the Water Reuse Dam level approaches capacity, is likely to discharge or is to be intentionally discharged.
- The following will be recorded in relation to the Water Reuse Dam (commencing in November 2015):
    - Weekly inspections (date and time);

- Maintenance requirements of the Water Reuse Dam or any required desilting (if any); and
- All discharges (intentional and unintentional).

Sediment Control Devices

Sediment control devices in the form of rock filters will be installed at regular intervals between the settlement ponds as indicated in Figure 7.1. These rock filters will be designed and installed to allow regular de-silting maintenance to ensure that they are operating effectively. The frequency of de-silting will be dependent on operating conditions and the size of the sediment control device.

Additional sediment control devices, including plant filter strips and smaller sediment traps, designed as a pond-riffle flow system will be installed upslope of the Water Reuse Dam.

Material Stockpiles

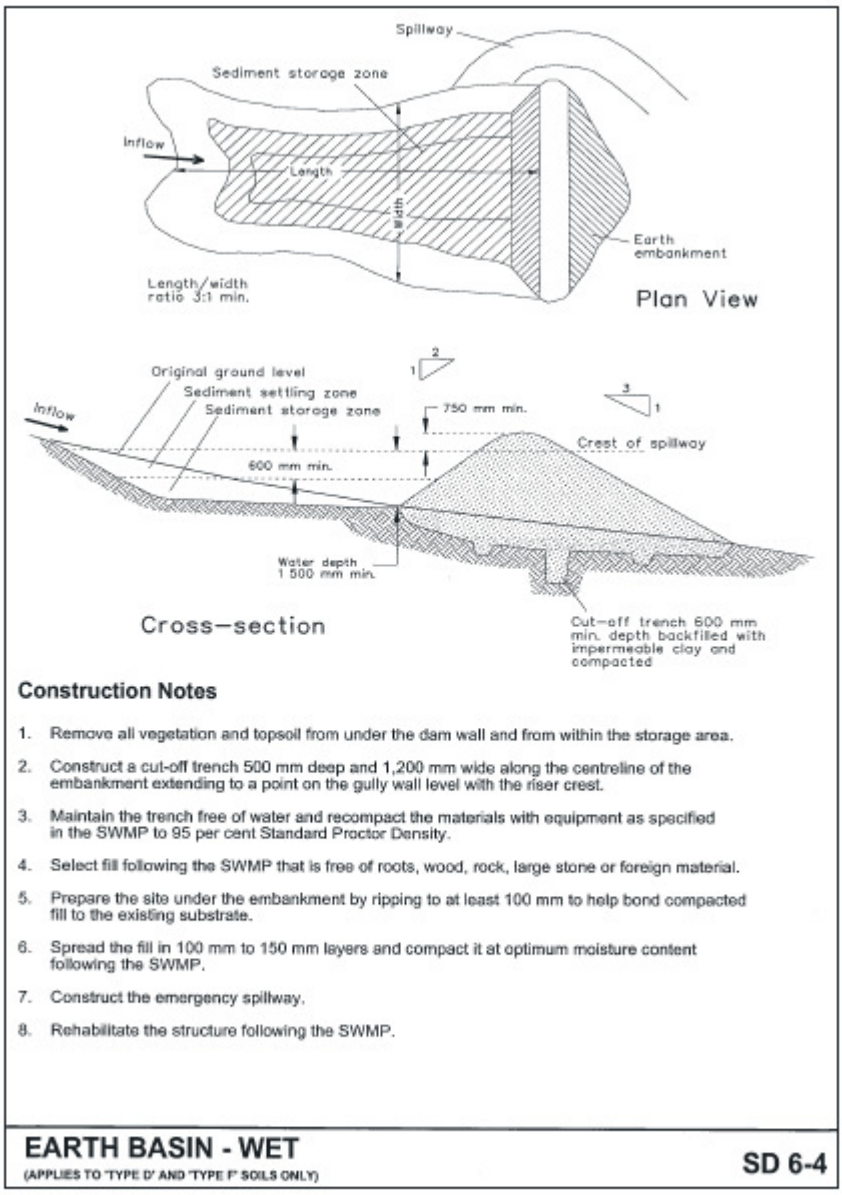
Long-term material stockpiles (ie topsoil and overburden) will be stabilised by seeding with seasonal grasses. All shorter term material stockpiles will be bunded to reduce run on and to capture runoff. Appropriate sediment control measures will include:

- Sediment fences;
- Diversion channels; and
- Rock check dams.

These will be established in accordance with "Managing Urban Stormwater – Soils and Construction 'Blue Book' (Landcom, NSW 2004)" where necessary to reduce the potential for sediment runoff. Examples of typical construction methods for temporary and long term erosion sediment control measures to be used are provided in Annexure B.

Figure 7.3 – Earth Basin (Wet) Design

(Known as Earth Basin Wet SD 6-4 extracted from Appendix I of the EA)



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7.4 MANAGEMENT OF ACID FORMING MATERIAL

7.4.1 ACID SULPHATE SOILS

Impact Assessment

As the proposed quarry excavation depth for the Central Extraction Area and Southern Extraction Area will be limited to a maximum depth of 8mAHD, no direct impacts to PASS are expected as a result of the proposed quarry expansion. The base of the proposed Water Reuse Dam and Water Supply Dam will not be excavated to a depth that will lower the water table below 1mAHD in adjacent class 1-4 lands, and these dams are not located within the region identified as low probability of occurrence of PASS, and as such are not expected to encounter PASS.

As the proposed quarry excavations are outside of the areas mapped as PASS and that such excavation would be above the maximum elevation of PASS in nearby mapped areas, and above the local groundwater table, no impact to PASS are expected from the quarry expansion.

Precautionary Test Drill

As a precautionary measure targeted geological testing has been undertaken by test drilling 2 bore holes. The first borehole was drilled to 2mAHD and the second borehole was drilled to minus 13mAHD, both in the vicinity of the Water Reuse Dam. Below the topsoil and overburden at approximately 2 metres depth the first borehole encountered yellow sandstone, whilst the second borehole encountered yellow sandstone then grey sandstone for the entire depth. Test samples were collected and no marine muds or silt layers were encountered.

7.4.2 ACID MINE DRAINAGE

Impact Assessment

Several thin coal seams and weathered siltstone interbeds were observed in drill cores conducted at the site. Two thin bands of material containing sulphide (pyrite) were encountered at one of the test drill locations (BH5) which is outside the Operational Area. These bands occurred at 12.15m depth below ground surface (50mm thick) and at 27.5m depth (20mm thick).

Pyrite is commonly associated with coal and metal ore deposits. Its oxidation occurs spontaneously in nature and can cause AMD and mine tailing leachate containing heavy metals. Based on the very minor (to insignificant) amounts of pyrite observed in drilling cores the potential for AMD is considered to be very minor due to their thickness in relation to the total sandstone resource.

In any event, it is noted that heavy metals are not a feature of the sandstone resource and as such are not expected to present a significant issue with regard to mobilisation of same.

Mitigation Measures

The following mitigation measures will be employed:

- Prevention – Where possible, material from the very thin veins containing pyrite will be separated, excavated and stockpiled for treatment. It is noted that due to the inconsistency and thinness of the veins this may not always be possible.

- Storage and treatment – Where pyrite material can be separated, it will be stored within the Operational Area and immediately covered with clay based overburden sourced from the Operational Area. This will limit the potential for oxidation and prevent the production of AMD.

- Containment and treatment – As all operational site runoff is to be contained within the Operational Area, the Water Reuse Dam will provide a means for capturing and treating (if required) any AMD.

- Water Reuse Dam – The Water Reuse Dam will be regularly monitored for pH to ensure AMD is not creating acidic conditions.

7.5 PLANS AND DESIGN OBJECTIVES FOR WATER STORAGE DAMS

Please refer to Figure 1.4 and section 6.2.2 for full details.

7.6 REINSTATEMENT OF DRAINAGE LINES ON THE REHABILITATED AREAS OF THE SITE

Landform alterations will be confined primarily to the Operational Area of the quarry and the remainder of the surrounding rural holdings will be unaffected. The final proposed landform is displayed in Figure 7.4

The exhausted quarrying areas that are not utilised for processing will be progressively rehabilitated and returned to pasture. The landscape elements have been designed to reduce the overall visual impact of the development and to provide enhancement to existing biodiversity and habitat at the site. Figure 7.5 shows the indicative final landscape planting and rehabilitation elements of the proposed quarry development.

Following rehabilitation of the final section of the quarry, the areas used for stockpiling materials and access would be returned to grazing land, with soil stockpiles reallocated over the benches of the quarry pit to allow for revegetation.

A more comprehensive rehabilitation plan, with associated design and performance criteria are set out in the Landscape Management Plan.

Figure 7.4 – Three Dimensional Final Landform
(Known as Figure 2.2 – Three Dimensional Final Landform extracted from Appendix I of the EA)

