



SOIL AND WATER MANAGEMENT PLAN

Wallerawang Quarry

FINAL

April 2019



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Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Walker Quarries Pty Limited

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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V0*	Alex Irwin	8 February 2019	Alex Irwin	26 February 2019
V1	Alex Irwin	1 April 2019	Alex Irwin	1 April 2019

Note * V0 represents the first version of this plan prepared by Umwelt Pty Ltd. This follows from Rev 4 produced by RW Corkery & Co. Pty Limited

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1.0 Scope

This Soil and Water Management Plan (SWMP) for the Wallerawang Quarry (the Quarry) has been reviewed and updated by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Walker Quarries Pty Limited (Walker Quarries) in accordance with *Condition 3(18)* of the Development Consent DA 344-11-2001. The SWMP synthesises the recommendations made during the preparation of an *Environmental Impact Statement* (EIS) for development of the Quarry (Pacrim, 2001), an *Environmental Assessment* for a modification to DA 344-11-2001 (RWC, 2017), the conditions of DA 344-11-2001 and Environment Protection Licence (EPL) 13172 and the document *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th eds.* (Landcom, 2004) and *Volume 2E Mines and Quarries* (DECC, 2008), hereafter referred to as the “Blue Book”.

The Quarry is located approximately 8 kilometres (km) northwest of Lithgow (see **Figure1.1**) and comprises a total disturbed area of approximately 11 hectares (ha). The Quarry is approved to produce 500 000 tonnes per year (tpa) of quartzite, rock aggregate material and sand for use principally in the Wallerawang, Lithgow, Blue Mountains and Sydney regions.

The original version of this SWMP was prepared in consultation with the Environment Protection Authority (EPA), Department of Industry – Office of Water (DOI-Water) (formerly Department of Primary Industries – Water) and WaterNSW. Matters raised by these agencies were considered and addressed as part of the preparation of the original SWMP (see **Appendix 2**). This version of the SWMP (V0) has been prepared following the approval of a modification to DA 344 11 2001 on 7 December 2018 and is the first version of the SWMP prepared by Umwelt. **Table 1.1** provides the full history of SWMP revisions.

Table 1.1 Document Status History

Rev No.	Prepared by		Purpose
	Name	Date	
0	P. Hensley	October 2014	Draft submitted to department prior to commencement
1	RW Corkery & Co	September 2016	Updated and approved following first IEA
2	RW Corkery & Co	November 2017	Updated following Modification 1 (issued August 2017)
3	RW Corkery & Co	September 2018	Updated Following 2 nd IEA
4	RW Corkery & Co	November 2018	Updated following 2018 Annual Review
V0	Alex Irwin	February 2019	Updated following Modification 2 (issued December 2018)
V1	Alex Irwin	April 2019	Updated following DPE Review (March 2019)

2.0 Site Description and Operations

Figure 2.1 displays the layout of the Quarry. Detailed information regarding approved activities is available in the following documents:

- Environmental Assessment for the Modification to the Operations at the Wallerawang Quarry (DA 344-11-2001), dated May 2017 (RWC, 2017).
- Statement of Environmental Effects (SEE) for Proposed Modification No 2 (MOD 2) to DA 344-11-2001 (Wallerawang Quarry), dated October 2018 and approved December 2018 (RWC, 2018).
- Wallerawang Quarry Mining Operations Plan, for the period 15 May 2018 to 15 December 2019 (RWC, 2018).

In general, the following activities are undertaken, subject to market demand:

- Where it can be accessed, topsoil will be stripped and stockpiled for use in rehabilitation activities. Vegetation that is cleared will be selectively placed within areas being revegetated to take advantage of the existing seed bank, where available.
- Raw material is extracted using conventional drill and blast, load and haul methods.
- Overburden material is temporarily stockpiled within the footprint of the open cut from where it is either used within the site for approved construction activities or sold for use as road base materials.
- Processing of raw material involving crushing, screening and washing using fixed or mobile plant to meet customer requirements.
- Product transportation involves loading of road registered trucks. Trucks then enter the Great Western Highway directly from the Quarry Site entrance.
- Progressive rehabilitation of eastern slopes of the extraction area and rehabilitation of the remaining landform at Quarry closure in accordance with the approved Mining Operations Plan (MOP).

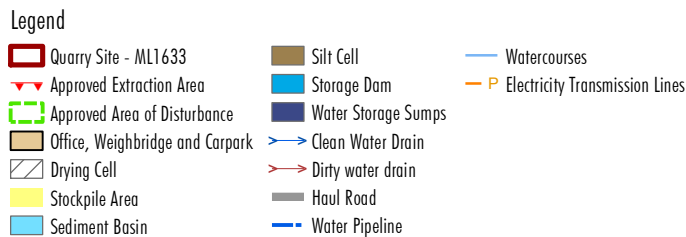
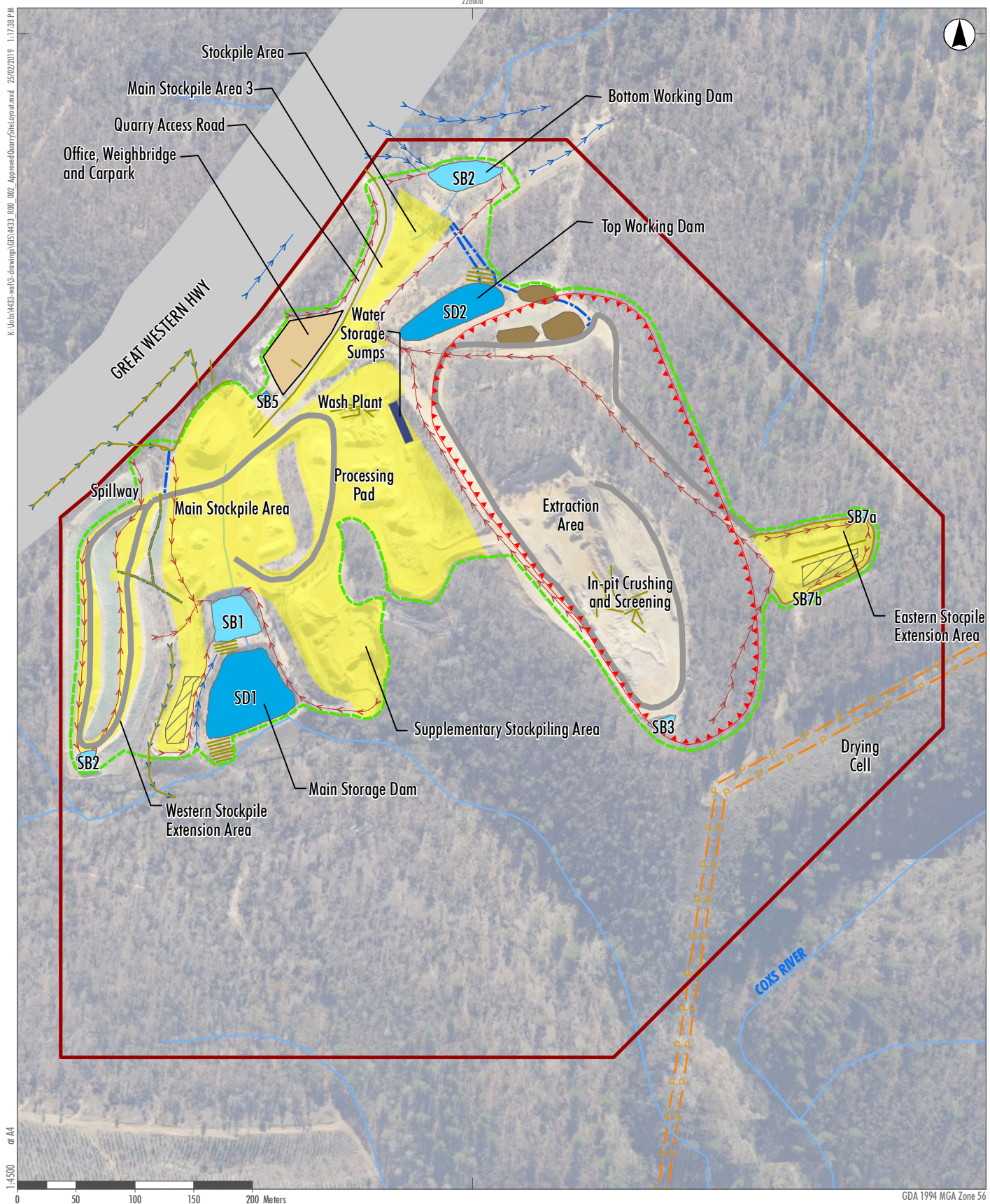