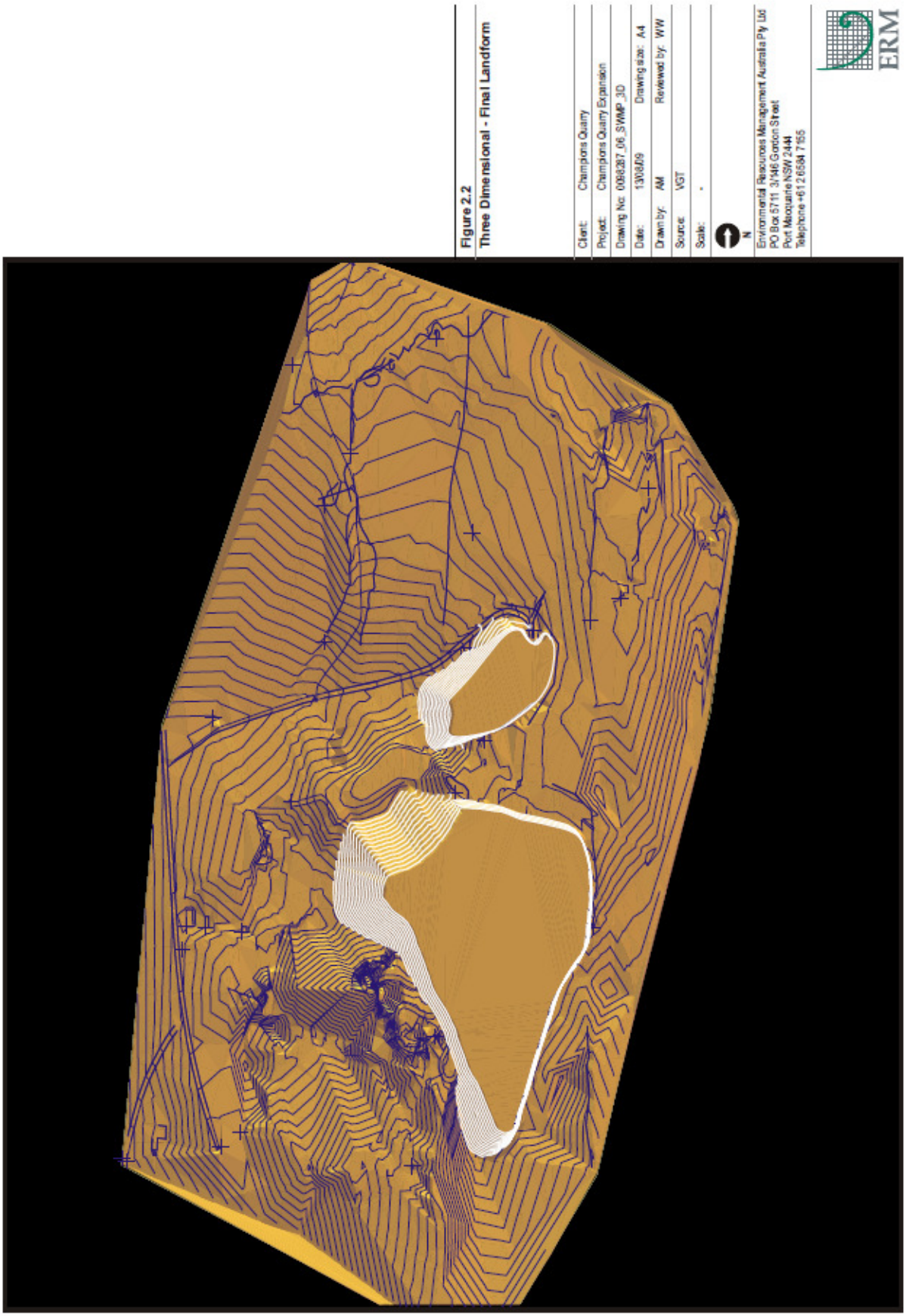
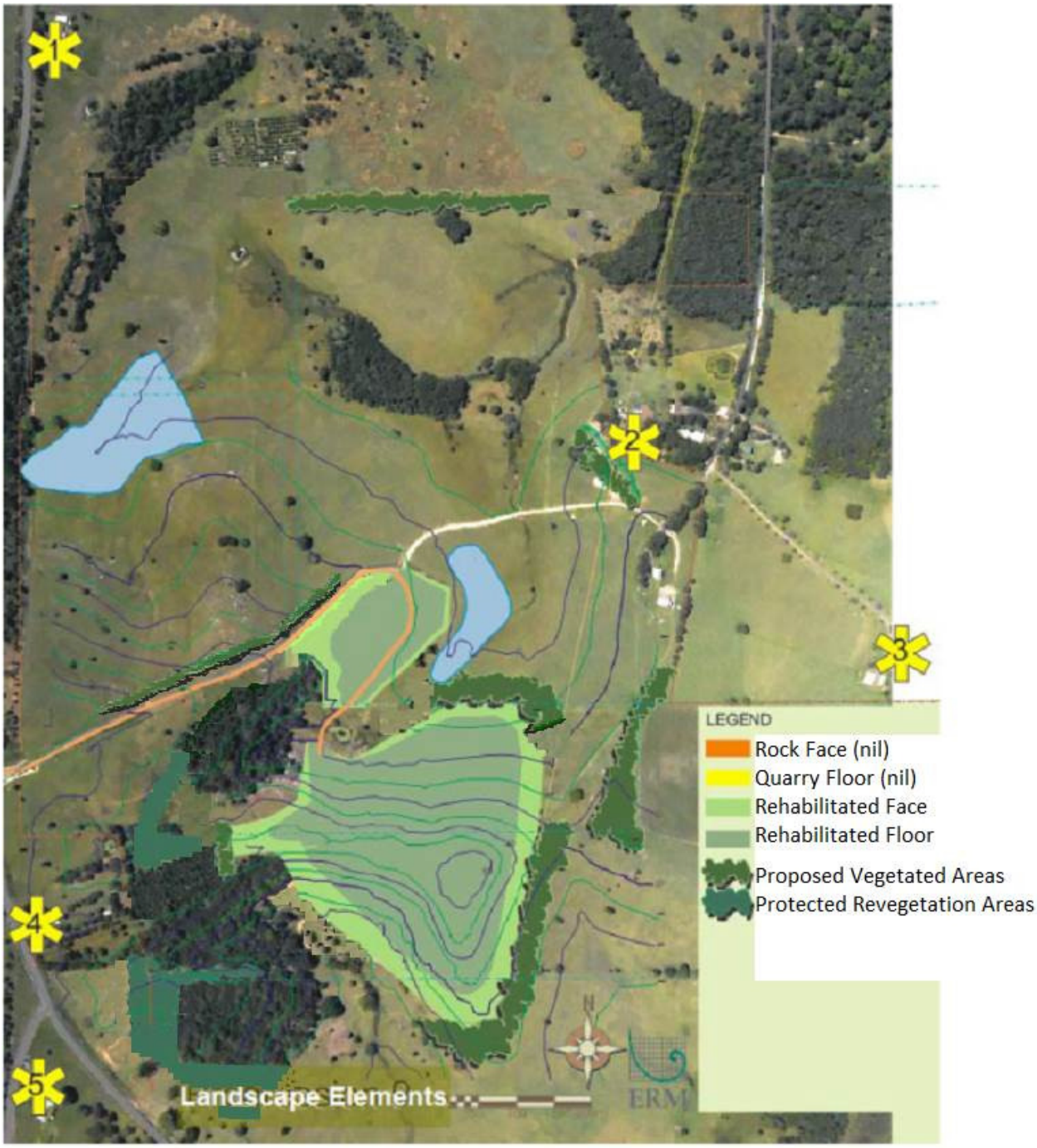


Figure 7.5 – Indicative Rehabilitated Extraction Areas and Final Landform

(Previously known as Figure 3.14 – Rehabilitated Extraction Areas and Final Landform extracted from the Champions Quarry Expansion Quarry Management Plan dated September 2010 being Annexure E in the RTS dated September 2010 – Amended)



7.7 CONTROL OF WATER POLLUTION FROM REHABILITATED AREAS OF THE SITE

The measures to be utilised by the Proponent to control water pollution from rehabilitated areas of the site include the following:

- Contour drains will be installed where required on the rehabilitated slopes to minimise the potential for scouring.
- Runoff will be directed to sediment traps (for example the Rock Gabion Sediment Trap and Filter featured in Figure 7.1 and Figure 7.2) and sediment basins (refer to Figure 1.4) before flowing to the on-site tributaries.
- Where necessary scour protection (such as riprap packed with soil and planted with sedges, rushes and grasses) and dissipaters (for examples utilising gabions, concrete splash pads, drop structures, riprap, and/or boulders) will be installed and rehabilitated slopes will be vegetated to reduce surface erosion.
- Rock batters will be benched where necessary to reduce erosion potential.
- Flows collected on each bench will be directed to contour drains or natural waterways.

The principles above will be implemented after having due regard of the Blue Book and adopting the relevant principles.

7.8 REVIEW AND REPORTING

7.8.1 REVIEW OF RESULTS

Upon receipt of monitoring results a suitably qualified person will enter the results into a spreadsheet that compiles all historical data. The results will then be reviewed by the Production Manager within 4 weeks of receiving monitoring results for any obvious trends or exceedences of the relevant criteria identified in Section 7 of this Management Plan and then a summary will be displayed on the Proponents website.

The Production Manager is responsible for ensuring all records are kept up to date. Records must be kept for a minimum of 4 years after the event and produced to any authorised personnel who request to see them.

7.8.2 EXCEEDANCE OF CRITERIA

In the event that the Production Manager identifies any exceedences in the monitoring results the response of the Proponent might include some or all of the following procedures:

- Assess the likely reasons for the occurrence;
- Investigate the nature of the exceedance;
- Identify the potential impacts and consequences of the exceedance;
- Where significant potential impact and consequences are identified, discuss the occurrence with a specialist hydrogeologist or environmental scientist with surface water experience, to assess the consequence of the exceedance;
- Resample and reanalyse the results if the results are questionable; and
- Develop and implement mitigation strategies to prevent future exceedances.

In addition, in accordance with Condition 7 of Schedule 5 of the Project Approval, the Proponent will:

- immediately notify the Secretary and any other relevant agencies of any Incident; and

- within 7 days of the Incident, the Proponent must provide the Secretary and any relevant agencies with a detailed report on the Incident, and such further reports as may be requested.

8 GROUNDWATER MANAGEMENT PLAN

8.1 BACKGROUND ON GROUNDWATER

As the quarry expands laterally and vertically it is not expected to intercept the regional groundwater table. Based on the hydrogeological properties encountered during site investigations, shallow perched groundwater identified within the Operational Area is not expected to result in significant levels of seepage into the quarry pits. This is further supported by the conditions experienced in the existing quarry pit where only limited seepage is encountered. Further geotechnical testing in the vicinity of the proposed Water Supply Dam and Water Reuse Dam did not identify the regional groundwater resource to the depth of drilling to -13mAHD. As such the Water Supply Dam, Water Reuse Dam and sedimentation basins and traps will not be constructed to a depth within 1m of the groundwater resource.

8.1.1 GROUNDWATER BORE SEARCH

A search of the DPI (Water) registered groundwater bore licences identified 23 licenced bores within approximately 3km of the Operational Area (refer to Table 8.1 below). The detailed groundwater bore logs and bore locations are provided in Annexure B of the SWMP.

The logs reported shallow and deep water bearing zones depending on the location of the bores. The shallow water bearing zones were generally reported in low lying areas (ie <10mAHD). Groundwater bores located along Hazlemount Lane to the north east of the Operational Area appear to access a water bearing zone in excess of 20m depth (ie<10mAHD).

An existing wind mill and well is located on the Project Site adjoining the intermittent watercourse approximately 250m to the north east of the existing quarry and is at elevation less than 10mAHD. During all seasonal conditions ERM understands that the water in the well stands at approximately 0.5m below ground surface.

Table 8.1 – Groundwater Bores within 3km of the Quarry Operational Area

(Known as Table 3.2 – Groundwater Bores within 3km of the Quarry Project Area extracted from Annexure I of the EA)

Bore Reference	Distance / Direction	Location	Authorised Purposes	Final Drilled Depth	Standing Water Level	Yield (L/sec)	Water Bearing Zones
GW034200	3.0km N	N6801348 E531839	Stock	11.0m	-	-	-
GW037211	2.5km SE	N6796575 E532855	Stock	3.7m	-	0.25	3.0m to3.6m
GW037579	2.8km SE	N6796174 E533151	Stock	3.7m	1.5m	-	2.7m-3.6m
GW037580	2.8km SE	N6796451 E533152	Stock	3.7m	1.5m	-	2.7m to 3.6m
GW038487	1.8km SE	N6796976 E532666	Stock	3.7m	0.7m	-	3.00m-3.6m
GW038540	1.5km NW	N6799905 E530698	Stock	1.5m	0.3m	0.25	0.9m to 1.5m
GW038541	1.0km W	N6798675 E530397	Stock	1.8m	0.6m	0.19	1.2m to 1.8m
GW043088	2.0km NE	N6800147 E532242	Stock	3.0m	1.2m	0.25	2.4m to3.0m
GW43089	2.0km N	N6800210 E531782	Domestic Farming Stock	1.2m	1.5m	0.38	0.9m to 1.2m
GW046137	1.5km S	N6797041 E531367	Stock	2.4m	1.8m	0.06	2.1m to 2.1m
GW046138	1.5km SW	N6797258 E530799	Stock	2.5m	2.1m	-	2.4m to 2.4m
GW046139	2.0km SE	N6796238 E532285	Stock	5.5m	-	0.05	4.9m to 5.5m
GW046148	3.0km SE	N6795590 E533068	Stock	3.7m	0.00	0.38	3.4m to 3.7m
GW046151	3.0km SE	N6795744 E532988	Stock	4.0m	-	0.38	3.7m to 4.0m
GW046341	3.0km SE	N6795591 E532825	Stock	4.3m	-	-	4.3m to 4.3m
GW047403	0.5km N	N6798949 E531318	Stock	7.5m	-	-	-
GW052250	2.7km N	N6800856 E531675	Stock	3.0m	2.5m	-	2.1m to 2.3m
GW058862	1.7km NE	N6799655 E531159	Stock	30.0m	-	0.25 0.38	10.0m to 10.0m

Bore Reference	Distance / Direction	Location	Authorised Purposes	Final Drilled Depth	Standing Water Level	Yield (L/sec)	Water Bearing Zones
						1.89	20.0m to 20.0m
							28.0m to 28.0m
GW061503	0.7km NE	N6799255 E532104	Domestic Stock	50.0m	-	0.13 0.78	25.0m to 27.0m
							40.0m to 48.0m
GW063949	1.8km NE	N6800421 E533353	Domestic Stock	25.0m	-	0.60	20.0m to 21.0m
GW065451	0.5km NE	N6798886 E532049	Domestic	41.0m	-	0.1 0.1 0.1	7.0m to 8.0m 27.0m-28.0m
							37.0m to 38.0m
GW067108	0.6km NE	N6799439 E5321132	Domestic Stock	-	18.50	0.9	22.0m to 30.0m
GW300053	2.8km N	N6801301 E531847	Stock	36.0m	9.0m	6.6	23.0m to 30.0
GW300375	0.6km NE	N6799334 E532124	Domestic Stock	40.0m	25.0m	1.5	0.0m to 40.0m
GW302233	2.9km SW	N6795953 E530360	Stock	-	-	-	-
GW302234	2.9km SW	N6795891 E530389	Stock	-	-	-	-
GW303341	2.0km NE	N6800574 E531935	Stock	-	-	-	-

8.1.2 HYDROGEOLOGICAL ASSESSMENT

Geological investigations undertaken encountered groundwater in 6 boreholes advanced across and adjacent to the Operational Area. Relatively high standing water levels were recorded, following a significant rainfall event in excess of 500mm, in 3 boreholes that were converted to monitoring wells (BH3, BH5 and BH6 in Figure 1.3). A summary of water level gauging undertaken is provided in Annexure D.

Slug testing and Rising Head Testing was undertaken in all three on site groundwater monitoring bores. This involved initially gauging the standing water level in the bores then pumping water from the bores. Following pumping a groundwater depth probe was used to measure the depth increase of water in the bores over time as they were recharged. The hydraulic testing sheets are provided in Annexure E of the SWMP.

The data collected from the above Rising Head Tests were analysed by ERM using AquiferTest™ software to calculate the hydraulic conductivity (K) for each bore. The software analysis slug test data for unconfined aquifers using the Bouwer-Rice (1976) method and the Hvorslev (1951) method. As a result the Bouwer-Rice method may provide a more accurate calculation of the hydraulic conductivity. However, in practice, the results from both tests are often quite close.

Table 8.2 below sets out the result of the hydraulic conductivity analysis for bores BH3, BH5 and BH6. The AquiferTest™ graphical output for each bore and test are provided in Annexure F of the SWMP.

Table 8.2 – Hydraulic Conductivity

Conductivity (K, m/s)		
Borehole	**Hvorslev Method**	**Bouwer-Rice Method**
BH3	2.5E-07	1.24 to 2.3E-07
BH5	2.83E-07	1.12E-07
BH6	4.55E-08	1.55E-08

The overall results indicate very low recharge rates and low calculated conductivity in the three monitoring bores. This suggests that the groundwater encountered is likely to represent shallow perched seepage water in sandstone. It is noted that the monitoring, while screened at depth are sand packed to near ground surface (refer to bore logs in Annexure C of the SWMP).

It is also noted that the groundwater gauging and slug testing events occurred immediately following significant rainfall in January 2008, which led to local and regional flooding. ERM understands that groundwater was also observed flowing from surface seepages at higher elevations on the southern ridgeline within the Operational Area at this time.

It is expected that shallow alluvial groundwater would generally follow the landform and flow in an east to north easterly direction towards Tucki Tucki Creek.

A further groundwater bore was advanced adjacent to the Central Extraction Area, to the north west of the Water Reuse Dam, referred to as borehole 7 (BH7). This borehole was converted to a monitoring well. No water level gauging was undertaken at BH7.

8.1.3 GROUNDWATER QUALITY

The groundwater borelogs indicate that the deeper aquifer beneath the region (<10mAHD) is generally suitable for stock purposed and domestic applications.

EAL Laboratories of Lismore have undertaken preliminary groundwater sampling on behalf of the Proponents during February 2007, with samples collected from Monitoring Point 8 (BH3), Monitoring Point 9 (BH5) and Monitoring Point 10 (BH6). An overview of the analytical results are provided in Annexure C. The complete results/reports are in Annexure H of the SWMP.

The analytical data indicates that the pH of shallow perched groundwater across the Project Site is slightly to mildly acidic (consistent with the soil pH) and contains low levels of nutrients and non-organics. It is noted that in the first round of data collected that elevated TPH were collected at sampling location BH6. As this was considered an anomaly at the time EAL resampled after further developing the bores. The subsequent results did not identify significant levels of TPH in groundwater water samples. The potential source of the recorded TPH levels was not determined, however it is considered likely to have resulted from the drilling activities (ie. hydraulic or lubricating oils).

8.2 GROUNDWATER MONITORING LOCATIONS

Groundwater monitoring is proposed to be undertaken in 3 existing cased groundwater bores adjacent to the Central Extraction Area and Southern Extraction Area (BH3, BH5 and BH6 in Figure 1.3) and at the onsite Windmill/bore (Monitoring Point 11). An additional cased groundwater bore (BH7) was also added to the monitoring schedule in 2015 (Monitoring Point 12). Monitoring Point 12 was added to the monitoring regime as an alternative to upgrading Monitoring Point 11 to include water quality monitoring. Hence Monitoring Points 8, 9, 10 and 12 will be monitored for groundwater levels and groundwater quality. Monitoring Point 11 will only be monitored for groundwater levels.

If Monitoring Points 8, 9, 10 or 12 are destroyed during quarrying activities, alternative groundwater testing location/s may need to be established. The monitoring locations are set out below in Table 8.3.

Monitoring should initially be undertaken on a quarterly basis (where water levels permit), to evaluate the influence of rainfall and quarrying activities on groundwater levels and quality (except Monitoring Point 11 which is level only), for an initial period of 3 years. After the initial monitoring period of 3 years, monitoring frequency will be reduced to half yearly.

Table 8.3 – Overview of Groundwater Monitoring Locations and Frequency

Monitoring Point	Type of Monitoring Point	Type of Discharge Point	Description of Location	Initial Monitoring Frequency	Ultimate Frequency
8	Groundwater level and quality monitoring	NA	BH3 on Figure 1.3	3 monthly	6 monthly
9	Groundwater level and quality monitoring	NA	BH5 on Figure 1.3	3 monthly	6 monthly
10	Groundwater level and quality monitoring	NA	BH6 on Figure 1.3	3 monthly	6 monthly
11	Groundwater level only	NA	Onsite Windmill/Bore	3 monthly	6 monthly
12	Groundwater level and quality monitoring	N/A	BH7 on Figure 1.3	3 monthly	6 monthly

Laboratory quality assurance and quality control procedures will be undertaken in accordance with National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B(3) – Guidelines on Laboratory Analysis of Potentially Contaminated Soils and will comprise matrix spikes, method blanks and laboratory control samples.

8.3 BASELINE DATA OF GROUNDWATER LEVELS, YIELD AND QUALITY

The Proponent will measure groundwater levels and collect groundwater quality samples from Monitoring Points 8, 9 and 10 (where water levels permit) (in relation to the parameters set out in Table 8.4 below) prior to commencing quarry operations in the Southern Extraction Area.

Monitoring Point 12 was only added to the monitoring regime in 2015, hence baseline data will only commence to be collected from Monitoring Point in the later part of 2015.

Notwithstanding this, there will be insufficient data available to calculate statistically derived site specific trigger levels for the range of analytes to be measured, and based on the proposed monitoring program, it may be some time before sufficient data is available. On this basis, and given the assessed low potential impact on groundwater from future quarrying operations, it is proposed to initially compare the data against criteria from the following published guidelines:

- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and
- NHMRC (2004) Australian Drinking Water Guidelines.

The parameters and initial assessment criteria for discharge water and groundwater are set out in Table 8.4 below. The parameters and initial assessment criteria for discharge water and groundwater are set out in Table 8.4. Site specific trigger levels will be established after 3 years of monitoring, once a larger data set is available.

Groundwater quality monitoring samples will be collected in accordance with NATA specifications and/or comprise sample collection and testing by a NATA registered laboratory.

Table 8.4 – Groundwater Quality Parameters and Assessment Criteria

Parameters Analysed	Unit	ANZECC 2000 Trigger Values for Freshwater[1]	NHMRC Drinking Water Guidelines
pH (units)	-	6.5-8.5 [2]	6.5-8.5 [2]
Conductivity	(dS/m)	0.350	n/s
Nitrate (NO_3)	(mg/L)	0.7	50
Aluminium (Al)	(mg/L)	0.055	0.2
Total Arsenic (As)	(mg/L)	0.024	0.01
Cadmium (Cd)	(mg/L)	0.0002	0.002
Total Chromium (Cr)	(mg/L)	n/s[3]	0.05[4]
Copper (Cu)	(mg/L)	0.0014	2
Mercury (Hg)	(mg/L)	0.0006	0.001
Nickel (Ni)	(mg/L)	0.011	0.02
Lead (Pb)	(mg/L)	0.0034	0.01
Zinc (Zn)	(mg/L)	0.008	3

Notes:
1. ANZECC (2000) default trigger level for slightly disturbed ecosystem in in south eastern Australia for upland and lowland rivers.
2. pH level determined in accordance with SoC 7 and to be reviewed following monitoring.
3. ANZECC (2000) default trigger levels do not specify a trigger value for Total Chromium (Cr) due to insufficient data.
4. If the concentration of total chromium exceeds 0.05mg/L then additional investigations into Chromium VI (hexavalent chromium) should be undertaken.

8.4 BASELINE DATA FOR THE SOUTHERN EXTRACTION AREA

The Proponent will measure groundwater levels and collect groundwater quality samples from Monitoring Points 8, 9 and 10 (where water levels permit) (in relation to the parameters set out in Table 8.4 below) prior to commencing quarry operations in the Southern Extraction Area.

The water level in Monitoring Point 11 is generally stabilised at approximately 0.5m below ground surface, and as such this will be used as baseline groundwater level for this stock watering well.

Monitoring Point 12 was only added to the monitoring regime in 2015, hence baseline data will only commence to be collected in the later part of 2015.

8.5 GROUNDWATER INFLOWS TO THE QUARRYING OPERATIONS

The lowest level the Proponent is permitted to carry out quarrying operations onsite is 8m AHD (excluding approved monitoring bores and pollution and sediment control devices). The Water Reuse Dam which was constructed in May 2014 and excavated to approximately 1m AHD at the lowest point. Tuckean Swamp is generally between 1-4m AHD and Tucki Tucki Creek is <0m AHD at the point that Tuckean Swamp (and potential surface water from the quarry) drains to Tucki Tucki Creek (Monitoring Point 2). .

Investigations of the Project Site have shown that groundwater seepage is not expected to add significantly to the overall water balance at the quarry. This is primarily due to the nature of the shallow unconfined groundwater stored within the porous sandstone. The excavation of the sandstone resource is considered likely to result in a localised lowering of the shallow sandstone groundwater profile thus limiting storage of water above any confining layers (i.e. siltstone). The recharge rates identified in the on-site groundwater bores are not considered typical of a confined aquifer or significant source of groundwater.

Further, no aquifers (including the deeper regional aquifer) have been or are to be intercepted by quarrying activities accordingly an assessment of groundwater flows is not considered necessary. The shallow perched seepage groundwater would be expected to flow via gravity and generally mirror the local topography until such time as it presents as seepage from hill slopes (refer to Figure 4.1).

Data from Monitoring Points 8, 9, 10, 12 (groundwater quality and recharge rates) and Monitoring Point 11 (groundwater levels) will be collected and utilised to identify potential quarry related impacts on groundwater inflows to quarrying operations.

As set out in Section 8.3, there is currently insufficient data available to calculate statistically derived site specific trigger levels for the range of analytes to be measured. Based on the proposed monitoring program, it may be some time before sufficient data becomes available. On this basis, and given the assessed low potential impact on groundwater from future quarrying operations, it is proposed to initially compare the data against criteria from the following published guidelines:

- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and
- NHMRC (2004) Australian Drinking Water Guidelines.

The parameters and initial assessment criteria for groundwater are set out in Table 8.4. Site specific trigger levels will be established after 3 years of monitoring, once a larger data set is available. Exceedances will be dealt with in accordance with Section 8.11.

Further, the Production Manager and/or Site Foreman will carry out ongoing inspections of the quarry faces to evaluate if water bearing zones have been intercepted in accordance with section 9.1 and determine whether any action is required.

8.6 A PROGRAM TO MONITOR THE IMPACTS OF THE PROJECT ON THE LOCAL ALLUVIAL AQUIFER

The soil depths on site are generally 0.5-1 metre below surface level, including in the vicinity of the Water Reuse Dam. Shallow perched groundwater in the soil profile and alluvial soils of the drainage lines at the site would be expected to flow via gravity and generally mirror the local topography until such time as it presents as seepage from hill slopes to the lower ephemeral drainage line/s (refer to Figure 4.1) and accordingly, perched water would flow downhill.