FIGURE 2.1

Approved Quarry Site Layout

3.0 Regulatory Requirements

3.1 Development Consent DA 344-11-2001 (as modified)

Conditions 3(16) and 3(17) of DA 344-11-2001 (as modified on 7 December 2018) provide instructions as to the requirements of Walker Quarries in relation to soil and water management. Condition 3(18) requires the preparation of a Soil and Water Management Plan. Conditions 5(3) to 5(5) provide instruction on the preparation, review and amendment to consent required management plans.

Table 3.1 identifies each of these conditional requirements and identifies the section of this SWMP where each is addressed.

Table 3.1 Conditional Requirements for Soil and Water Management Plan of DA 344-11-2001

No	Condition	Section
Water Supply		
3(16)	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations under the consent to match its available water supply, to the satisfaction of the Secretary.	5.2
Water Discharges		
3(17)	The Applicant must comply with the discharge limits in any EPL, or with section 120 of the POEO Act.	3.2, 4
Soil and Water Management Plan		
3(18)	<p>The Applicant must prepare a Soil and Water Management Plan for the development to the satisfaction of the Secretary. This plan must:</p> <ul style="list-style-type: none"> (a) be prepared by suitably qualified and experienced person/s approved by the Secretary; (b) be prepared in consultation with the EPA, DPI Water and WaterNSW; (c) be submitted to the Secretary for approval within three months of the determination of Modification 1, unless otherwise agreed by the Secretary; and (d) include a: <ul style="list-style-type: none"> • Site Water Balance that includes: <ul style="list-style-type: none"> – details of: <ul style="list-style-type: none"> ▪ sources and security of water supply; ▪ water use and management on site; ▪ any off-site water transfers; and ▪ reporting procedures; and – measures to be implemented to minimise clean water use on site; 	<p>App 1</p> <p>App 2</p> <p>Noted</p> <p>7.1, 7.3.1, 7.3.3</p> <p>7.2, 7.3.2</p> <p>N/A</p> <p>10.7</p> <p>6</p>