Observations on site to-date indicate seepage inflow is limited to up-gradient. Routine inspections will be carried out by the Production Manager and/or Site Foreman in accordance with section 9.1 to monitor any potential impacts on the shallow perched “alluvial aquifer/sediments”.

Data from Monitoring Points 8, 9, 10, 12 (groundwater quality and recharge rates) and Monitoring Point 11 (groundwater levels) will be collected and utilised to identify potential quarry related impacts on the local alluvial aquifer.

As set out in section 8.3, initially there will be insufficient data available to calculate statistically derived site specific trigger levels. As such, it is proposed to initially compare the data against criteria from the following published guidelines:

- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and
- NHMRC (2004) Australian Drinking Water Guidelines.

The parameters and initial assessment criteria for groundwater are set out in Table 8.4. Site specific trigger levels will be established after 3 years of monitoring, once a larger data set is available. Exceedances will be dealt with in accordance with Section 8.11.

8.7 A PROGRAM TO MONITOR THE IMPACTS OF THE PROJECT ON ANY GROUNDWATER BORES

The groundwater bore logs (see section 8.1) reported shallow and deep water bearing zones depending on the location of the bores. Groundwater bores that have the potential impacted by quarrying operations are the shallow bores in low lying areas (<10m AHD) which are generally suited for stock purposes and domestic applications.

An existing wind mill and well is located on the Project Site adjoining the intermittent watercourse (between Monitoring Points 3 and 4) at an elevation of less than 10mAHD. This is known as Monitoring Point 11. The on-site windmill and associated well is considered to be closest shallow bore in the low lying area and therefore the most likely to be adversely impacted by quarrying operations.

The Proponent will monitor the standing water levels of the on-site windmill as set out in Section 8.3 to determine any fluctuations in levels (including potentially as a results of seasonal factors). It is understood that generally the water in the well stands at approximately 0.5m below ground surface and this will be used as the baseline data.

Data from Monitoring Point 8 (groundwater quality and recharge rates) Monitoring Point 11 (groundwater level) and Monitoring Point 12 (groundwater quality and recharge rates) will be collected and utilised to identify potential quarry related impacts on the local domestic groundwater bores identified in Table 8.5 being within 700 metres of the Project Site.

A landowner of a local domestic groundwater bore may apply to the Proponent to initiate an investigation by the Proponent (or its representatives) into the landowner's groundwater bore if:

a. the subject bore is a local domestic groundwater bore identified in Table 8.5;

b. the landowner reasonably believes that their groundwater bore is being negatively affected by the Project; and

c. there has been one or more of the following:

    i. the identification by the Proponent of a significant and continued project related loss of water quality at Monitoring Point 8 and/or Monitoring Point 12; and/or

    ii. the identification by the Proponent of a significant and continued project related fall in the water level in Monitoring Point 8 and/or Monitoring Point 11 and/or Monitoring Point 12.

When initiating an investigation by the Proponent, the Proponent may consider the following:

a. the significance of the loss of water quality and/or fall in water level at the relevant Monitoring Point;

b. the period of the continued loss of water quality and/or fall in water level at the relevant Monitoring Point;

c. the likelihood of the loss of water quality and/or the fall in water level being project related at the relevant Monitoring Point;

d. the impact of seasonal factors on the loss of water quality and/or fall in water level at the relevant Monitoring Point;

e. any experts opinions;

f. any additional testing/data; and

g. the level of co-operation offered by the landowner to the Proponent to enable a successful investigation to take place.

If the landowner of a local domestic groundwater bore and the Proponent cannot reach a satisfactory outcome, then the landowner or the Proponent may apply to the DP & I to seek a resolution.

Table 8.5 – Local Domestic Groundwater Bores

(Extracted from Table 3.2 – Groundwater Bores within 3km of the Quarry Project Area extracted contained within Annexure I of the EA)

Bore Reference	Distance/ Direction	Location	Authorised Purposes	Final Drilled Depth	Standing Water Level	Yeild (L/sec)	Water Bearing Zones
GW061503	0.7km NE	N6799255 E532104	Domestic Stock	50.0m	-	0.13 0.78	25.0m to 27.0m 40.0m to 48.0m
GW065451	0.5km NE	N6798886 E532049	Domestic	41.0m	-	0.1 0.1 0.1	7.0m to 8.0m 27.0m-28.0m 37.0m to 38.0m
GW067108	0.6km NE	N6799439 E5321132	Domestic Stock	-	18.50	0.9	22.0m to 30.0m
GW300375	0.6km NE	N6799334 E532124	Domestic Stock	40.0m	25.0m	1.5	0.0m to 40.0m
The Proponents note: 1. Bore GW300375 was drilled to a depth below the bottom underground stream which resulted in the loss of all retrievable ground water. Therefore the Bore is unable to pump stock or domestic water. 2. The over drilling of Bore GW300375 resulted in the loss of most of the retrievable ground water in Bore GW067108. 3. The over drilling of Bore GW300375 resulted in the loss of the retrievable ground water in the 25.0-27.0m water bearing zone in Bore GW061503							

8.8 A PROGRAM TO MONITOR THE IMPACTS OF THE PROJECT ON GROUNDWATER DEPENDENT ECO-SYSTEMS

Environmental Value of Receiving Waters

Tucki Tucki Creek is the primary receiving waters for any discharges or runoff from the Project Site. The waterway is affected by variable quality runoff from both agricultural and urban sub-catchments.

Groundwater dependent eco-systems potentially include the Tuckean Swamp and Tucki Tucki Creek. Tuckean Swamp is located approximately 1.5 kilometres from the eastern boundary of the Project Site. Tuckean Swamp drains into Tucki Tucki Creek which is located approximately 2.5 kilometres from the Project Site.

Impacts and Management of Clean Water Run-off from Undisturbed Areas

Clean water/run-off from undisturbed quarrying areas will be diverted around areas disturbed or affected by quarrying activities. This will reduce the potential for clean runoff to be polluted by quarrying activities and the additional diversion elements may result in an improved water quality. As set out in section 7.3.1, the diverted clean water will travel through various diversion elements including diversion drains, contour drains, bunds and pipe culverts until it reaches the unnamed intermittent watercourse along the eastern boundary of the Project Site at an elevation of less than 10m AHD. This diversion will have little to no effects to local flows.

The existing surface water monitoring program set out in sections 7.1 and 7.2 of this Management Plan and associated management strategies within this Management Plan provides for the testing of the clean water run-off from undisturbed quarrying areas prior to the water leaving the site. This is via testing at Monitoring Point 4. This ensures that water quality is maintained and the clean water/run-off from undisturbed quarrying does not impact either Tuckean Swamp or Tucki Tucki Creek.

Impacts and Management of Water Run-off from Disturbed Quarrying Areas

Water from disturbed quarrying areas will be conveyed via drainage facilities/sediment control devices (refer to section 7.3.2) to sediment traps which will ultimately drain to the Water Reuse Dam. This is to prevent sediment laden or potentially contaminated runoff leaving the Operational Area. The Water Reuse Dam will maintain 6ML of freeboard to receive stormwater runoff from the Operational Area and provide additional sediment capture and water quality control. The water levels in the Water Reuse Dam will be managed via operational reuse (including processing and dust suppression), and also via land application on the Project Site during favourable climatic conditions to maintain the 6ML of freeboard capacity. Under most operating conditions all operational site water is expected to be detained on-site for reuse or for land application and not discharged. Notwithstanding this, if water is required to be discharged and the water quality objectives are satisfied then water may be appropriate for water to be discharged to the environment.

As set out in section 6.3.2, the MUSIC model predicts that the Water Reuse Dam would only be expected to overflow on very rare occasion assuming a minimum 6ML of freeboard is maintained for temporary storage. The modelling also indicates that there is expected to be a clear beneficial effect in terms of mean annual pollutants loads in all models from the predevelopment runoff from agricultural grazing lands. The pollutant loads are predicted to be less or no worse than under existing conditions. Further, a contour drain has been constructed, so that in the unlikely event that the Water Reuse Dam discharges, the discharge will drain over land and not generally feed directly into a watercourse of any type.

In the Water Reuse Dam discharges and the discharge is not captured and maintained over land and then feeds into the minor order ephemeral streams on-site, then the water will travel through extensive natural reed beds and filtration devices, before having to travel 1-2 kilometres over low lying agricultural land before it reaches either Tuckean Swamp or Tucki Tucki Creek.

The existing surface water monitoring program set out in sections 7.1 and 7.2 of this Management Plan and associated management strategies within this Management Plan provide for the testing of Water Run-off from Disturbed Quarrying Areas prior to the water leaving the quarry site (for the initial period/frequency):

- Weekly testing of water in the Water Reuse Dam for pH (Monitoring Point 7);
- 3 monthly testing of the water quality in the Water Re-Use Dam (Monitoring Point 5); and
- Testing of the water quality of any discharge from the Water Reuse Dam prior to being actively discharged to receiving watercourses and daily while discharging (Monitoring Point 6).

Routine testing (3 monthly for the initial period/frequency) is also to be carried out downstream of the Water Reuse Dam, 1-2 kilometres before any water from disturbed quarrying areas potentially reaches either Tuckean Swamp or Tucki Tucki Creek (Monitoring Point 3).

Simultaneous testing (3 monthly for the initial period/frequency) is also to be carried out as follows:

- Upstream in Tucki Tucki Creek at a point immediately upstream of the drain that leads from the Project Site to Tucki Tucki Creek (Monitoring Point 1); and

- Downstream in Tucki Tucki Creek at a point immediately downstream of the drain that leads from the Project Site to Tucki Tucki Creek (Monitoring Point 2).

Data from Monitoring Points 1, 2 and 3 can be collected and confirm that quarry operations are not impacting on receiving waters, Tuckean Swamp or Tucki Tucki Creek.

Routine inspections of key areas of the Tuckean Swamp and Tucki Tucki Creek (where access is permitted) will be conducted by the Production Manager and/or Site Foreman to monitor any potential harm to soils or water quality and/or quantity.

Impact of Loss of Surface Water Catchment (from Disturbed Quarrying Areas)

The Water Supply Dam has a total catchment area of approximately 19ha and would be constructed at the confluence of two first order watercourses. The second order watercourse downstream of the Water Supply Dam (denoted watercourse 1) is mostly dry, with water flowing only after significant rainfall events. Watercourse 1 is joined downstream by several first order watercourses and is then piped beneath Hazlemount Lane, approximately 800 metres east of the Water Reuse Dam. Thereafter, flows along watercourse 1 become indistinct as the watercourse enters very flat, partially cleared lands to the east of Hazlemount Lane. This land area adjoins Tucki Tucki Creek approximately 1.5 kilometres east of Hazlemount Lane. During flood events water flows generally south east over adjoining flood prone lands.

At the culvert crossing of Hazlemount Lane watercourse 1 has a catchment area of approximately 140ha. A reduction of approximately 32ha from its surface catchment area due to construction of the Water Supply and Water Reuse Dams would be expected to have a minor impact on the magnitude and frequency of sub-catchment surface water flows (i.e. for small storm events) within watercourse 1 or subsequent Tuckean Swamp/Tucki Tucki Creek.

The Water Reuse Dam is to be constructed off-line and next to an unnamed first order watercourse (denoted watercourse 2), with a catchment area of approximately 13 ha measured at its downstream confluence with watercourse 1. Construction of the Water Reuse Dam would result in the loss of approximately 4ha of the catchment area of watercourse 1. This would have a negligible impact on the magnitude and frequency of sub-catchment surface water flows within watercourse 2 or subsequent Tuckean Swamp/Tucki Tucki Creek.

It is further noted that watercourse 1 and watercourse 2 are located in cleared grazing land with limited habitat value. These streams are both influenced by seepage and spring activity which is likely to dominate low flow conditions in the lower reaches of the watercourses downstream of the proposed quarry expansion. These factors would limit the impact of the loss of surface water catchment due to the proposed quarry extension and associated dams.