No	Condition	Section
	<ul style="list-style-type: none"> Surface Water Management Plan, that includes: <ul style="list-style-type: none"> a program for obtaining detailed baseline data on surface water flows and quality in water bodies that could potentially be affected by the development; a detailed description of the surface water management system on site including the: <ul style="list-style-type: none"> clean water diversion system; erosion and sediment controls; dirty water management system; and water storages; and a program to monitor and report on: <ul style="list-style-type: none"> any surface water discharges; the effectiveness of the water management system, the quality of water discharged from the site to the environment; surface water flows and quality in local watercourses; Groundwater Management Plan that includes: <ul style="list-style-type: none"> a provision that requires the Applicant to obtain appropriate water licence(s) to cover the volume of any unforeseen groundwater inflows into the quarry from the quarry face or floor; and a monitoring program to manage potential impacts, if any, on any alluvium and associated surface water source near the proposed extraction area that includes: <ul style="list-style-type: none"> identification of a methodology for determining threshold water level criteria; contingency measures in the event of a breach of thresholds; and a program to regularly report on monitoring. <p>The Applicant must implement the approved SWMP as approved from time to time by the Secretary.</p>	<p>10.2.1, 10.3.1</p> <p>6 & App 3</p> <p>9.2</p> <p>9.3, 9.4</p> <p>8, 9</p> <p>5.2</p> <p>10.1, 10.2.1, 10.3.1, 10.4.1</p> <p>3.3</p> <p>10.1, 10.2.2, 10.3.2, 10.4.2</p> <p>Noted</p>
Management Plan Requirements		
5(3)	The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:	
	(a) detailed baseline data;	5.1.1
	(b) a description of:	
	<ul style="list-style-type: none"> the relevant statutory requirements (including any relevant approval, licence or lease conditions); 	3
	<ul style="list-style-type: none"> any relevant limits or performance measures/criteria; and 	10.4
	<ul style="list-style-type: none"> the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures; 	10
	(c) a description of the measures that to be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	6, 9
	(d) a program to monitor and report on the: <ul style="list-style-type: none"> impacts and environmental performance of the development; and effectiveness of any management measures (see (c) above); 	10

No	Condition	Section
	(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	10.6
	(f) a program to investigate and implement ways to improve the environmental performance of the development over time;	10.6, 11, 12.1
	(g) a protocol for managing and reporting any: <ul style="list-style-type: none"> incidents; complaints; non-compliances with statutory requirements; and exceedances of the impact assessment criteria and/or performance criteria; and a protocol for periodic review of the plan. 	13
5(4)	The Applicant must continue to apply existing approved management plans, strategies or monitoring programs that have most recently been approved under this consent, until the approval of a similar plan, strategy or program under this consent.	13.3
5(5)	Within 3 months of the submission of an: <ul style="list-style-type: none"> (a) incident report under condition 9 below; (b) Annual Review under condition 11 below; (c) audit report under condition 12 below; and (d) any modifications to this consent, the Applicant must review the strategies, plans and programs required under this consent, to the satisfaction of the Secretary. The applicant must notify the Department in writing of any such review being undertaken. Where this review leads to revisions in any such document, then within 6 weeks of the review the revised document must be submitted for the approval of the Secretary.	App 2

3.2 Environment Protection Licence EPL - 13172

Environment Protection Licence 13172 (EPL 13172) contains a number of conditional requirements related to the prevention of pollution of or to water. **Table 3.2** identifies each of these conditional requirements and identifies the section of this SWMP where each is addressed.

Table 3.2 Conditional Requirements for Prevention of Pollution (Water) of EPL 13172