Seepage and spring activity are considered likely to dominate low flow conditions in the lower reaches of the watercourses downstream of the Water Reuse Dam. These factors would limit any impact of the loss of surface water catchment due to the quarry extension and associated dams and accordingly is not expected to impact on PASS in low lying lands to the east of the Project Area including Tuckean Swamp or Tucki Tucki Creek.

8.9 A PROGRAM TO MONITOR SEEPAGE/LEACHATE FROM WATER STORAGES OR BACKFILLED VOIDS ON SITE

It is expected that any seepage water from the quarry face will either evaporate or be collected as part of the surface water management system, which is designed to protect receiving water bodies. Further, given the high plasticity index of the weathered sandstone which is in excess of 2.5m layer of compacted clay lining in the water storages, it is considered that with this compaction the weathered sandstone at the base and side of the dams and the clay mix, will act as an effective sealing barrier/liner and therefore no leakage is expected.

The Production Manager and/or Site Foreman will carry out ongoing inspections of the dam batters and backfilled voids to evaluate if there are any impacts of seepage/leachate in accordance with section 9.1 and determine whether any action is required.

Data from Monitoring Points 8, 9, 10, 12 (groundwater quality and recharge rates) and Monitoring Point 11 (groundwater levels) will be collected and utilised to identify potential quarry related impacts of seepage/leachate from water storages or backfilled voids on site.

As set out in Section 8.3, initially there will be insufficient data available to calculate statistically derived site specific trigger levels for the range of analytes to be measured, and based on the proposed monitoring program, it may be some time before sufficient data is available. On this basis, and given the assessed low potential impact on groundwater from future quarrying operations, it is proposed to initially compare the data against criteria from the following published guidelines:

- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and
- NHMRC (2004) Australian Drinking Water Guidelines.

The parameters and initial assessment criteria for groundwater are set out in Table 8.4. Site specific trigger levels will be established after 3 years of monitoring, once a larger data set is available. Exceedances will be dealt with in accordance with Section 8.11.

8.10 A PROGRAM TO MONITOR ANY INTERACTION BETWEEN WATER FROM THE RE-USE DAM AND THE LOCAL AQUIFER IDENTIFIED WITHIN NEARBY ALLUVIAL SEDIMENTS

Identification of Shallow Perched "Alluvial Aquifer/Sediments" /Groundwater

On 16 and 17 November 2010, a 10m bore was drilled into the current footprint of the proposed Water Reuse Dam to a maximum depth of minus 13m AHD.

No significant shallow groundwater was intersected during drilling (a blow test on completion of drilling estimated a groundwater yield of no more than 3 litres per minute). This drilling occurred during intermission of relatively high rainfall period. The regional aquifer was not intercepted, in fact no aquifer was intersected. Higher yielding water bearing units are located at depths greater than the maximum base depth of the Water Reuse Dam.

As that the base of the Water Reuse Dam is expected to be about 6m below the current natural ground surface elevation which is approximately 7m AHD, the Water Reuse Dam will not intersect the groundwater table.

The results confirmed that the geological profile includes a poorly developed (ie 0.5m) layer of top soil followed by a 2.5m layer of clay underlain by a highly weathered to weathered yellow sandstone with a high plasticity index. No alluvial deposits or groundwater was intersected.

The yellow sandstone was considered ideal for dam construction and will allowed the dam to be excavated to a depth of at least 6m. The construction of the Water Reuse Dam was complete in May 2014 to an actual depth of approximately 1m AHD (at the lowest point) and notably no confined aquifer was intercepted, merely perched water.

Potential Discharge and/or Seepage from the Water Reuse Dam

The Water Reuse Dam was constructed in May 2014 and utilising material from on-site (classified by geotechnical experts as self-cementing high plasticity sandstone material) the dam was sealed so that seepage losses would be negligible. Consequently, interactions between the Water Reuse Dam and shallow perched "alluvial aquifer/sediments" is considered negligible. Perched water in the alluvial sediments of the drainage lines down hydraulic gradient of the Water reuse Dam are expected to present as surface water, particularly at times of higher rainfall and greater ground saturation. Hence, the alluvia groundwater monitoring program will focus on water quality in the Water Reuse Dam and the downstream surface water.

Monitoring Program

Notwithstanding, the surface water monitoring program set out in Sections 7.1 and 7.2 of this Management Plan and associated management strategies within this Management Plan provide for the testing of the following (initial period/frequency):

- Weekly testing of water in the Water Reuse Dam for pH (Monitoring Point 7);
- 3 monthly testing of the water quality in the Water Reuse Dam (Monitoring Point 5);
- 3 monthly testing of the water quality in the onsite watercourse which is adjacent to the Water Reuse Dam (Monitoring Point 4) and downhill and down gradient of the Water Reuse Dam; and
- 3 monthly testing to be carried out downstream of the Water Reuse Dam (Monitoring Point 3).

Data from Monitoring Points 7, 5, 3 and 4 will be collected and utilised to evaluate the interactions between the Water Reuse Dam and perched groundwater of the shallow perched "alluvial aquifer/sediments".

The Proponent will monitor the standing water levels of the onsite windmill as set out in sections 8.3 to determine any fluctuations in levels (including potentially as a results of seasonal factors). It is understood that generally the water in the well stands at approximately 0.5m below ground surface and this will be used as the baseline data.

Routine inspections of key areas surrounding the Water Reuse Dam will be conducted by the Production Manager and/or Site Foreman to monitor for any evidence seepage, such as direct water discharge or enhanced vegetation growth.

8.11 REVIEW AND REPORTING

8.11.1 REVIEW OF RESULTS

Upon receipt of monitoring results, they will be entered into a spreadsheet that compiles all historical monitoring data. The results will then be reviewed by the Production Manager for any obvious trends or exceedences of the relevant criteria identified in Section 8 of this Management Plan and then a summary will be displayed on the Proponents website.

The Production Manager is responsible for ensuring all records are kept up to date. Records must be kept for a minimum of 4 years after the event and provided to regulatory authorities upon request.

8.11.2 EXCEEDANCE OF CRITERIA

In the event that the Production Manager identifies any exceedances in the monitoring results the response of the Proponent might include some or all of the following procedures:

- Assess the likely reasons for the occurrence;
- Investigate the nature of the exceedance;
- Identify the potential impacts and consequences of the exceedance;
- Where significant potential impact and consequences are identified, discuss the occurrence with a specialist hydrogeologist or environmental scientist with surface water experience, to assess the consequence of the exceedance;
- Resample and reanalyse the results if the results are questionable; and
- Develop and implement mitigation strategies to prevent future exceedances.

In addition, in accordance with Condition 7 of Schedule 5 of the Project Approval, the Proponent will:

- immediately notify the Secretary and any other relevant agencies of any Incident; and
- within 7 days of the Incident, the Proponent must provide the Secretary and any relevant agencies with a detailed report on the Incident, and such further reports as may be requested.

9 INSPECTIONS

9.1 SITE INSPECTIONS

Weekly Routine Quarry Inspections

The following routine quarry inspections will generally be carried out on a weekly basis whilst the quarry is operating, and increased to a higher frequency in the event that an inspection reveals potential harm to soils or water quality and/or quantity as a result of quarrying operations:

- Routine quarry inspections of work areas will be conducted by the Production Manager and/or Site Foreman to monitor all work practices and identify non-conforming areas and activities or work practices which could lead to potential harm to soils or water quality and/or quantity.
- Routine inspections of quarry faces will also be undertaken by the Production Manager and/or Site Foreman to:
    - determine if there are any impacts from seepage/leachate from water storages or backfilled voids;
    - evaluate if water bearing zones have been intercepted; and
    - evaluate if there are any additional needs in relation to water storage or treatment at the site.
- Routine inspections of key areas surrounding the Water Reuse Dam will be conducted by the Production Manager and/or Site Foreman to monitor any potential interactions between the Water Reuse Dam and perched groundwater within the shallow perched "alluvial aquifer/sediments" immediately down hydraulic gradient from the Dam.

Inspections of the Water Reuse Dam

The Water Reuse Dam as the primary sedimentation basin will be monitored and maintained as follows:

- The Water Reuse Dam will be visually inspected by the Site Foreman minimally 2-3 times per week for capacity, maintenance requirements and discharges.
- The Water Reuse Dam will be inspected weekly to determine capacity, assess any intentional and unintentional discharge and assess any maintenance requirements.
- Weekly inspections of the Water Reuse Dam will be increased to daily monitoring while the Water Reuse Dam level approaches capacity, is likely to discharge or is to be intentionally discharged.
- The following will be recorded in relation to the Water Reuse Dam (commencing in November 2015):
    - Weekly inspections (date and time);
    - Maintenance requirements of the Water Reuse Dam or any required desilting (if any); and
    - All discharges (intentional and unintentional); and
- Rainfall records will be progressively monitored to assist in identifying times of high rainfall events.

Periodic Non-Quarry/Off Site Inspections

Routine inspections of key areas of the Tuckean Swamp and Tucki Tucki Creek (where access is permitted) will be conducted by the Production Manager and/or Site Foreman to monitor any potential harm to soils or water quality and/or quantity. It is anticipated that these will generally be conducted monthly but increased to a higher frequency in the event that an inspection reveals potential harm to soils or water quality and/or quantity as a result of quarrying operations.

Non-Conforming Inspections

Where non-compliance with nominated performance goal/s is detected, and/or the potential for environmental harm is identified during an inspection and incident notice will be raised by the Site Foreman and/or Production Manager in accordance with the EMS. Following which a management strategy will be developed to address the issue as it arises. This would include notification of the incident to the regulator where required.

10 REVIEW AND REPORTING OF MONITORING RESULTS

10.1 INFORMATION PUBLICLY AVAILABLE ON PROPONENTS WEBSITE

The following information will be made publicly available on the Proponents website:

- a summary of the monitoring results of the Project (per paragraph 7.8.1 and 8.11.1) within 28 days of receipt of monitoring results by the Proponent;
- a complaints register including an analysis of why and when the complaint was made, actions (if any) and resolutions (if applicable) and updated on a quarterly basis; and
- a copy of all annual reviews of this Management Plan over the last 5 years (refer to paragraph 10.2 and 10.3).

10.2 ANNUAL RESULTS REPORT

As part of the annual reporting required under the Project Approval (Schedule 5, Condition 4) the Proponent will prepare an annual report based on all routine monitoring results collected during the previous 12 months. The Annual Report will consist of the following information:

- Summary of surface water monitoring results;
- Summary of groundwater monitoring results;
- Summary of site water balance comparisons (refer to paragraph 6.4);
- Comparison of relevant results against relevant performance criteria;
- Identify any non-compliance during the previous year;
- Conclusions about possible causes of trends and make recommendations where required including whether any follow up investigations are required; and
- State what remedial actions if any were being made in response to non-compliance.

10.3 GENERAL ANNUAL REPORTING

The Proponent must submit a report to the Department by the end of March each year reviewing the environmental performance of the Project to the satisfaction of the Secretary in accordance with Schedule 5 Condition 4 of the Project Approval. The review will:

(a) Describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;

(b) Include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against:

- The relevant statutory requirements, limits or performance measures/criteria;
- The monitoring results of the previous year; and
- The relevant predictions of the EA, EA (Mod 1) and EA (Mod 2);

(c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;

(d) Identify any trends in the monitoring data over the life of the Project;

(e) Identify any discrepancies between the predicted and actual impacts of the Project and analyse the cause of any significant discrepancies; and

(f) Describe what measures will be implemented over the current calendar year to improve the environmental performance of the Project.

Further in accordance with Schedule 5 Condition 5 of the Project Approval within 3 months of the submission of one of the following the Proponent must review and if necessary revise the strategies, plans and programs required under the Project Approval to the satisfaction of the Secretary:

(a) Annual review under Schedule 5 Condition 4 of the Project Approval;

(b) Incident report under Schedule 5 Condition 7 of the Project Approval;

(c) Audit report Schedule 5 Condition 9 of the Project Approval; and

(d) Any modifications to the Project Approval.

The Proponent in consultation with the Production Manager will implement any changes arising from reviews of the quarry strategies, plans and programs. Records of such reviews will be maintained. Details of any significant changes made to this Strategy and associated monitoring programs and monitoring plans will be forwarded to all relevant project personnel.