No	Condition	Section												
P1 Location of Monitoring/Discharge Points and Areas														
P1.3	The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.													
	<table><tr><th>EPA ID. No</th><th>Type of Monitoring Point</th><th>Type of Discharge Point</th><th>Location Description</th></tr><tr><td>1</td><td>Discharge to waters; Discharge quality monitoring.</td><td>Discharge to waters; Discharge quality monitoring.</td><td>Overflow from settlement dam to unnamed tributary of Coks River as shown by point "SD1" in Figure 4 "Surface Water Monitoring Locations" Wallerawang Quarry Soil and Water Management Plan Report Np 949/02f – January 2018".</td></tr><tr><td>2</td><td>Discharge to waters; Discharge quality monitoring.</td><td>Discharge to waters; Discharge quality monitoring.</td><td>Overflow from settlement dam to unnamed tributary of Coks River as shown by point "SB2" in Figure 4 "Surface Water Monitoring Locations" Wallerawang Quarry Soil and Water Management Plan Report Np 949/02f – January 2018".</td></tr></table>	EPA ID. No	Type of Monitoring Point	Type of Discharge Point	Location Description	1	Discharge to waters; Discharge quality monitoring.	Discharge to waters; Discharge quality monitoring.	Overflow from settlement dam to unnamed tributary of Coks River as shown by point "SD1" in Figure 4 "Surface Water Monitoring Locations" Wallerawang Quarry Soil and Water Management Plan Report Np 949/02f – January 2018".	2	Discharge to waters; Discharge quality monitoring.	Discharge to waters; Discharge quality monitoring.	Overflow from settlement dam to unnamed tributary of Coks River as shown by point "SB2" in Figure 4 "Surface Water Monitoring Locations" Wallerawang Quarry Soil and Water Management Plan Report Np 949/02f – January 2018".	10.2
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1	Discharge to waters; Discharge quality monitoring.	Discharge to waters; Discharge quality monitoring.	Overflow from settlement dam to unnamed tributary of Coks River as shown by point "SD1" in Figure 4 "Surface Water Monitoring Locations" Wallerawang Quarry Soil and Water Management Plan Report Np 949/02f – January 2018".											
2	Discharge to waters; Discharge quality monitoring.	Discharge to waters; Discharge quality monitoring.	Overflow from settlement dam to unnamed tributary of Coks River as shown by point "SB2" in Figure 4 "Surface Water Monitoring Locations" Wallerawang Quarry Soil and Water Management Plan Report Np 949/02f – January 2018".											

No	Condition	Section																														
L1 Pollution of Waters																																
L1.1	Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the <i>Protection of the Environment Operations Act 1997</i> .	10.4																														
L2 Concentration Limits																																
L2.1	For each monitoring/discharge point or utilisation area specified in the table\ below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area must not exceed the concentration limits specified for that pollutant in the table.	10.4																														
L2.2	Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.	10.4																														
L2.3	To avoid any doubt, this condition does not authorize the pollution of waters by any pollutant other than those specified in the table\.	10.4																														
L2.4	Water and Land Concentration Limits. <table><tr><th>Pollutant</th><th>Units of Measure</th><th>50th percentile concentration limit</th><th>90th percentile concentration limit</th><th>3DGM concentration limit</th><th>100th percentile concentration limit</th></tr><tr><td>Oil and grease</td><td>Milligrams per litre</td><td colspan="3"></td><td>10</td></tr><tr><td>pH</td><td>pH</td><td colspan="3"></td><td>6.5 – 8.5</td></tr><tr><td>Sulfate</td><td>Milligrams per litre</td><td colspan="3"></td><td>250</td></tr><tr><td>Total suspended solids</td><td>Milligrams per litre</td><td colspan="3"></td><td>30</td></tr></table>	Pollutant	Units of Measure	50 th percentile concentration limit	90 th percentile concentration limit	3DGM concentration limit	100 th percentile concentration limit	Oil and grease	Milligrams per litre				10	pH	pH				6.5 – 8.5	Sulfate	Milligrams per litre				250	Total suspended solids	Milligrams per litre				30	10.4
Pollutant	Units of Measure	50 th percentile concentration limit	90 th percentile concentration limit	3DGM concentration limit	100 th percentile concentration limit																											
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pH	pH				6.5 – 8.5																											
Sulfate	Milligrams per litre				250																											
Total suspended solids	Milligrams per litre				30																											
L2.5	The concentration limits stipulated by condition L2.4 for EPA identification points 1 and 2 are deemed not to apply when the discharge from the stormwater control structures (sediment dams) occurs solely as a result of rainfall measured at the premises which exceeds: a) A total of 56 mm of rainfall over any consecutive 5 day period.	10.4																														
L2.6	The concentration limit for total suspended solids stipulated by condition L2.4 for EPA identification points 1 and 2 are deemed not to apply where: a) The water discharged is covered by condition L2.5: OR b) When not covered by condition L2.5, the water discharged (in accordance with conditions O5.1 and O5.2) is within pH range 6.5 – 8.5 and has a turbidity (as measured in nephelometric turbidity units (NTU) using a hand held turbidity meter) of 25 NTU or less at the time of the discharge; and c) The EPA is advised within 3 working days of the completion of the sample testing and analysis as required by condition M2.2 of any results above the licence discharge limits specific under condition L2.4.	10.4																														
O4 Effluent Application to Land																																
O4.1	The quantity of effluent applied to the utilization areas(s) must not exceed the capacity of the utilization areas(s) to effectively utilise the effluent.	N/A (8)																														
O4.2	Effluent application to the utilization area(s) must not occur in a manner that causes surface run-off from the utilization areas(s).																															
O4.3	Spray from the effluent application to the utilizations area(s) must not drift beyond the boundary of the utilization area(s).																															