10.4 MAJOR REPORTING AND REVIEW OF SURFACE WATER MONITORING

After a period of 3-5 years of quarrying operations and the Proponent receiving consistent monitoring results from the surface water monitoring program it is proposed that site specific assessment criteria be established if the Proponent determines the pre-determined assessment criteria derived from the ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality are not suitable.

Annexure A – Updated Sediment Pond Calculations for Type D Basin Based 95 Percentile Rainfall Event

1. Site Data Sheet

Site Name:	**Champions Quarry**
Site Location:	**Tucki Tucki**
Precinct:	
Description of Site:	

Site area	Sub-catchments						Remarks
	Q1						
Total catchment area (ha)	14						
Disturbed catchment area (ha)	9						
Soil analysis (enter sediment type if known, or laboratory particle size data)							
Sediment Type (C, F or D) if known:	F						From Appendix C
% sand (fraction 0.02 to 2.00 mm)							Soil texture should be assessed through
% silt (fraction 0.002 to 0.02 mm)							mechanical dispersion only. Dispersing
% clay (fraction finer than 0.002 mm)							agents (e.g. Calgon) should not be used
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	F						Automatic calculation from above
Rainfall data							
Design rainfall depth (days)	5						See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	95						See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	95.3						See Section 6.3.4 (h)
Rainfall R-factor (if known)	4360						See Appendix B
IFD: 2-year, 6-hour storm (if known)	14.1						See IFD chart for the site
RUSLE Factors							
Rainfall erosivity (*R*-factor)	4360						Auto-filled from above
Soil erodibility (*K*-factor)	0.06						
Slope length (m)	80						
Slope gradient (%)	5						RUSLE LS factor calculated for a high
Length/gradient (*LS*-factor)	1.19						rill/interrill ratio.
Erosion control practice (*P*-factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C*-factor)	1	1	1	1	1	1	
Calculations							
Soil loss (t/ha/yr)	404						
Soil Loss Class	4						See Section 4.4.2(b)
Soil loss (m^3/ha/yr)	311						
Sediment basin storage volume, m^3	475						See Sections 6.3.4(i) and 6.3.5 (e)

4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$V = 10 \times C_v \times A \times R_{x\text{-day},\, y\text{-\%ile}}$ (m^3)

where:

10 = a unit conversion factor

C_v = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

$R_{x\text{-day},\, y\text{-\%ile}}$ = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

Sediment Storage Zone Volume

In the detailed calculation on Soil Loss Classes 1 to 4 lands, the sediment storage zone can be taken as 50 percent of the settling zone capacity. Alternately designers can design the zone to store the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)). However, on Soil Loss Classes 5, 6 and 7 lands, the zone must contain the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(iii).

Place an "X" in the box below to show the sediment storage zone design parameters used here:

	50% of settling zone capacity,
X	2 months soil loss calculated by RUSLE

Total Basin Volume

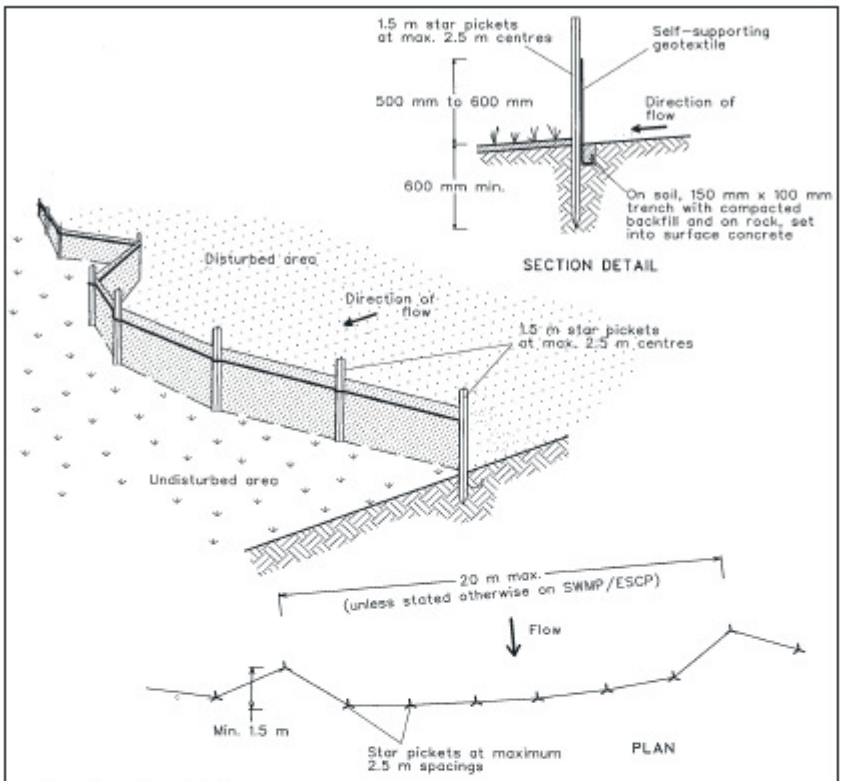
Site	C_v	$R_{x\text{-day, y-\%ile}}$	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)
Q1	0.90	95.3	14	12007.8	475	12482.8

Note that designers should achieve a minimum 3:1 length:width ratio in Type D or F basins

Annexure B – Examples of Erosion Sediment Control Measures (Annexure G (Erosion Sediment Control Measures) of Annexure I of the EA)

Annex G

Erosion Sediment Control Measures

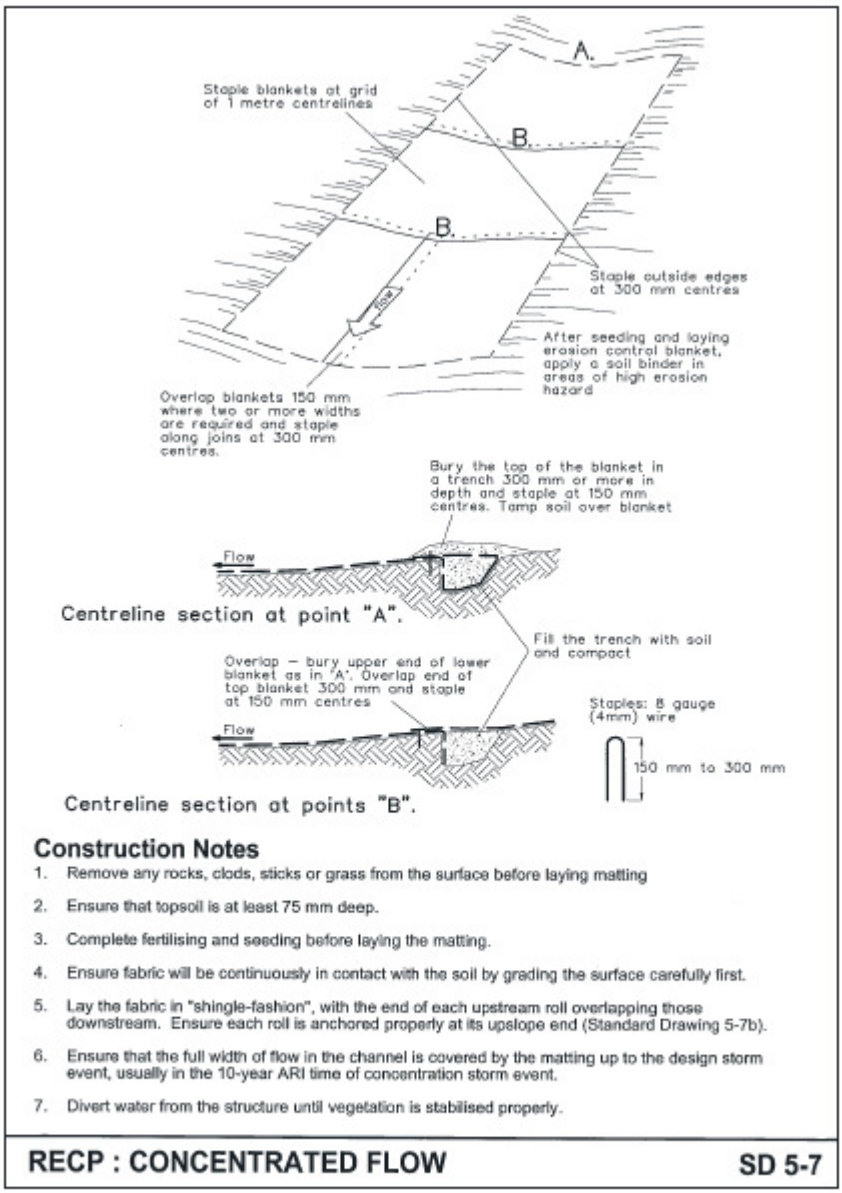


Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE **SD 6-8**

6-36

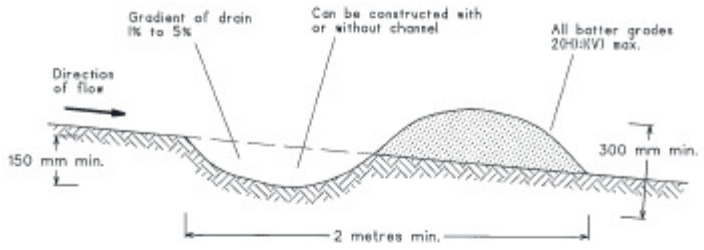


Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

RECP : CONCENTRATED FLOW **SD 5-7**

5-28



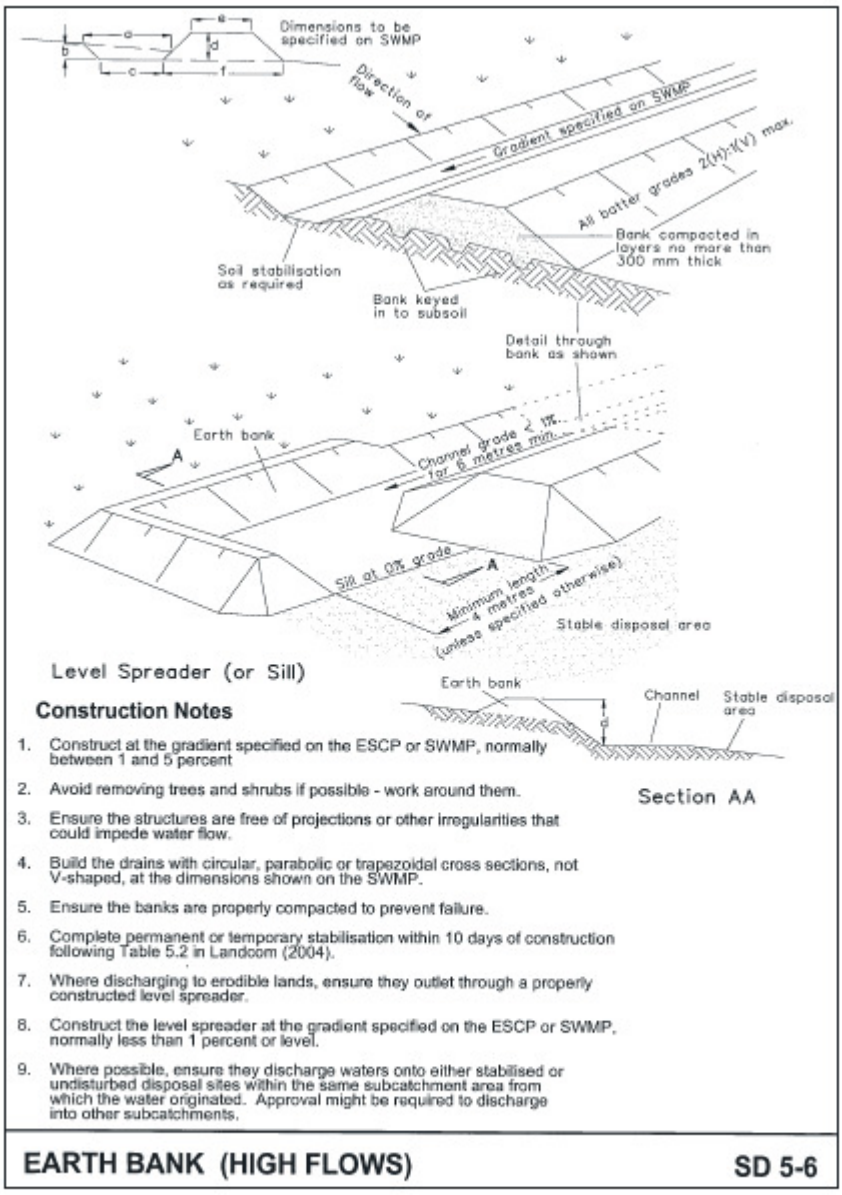
NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW) **SD 5-5**

5-25

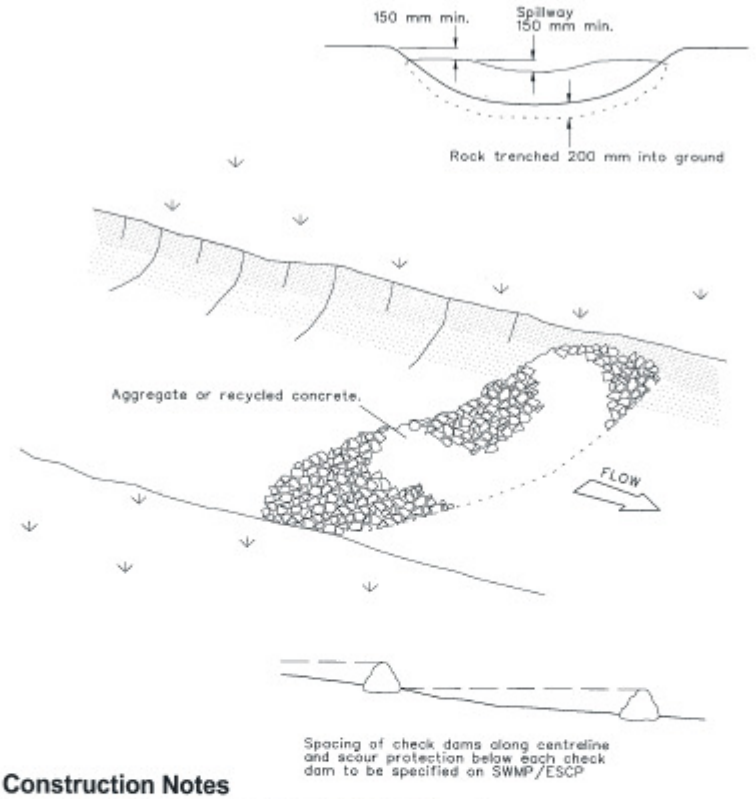


Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

EARTH BANK (HIGH FLOWS) **SD 5-6**

5-26

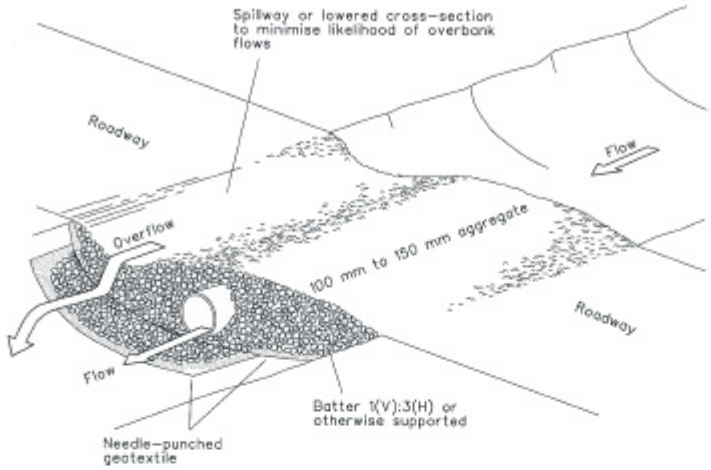


Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM **SD 5-4**

5-22

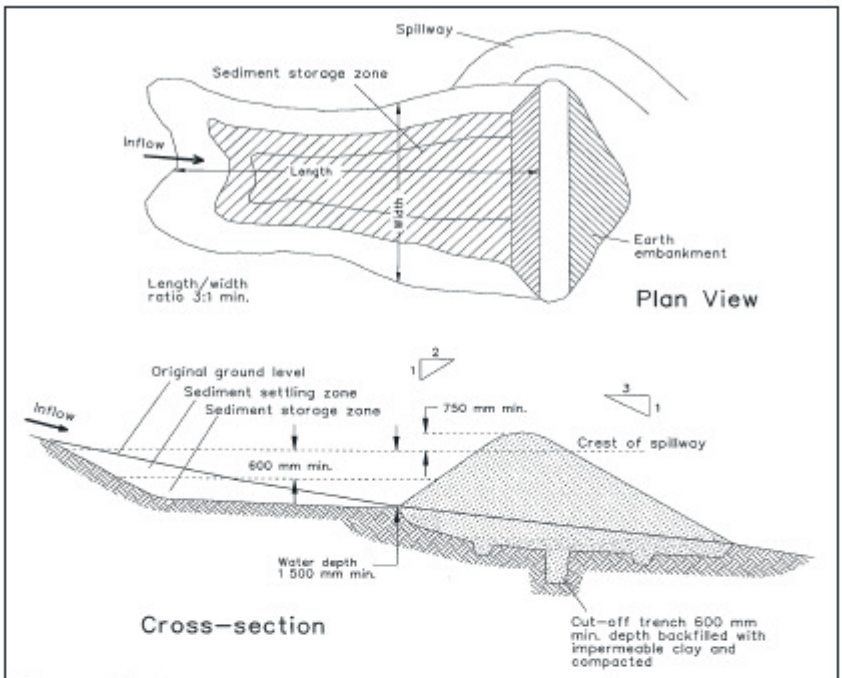


Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

TEMPORARY WATERWAY CROSSING **SD 5-1**

5-14



Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET
(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

6-19

Annexure C – An Overview of the Surface Water and Groundwater Testing Analytical Results 2008 (Extracted from Annexure H (EAL Laboratory Analytical Reports) of Annexure I of the EA)

RESULTS OF WATER ANALYSIS (Page 1 of 1)

4 groundwater samples collected by EAL for Champions Quarry on the 29th January, 2008 - Lab. Job No. E8661

Analysis requested by Geoff Champion - **Your Project: Predevelopment Monitoring**

PARAMETER	METHODS REFERENCE	Sample 1 BH 2	Sample 2 BH 3	Sample 3 BH 5	Sample 4 BH 6
	Job No.	*E8661/1*	*E8661/2*	*E8661/3*	*E8661/4*
Redox (mV)	field	-10.7	323.6	55.3	137.2
pH	APHA 4500-H+-B	6.20	3.84	6.18	5.51
CONDUCTIVITY (EC) (dS/m)	APHA 2510-B	0.21	0.34	0.42	0.12
TOTAL DISSOLVED SALTS (mg/L)	calculation using EC x 680	141	233	285	83
TOTAL SUSPENDED SOLIDS (mg/L)	GFC equiv. filter - APHA 2540-D	16	2	<0.5	11
WATER HARDNESS (mg/L $CaCO_3$ equivalent)	** using Ca&Mg calculation	17	22	22	4
TOTAL PHOSPHORUS (mg/L P)	APHA 4500 P-H	0.06	0.02	0.04	0.09
ORTHOPHOSPHATE (mg/L P)	APHA 4500 P-G	0.01	0.01	0.03	0.03
TOTAL NITROGEN (mg/L N)	APHA 4500 N-C	7.49	1.11	0.52	3.00
TOTAL KJELDAHL NITROGEN (mg/L N)	CALCULATION: TN - NOx	7.48	1.01	0.48	2.98
NITRATE (mg/L N)	APHA 4500 NO_3^--F	0.012	0.086	0.030	0.025
NITRITE (mg/L N)	APHA 4500 NO_2^--C	0.003	0.009	0.003	0.001
AMMONIA (mg/L N)	APHA 4500 NH_3-H	<0.005	0.129	<0.005	0.016
SODIUM (mg/L)	** APHA 3120 ICPOES[note 2]	25.1	29.7	62.7	17.5
POTASSIUM (mg/L)	** APHA 3120 ICPOES[note 2]	1.8	1.5	1.4	1.0
CALCIUM (mg/L)	** APHA 3120 ICPOES[note 2]	1.6	1.4	4.4	0.2
MAGNESIUM (mg/L)	** APHA 3120 ICPOES[note 2]	3.3	4.5	2.8	0.8
SODIUM ABSORPTION RATIO	BY CALCULATION	2.6	2.7	5.8	3.9
CHLORIDE (mg/L)	** APHA 4500-Cl^-	37	47	56	19
SULPHATE (mg/L SO_4^{2-})	** APHA 3120 ICPOES[note 2]	9	38	49	10
CHLORIDE/ SULPHATE RATIO	Calculation	4.0	1.2	1.1	1.9
SILVER (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	<0.001
ALUMINIUM (mg/L)	** APHA 3120 ICPMS/OES[note 1&2]	1.061	0.385	0.056	0.665
ARSENIC (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	<0.001
CADMIUM (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	0.002
CHROMIUM (mg/L)	** APHA 3120 ICPMS[note 1&2]	0.004	0.001	<0.001	0.003
COPPER (mg/L)	** APHA 3120 ICPMS[note 1&2]	0.009	0.007	<0.001	0.005
IRON (mg/L)	** APHA 3120 ICPMS/OES[note 1&2]	7.660	3.495	1.857	2.715
MANGANESE (mg/L)	** APHA 3120 ICPMS/OES[note 1&2]	0.454	1.929	0.734	0.185
NICKEL (mg/L)	** APHA 3120 ICPMS[note 1&2]	0.011	0.008	0.002	0.011
LEAD (mg/L)	** APHA 3120 ICPMS[note 1&2]	0.004	0.006	<0.001	0.002
SELENIUM (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	0.002	0.002	<0.001
ZINC (mg/L)	** APHA 3120 ICPMS[note 1&2]	0.102	0.080	0.015	0.063
MERCURY (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	<0.001
BTEX					
Benzene (µg/L)	subcontracted - results attached	<1	<1	<1	<1
Toluene (µg/L)	subcontracted - results attached	2	<1	<1	<1
Ethylbenzene (µg/L)	subcontracted - results attached	<1	<1	<1	<1
Meta-And-Para-Xylene (µg/L)	subcontracted - results attached	<2	<2	<2	<2
Ortho-Xylene (µg/L)	subcontracted - results attached	<1	<1	<1	<1
Volatile Halogenated Compounds (VHC's)	subcontracted - results attached	N.D	N.D	N.D	N.D
Bis (2-ethylhexyl) phthlate (SVOC) (µg/L)	subcontracted - results attached	80	<20	<20	<20
Semivolatile Organic Compounds (SVOC's)	subcontracted - results attached	N.D	N.D	N.D	N.D
Total Petroleum Hydrocarbons (TPH)					
C10-C14 Fraction (µg/L)	subcontracted - results attached	47,700	190	<50	690
C15-C28 Fraction (µg/L)	subcontracted - results attached	28,800	<200	<200	420
C28-C36 Fraction (µg/L)	subcontracted - results attached	4,450	80	<50	110
SUM C10-C36 (µg/L)		80,950	270	..	1,220

Notes:

1a. Total Available metals - samples acidified with nitric acid and then filtered through 0.45µm cellulose acetate

2. Metals/ salts analysed by ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) or ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry)

3. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 µg/L (micrograms per litre)= 1000 ppb (part per billion)

4. For conductivity - 1 dS/m = 1 mS/cm = 1000 µS/cm

5. No other pesticides occurred above reportable levels for chemicals screened in the attached list

6. For Bacteria - cfu= colony forming unit

7. Analysis performed according to APHA, 1998, "Standard Methods for the Examination of Water & Wastewater", 20th Edition, except where stated otherwise.