No	Condition	Section																								
O5 Other Operating Conditions																										
O5.1	The stormwater control structures (sediment dams) identified at Condition L2.4 EPA identification point 1 and 2 must be drained or pumped out as necessary to maintain each basins design storage capacity within 5 days following rainfall.	9 & App 3																								
O5.2	Water discharged to comply with condition O5.1 may only be discharged to waters from those stormwater control structures (sediment dams) identified at EPA identification point 1 and 2 where the discharged water complies with the discharge limits stipulated at condition L2.4 (and taking into consideration condition L2.6).																									
O5.3	The licensee must undertake maintenance as necessary to desilt any storage basin identified at EPA identification points 1 and 2 in order to retain each storage basins design storage capacity (the capacity to store 56mm of rainfall over any consecutive 5 day period).																									
M1 Monitoring Records																										
M1.1	The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.	10.7																								
M1.2	All records required to be kept by this licence must be: a) in a legible form, or in a form that can readily be reduced to a legible form; b) kept for at least 4 years after the monitoring or event to which they relate took place; and c) produced in a legible form to any authorised officer of the EPA who asks to see them.	10.6																								
M1.3	The following records must be kept in respect of any samples required to be collected for the purposes of this licence: a) the date(s) on which the sample was taken; b) the time(s) at which the sample was collected; c) the point at which the sample was taken; and d) the name of the person who collected the sample.	10.5																								
M2 Requirement to monitor concentration of pollutants discharged																										
M2.1	For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns.	10.6																								
M2.2	Water and/or Land Monitoring Requirements. <table><tr><th>Pollutant</th><th>Units of Measure</th><th>Frequency</th><th>Sampling Method</th></tr><tr><td>Conductivity</td><td>Microsiemens per centimetre</td><td>Monthly during discharge</td><td>Grab sample</td></tr><tr><td>Oil and Grease</td><td>Milligrams per litre</td><td>Monthly during discharge</td><td>Grab sample</td></tr><tr><td>pH</td><td>pH</td><td>Monthly during discharge</td><td>Grab sample</td></tr><tr><td>Sulfate</td><td>Milligrams per litre</td><td>Monthly during discharge</td><td>Grab sample</td></tr><tr><td>Total Suspended Solids</td><td>Milligrams per litre</td><td>Monthly during discharge</td><td>Grab sample</td></tr></table>	Pollutant	Units of Measure	Frequency	Sampling Method	Conductivity	Microsiemens per centimetre	Monthly during discharge	Grab sample	Oil and Grease	Milligrams per litre	Monthly during discharge	Grab sample	pH	pH	Monthly during discharge	Grab sample	Sulfate	Milligrams per litre	Monthly during discharge	Grab sample	Total Suspended Solids	Milligrams per litre	Monthly during discharge	Grab sample	10.3
Pollutant	Units of Measure	Frequency	Sampling Method																							
Conductivity	Microsiemens per centimetre	Monthly during discharge	Grab sample																							
Oil and Grease	Milligrams per litre	Monthly during discharge	Grab sample																							
pH	pH	Monthly during discharge	Grab sample																							
Sulfate	Milligrams per litre	Monthly during discharge	Grab sample																							
Total Suspended Solids	Milligrams per litre	Monthly during discharge	Grab sample																							
M3 Testing methods – concentration limits																										
M3.1	Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.	10.5																								