8. Analysis conducted between sample arrival date and Report provision date

9. ** denotes these test procedures are as yet not NATA registered but quality control data is available

10. N.D = Not detected

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RESULTS OF WATER ANALYSIS (Page 1 of 1)

6 samples collected by EAL for Champions Quarry on the 20th February, 2008 - Lab. Job No. E8792

Analysis requested by Geoff Champion - Your Project: Confirmation Sampling

PARAMETER	METHODS REFERENCE	Sample 1 Hazlemount Ln Culvert	Sample 2 SW3	Sample 3 S4	Sample 4 BH2	Sample 3 BH3	Sample 4 BH6
	Job No.	*E8792/1*	*E8792/2*	*E8792/3*	*E8792/4*	*E8792/5*	*E8792/6*
Total Petroleum Hydrocarbons (TPH)							
C10-C14 Fraction (µg/L)	subcontracted - results attached	<50	<50	<50	<50	90	<50
C15-C28 Fraction (µg/L)	subcontracted - results attached	<200	<200	<200	<200	<200	<200
C28-C36 Fraction (µg/L)	subcontracted - results attached	<50	<50	<50	70	<50	<50
SUM C10-C36 (µg/L)		..	..	..	70	90	..

Notes:

1a. Total Available metals - samples acidified with nitric acid and then filtered through 0.45µm cellulose acetate

2. Metals/ salts analysed by ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) or ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry)

3. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 µg/L (micrograms per litre)= 1000 ppb (part per billion)

4. For conductivity - 1 dS/m = 1 mS/cm = 1000 µS/cm

5. No other pesticides occurred above reportable levels for chemicals screened in the attached list

6. For Bacteria - cfu= colony forming unit

7. Analysis performed according to APHA, 1998, "Standard Methods for the Examination of Water & Wastewater", 20th Edition, except where stated otherwise.

8. Analysis conducted between sample arrival date and Report provision date

9. ** denotes these test procedures are as yet not NATA registered but quality control data is available

10. N.D = Not detected

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RESULTS OF WATER ANALYSIS (Page 1 of 1)

4 surface water samples collected by EAL for Champions Quarry on the 1st February, 2008 - Lab. Job No. E8684
Analysis requested by Geoff Champion - **Your Project: Predevelopment Monitoring**

PARAMETER	METHODS REFERENCE	Sample 1 SW1	Sample 2 SW2	Sample 3 SW3	Sample 4 SW4
	Job No.	*E8684/1*	*E8684/2*	*E8684/3*	*E8684/4*
Redox (mV)	field	216.8	214.8	113.0	-55.1
pH	Field meter	6.42	6.44	5.80	6.16
CONDUCTIVITY (EC) (dS/m)	Field meter	0.13	0.13	0.20	0.32
TOTAL DISSOLVED SALTS (mg/L)	calculation using EC x 680	88	88	136	215
DISSOLVED OXYGEN (mg/L O_2)	Field meter	6.0	7.1	1.0	1.3
TURBIDITY (ntu)	Field meter	4.3	7.5	139.0	46
TOTAL SUSPENDED SOLIDS (mg/L)	GFC equiv. filter - APHA 2540-D	4	4	26	16
WATER HARDNESS (mg/L $CaCO_3$ equivalent)	** using Ca&Mg calculation	22	22	30	29
TOTAL PHOSPHORUS (mg/L P)	APHA 4500 P-H	0.08	0.07	0.13	0.18
ORTHOPHOSPHATE (mg/L P)	APHA 4500 P-G	0.01	0.01	0.01	<0.01
TOTAL NITROGEN (mg/L N)	APHA 4500 N-C	0.34	0.31	1.49	1.59
TOTAL KJELDAHL NITROGEN (mg/L N)	CALCULATION: TN - NOx	0.31	0.28	1.48	1.58
NITRATE (mg/L N)	APHA 4500 NO_3^--F	0.023	0.029	0.010	0.001
NITRITE (mg/L N)	APHA 4500 NO_2^--C	0.001	0.003	<0.001	0.007
AMMONIA (mg/L N)	APHA 4500 NH_3-H	0.018	0.014	0.009	0.009
SODIUM (mg/L)	** APHA 3120 ICPOES[note 2]	15.9	16.0	19.1	29.0
POTASSIUM (mg/L)	** APHA 3120 ICPOES[note 2]	1.1	0.8	1.2	3.1
CALCIUM (mg/L)	** APHA 3120 ICPOES[note 2]	3.5	3.6	4.8	3.3
MAGNESIUM (mg/L)	** APHA 3120 ICPOES[note 2]	3.1	3.2	4.4	4.9
SODIUM ABSORPTION RATIO	BY CALCULATION	1.5	1.5	1.5	2.4
CHLORIDE (mg/L)	** APHA 4500-Cl^-	23	22	32	47
SULPHATE (mg/L SO_4^{2-})	** APHA 3120 ICPOES[note 2]	3	3	4	3
CHLORIDE/ SULPHATE RATIO	Calculation	7.5	7.3	8.0	15.8
SILVER (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	<0.001
ALUMINIUM (mg/L)	** APHA 3120 ICPMS/OES[note 1&2]	0.046	0.056	0.194	0.255
ARSENIC (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	0.001	0.002
CADMIUM (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	0.002
CHROMIUM (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	0.001	0.002
COPPER (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	<0.001
IRON (mg/L)	** APHA 3120 ICPMS/OES[note 1&2]	2.264	2.340	15.940	56.280
MANGANESE (mg/L)	** APHA 3120 ICPMS/OES[note 1&2]	0.086	0.068	1.756	1.081
NICKEL (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	0.001
LEAD (mg/L)	** APHA 3120 ICPMS[note 1&2]	0.004	0.006	<0.001	0.002
SELENIUM (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	0.001
ZINC (mg/L)	** APHA 3120 ICPMS[note 1&2]	0.009	0.003	0.005	0.023
MERCURY (mg/L)	** APHA 3120 ICPMS[note 1&2]	<0.001	<0.001	<0.001	<0.001
BTEX					
Benzene (µg/L)	subcontracted - results attached	<1	<1	<1	<1
Toluene (µg/L)	subcontracted - results attached	<1	<1	<1	30
Ethylbenzene (µg/L)	subcontracted - results attached	<1	<1	<1	<1
Meta-And-Para-Xylene (µg/L)	subcontracted - results attached	<2	<2	<2	<2
Ortho-Xylene (µg/L)	subcontracted - results attached	<1	<1	<1	<1
Volatile Halogenated Compounds (VHC's)	subcontracted - results attached	N.D	N.D	N.D	N.D
Semivolatile Organic Compounds (SVOC)	subcontracted - results attached	N.D	N.D	N.D	N.D
Total Petroleum Hydrocarbons (TPH)					
C10-C14 Fraction (µg/L)	subcontracted - results attached	<50	<50	9,180	<50
C15-C28 Fraction (µg/L)	subcontracted - results attached	<200	<200	60,300	<200
C28-C36 Fraction (µg/L)	subcontracted - results attached	<50	<50	740	120
SUM C10-C36 (µg/L)		..	..	70,220	120

Notes:

1a. Total Available metals - samples acidified with nitric acid and then filtered through 0.45µm cellulose acetate
2. Metals/ salts analysed by ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) or ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry)
3. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 µg/L (micrograms per litre)= 1000 ppb (part per billion)
4. For conductivity - 1 dS/m = 1 mS/cm = 1000 µS/cm
5. No other pesticides occurred above reportable levels for chemicals screened in the attached list
6. For Bacteria - cfu= colony forming unit
7. Analysis performed according to APHA, 1998, "Standard Methods for the Examination of Water & Wastewater", 20th Edition, except where stated otherwise.
8. Analysis conducted between sample arrival date and Report provision date
9. ** denotes these test procedures are as yet not NATA registered but quality control data is available
10. N.D = Not detected

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Annexure D – Summary Groundwater Level Gauging Data (Annexure D (Summary Groundwater Level Gauging Data) of Annexure I of the EA)

Annex D

Summary Groundwater Level Gauging Data

GEOTALST01597AB **Champion's Quarry**

Borehole Completion Details

Borehole	GPS to WGS1984 UTM 56J		Date Commenced	Date completed	Surface Level (AHD)	Rotary Drilling Depth		Rock Coring Depth		Standing Water Level Depth (m)	Measurement Date	Notes	Piezometer Installed?
	m E	m N				Start (m)	End (m)	Start (m)	End (m)				
BH1	531336	6798300	12/10/2007	12/10/2007	29.3	0.0	1.0	1.0	20.3	10.8	15/10/2007 8:30	level during drilling	No
										10.45	23/10/2007	level at completion of drilling program	
BH2	531199	6798403	15/10/2007	15/10/2007	28.7	0.0	1.0	1.0	20.3	3.2	16/10/2007 8:30	level during drilling	Piezo to 20m, Slotted and Filtersock 14m-20m, Sand backfilled, Bentonite Plug from 0m - 0.5m
										3.3	23/10/2007	level at completion of drilling program	
										1.2	18/01/2008	level following significant January rainfalls	
BH3	531657	6797945	16/10/2007	16/10/2007	36.2	0.0	1.2	1.2	21.7	4.8	17/10/2007	level during drilling	Piezo to 21.5m, Slotted and Filtersock 15.5m-21.5m, Sand backfilled, Bentonite Plug from 0m - 0.5m
										10.33	23/10/2007	level at completion of drilling program	
										7.3	18/01/2008	level following significant January rainfalls	
BH4	531440	6797931	17/10/2007	19/10/2007	50.2	0.0	1.0	1.0	42.3	3.8	18/10/2007 8:30	level during drilling	No
										9.55	19/10/2007 8:30	level during drilling	
										9.41	22/10/2007 10:00	level 3 days after drilling hole finished	
										9.52	23/10/2007	level at completion of drilling program	
										2.7	18/01/2008	level following significant January rainfalls	
BH5	531105	6797994	22/10/2007	23/10/2007	49.2	0.0	1.3	1.3	41.6	4.8	23/10/2007 15:30	level at completion of drilling program, note level rising during day so levels thought to be unreliable.	Piezo to 41.6m, Slotted and Filtersock 35.6m-41.6m, Sand backfilled, Bentonite Plug from 0m - 0.5m
										5.8	23/10/2007 8:00		
										6.4	18/01/2008	level following significant January rainfalls	
BH6	531450	6797729	22/10/2007	22/10/2007	29.2	0.0	1.0	1.0	22.0	17.8	23/10/2007 10:30	level at completion of drilling, but likely affected by drill water	Piezo to 22.0m, Slotted and Filtersock 16m-22m, Sand backfilled, Bentonite Plug from 0m - 0.5m
										1.1	18/01/2008	level following significant January rainfalls	

REFERENCES

- The Guideline for Preparation of Environmental Management Plans (Department of Infrastructure, Planning and Natural Resources, 2004);
- The Australia and New Zealand Guidelines for Fresh and Marine Waters Quality (ANZECC and ARMCANZ, 2000);
- Managing Urban Stormwater – Soils and Construction 'Blue Book' (Landcom, NSW 2004);
- The Soil Landscape of the Lismore-Ballina 1:100,000 Sheet (Morand, 1994)
- EA – Champions Quarry Expansion, Environmental Assessment Report prepared by ERM Pty Limited and dated February 2010;
- Champions Quarry Soil and Water Management Plan by ERM dated February 2010 forming part of the Environmental Assessment Report dated 25 February 2010 (Appendix I of the EA);
- Champions Quarry Response to Submissions, prepared by ERM Pty Limited and dated September 2010;
- Applicants Statement of Evidence on Groundwater and Hydrogeology by Environmental Auditing Expert Hydrogeologist Jan Rasmussen dated 5 July 2010;
- Applicants Evidence in Reply on Groundwater and Hydrogeology by Environmental Auditing Expert Hydrogeologist Jan Rasmussen dated 1 December 2010;
- Applicants Evidence in Reply – Groundwater and Hydrogeology Rehabilitated Slope Stability and Erosion by Professor Wayne Erskine dated 3 December 2010;
- Preferred Project Report – Champions Quarry Expansion, Preferred Project Report prepared by ERM Pty Limited and dated December 2011;
- Planning and Assessment Commission of NSW Conditions of Approval dated August 30, 2012;
- Minister for Planning and Infrastructure - Notice of Modification dated October 29, 2013; and
- Minister for Planning - Notice of Modification dated September 16, 2016.