No	Condition	Section
M5 Recording of pollution complaints		
M5.1	The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.	11.2.3
M5.2	The record must include details of the following: a) the date and time of the complaint; b) the method by which the complaint was made; c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect; d) the nature of the complaint; e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and f) if no action was taken by the licensee, the reasons why no action was taken.	11.2.3
M5.3	The record of a complaint must be kept for at least 4 years after the complaint was made.	11.2.3
R1 Annual return documents		
R1.1	The licensee must complete and supply to the EPA an Annual Return in the approved form comprising: 1. a Statement of Compliance, 2. a Monitoring and Complaints Summary, 3. a Statement of Compliance – Licence Conditions, 4. a Statement of Compliance – Load based fee, 5. a Statement of Compliance – Requirement to Prepare Pollution Incident Response Management Plan, 6. a Statement of Compliance – Requirement to Publish Pollution Monitoring Data; and 7. a Statement of Compliance – Environmental Management Systems and Practices.	10.7
R1.2	An Annual Return must be prepared in respect of each reporting period, except as provide below. ...	10.7
R2 Notification of environmental harm		
R2.1	Notifications must be made by telephoning the Environment Line service on 131 555.	11.3
R2.2	The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.	11.2

3.3 Water Licensing

Previous assessment of the Quarry (Pacrim, 2001) concluded that the local groundwater table occurs well below the extraction area at an elevation equivalent to the base of the Coks River (850m AHD). However, if groundwater is encountered at an elevation above 930m AHD, i.e. base elevation of the approved extraction area (refer to **Section 10.0**), Walker Quarries will make application and obtain appropriate water access licence(s) and water supply and use approvals.

4.0 Objectives and Outcomes

Table 4.1 presents the objectives and key performance outcomes relating to water management for this SWMP and the Quarry.

Table 4.1 Water Management Objectives and Key Performance Outcomes

Objectives	Key Performance Outcomes
To ensure compliance with the conditions of DA 344-11-2001 and EPL 13172 and reasonable community expectations.	Implementation of this SWMP. No legitimate community complaints or reportable incidents.
To implement appropriate water management and mitigation measures during all stages of the Quarry so as to ensure that harm to the environment is minimised as far as possible.	Implementation of this Plan. No discharge of water in breach of EPL 13172 criteria. No reportable incidents related to water management or pollution.
To implement an appropriate monitoring program which reviews compliance with relevant criteria during all stages of the Quarry.	All identified monitoring is undertaken in accordance with the relevant procedures and at the relevant intervals. Monitoring results are published and reported annually within the Annual Review and/or Annual Return.
To implement continual improvement for investigating, implementing and reporting on reasonable and feasible measures to improve water quality and reduce soil loss.	Annual Review includes a review of this Plan, which is updated as required in response to this review or a review following a reported incident.
To implement an appropriate incident reporting program, if required.	Incidents (if any) are reported in an appropriate manner (in accordance with this Plan).

5.0 Site Characteristics and Constraints

5.1 Surface Water

5.1.1 Baseline Water Quality

Sampling of the water in the Coxs River was undertaken between April and October 2016 at one monitoring location upstream of the Quarry (SD-3) and one monitoring location downstream of the Quarry (SD-4) as shown on **Figure 5.1** (refer to **Section 10.0**). The results of this monitoring are presented in **Table 5.1**.

Table 5.1 Coxs River Water Sampling Results 2016

Month Sampled	pH		Total Suspended Solids (mg/L)		Oil and Grease (mg/L)		Sulphate (mg/L)		Electrical conductivity (mS/cm)	
	SD-3	SD-4	SD-3	SD-4	SD-3	SD-4	SD-3	SD-4	SD-3	SD-4
Apr	8.92	8.99	<5	<5	<5	<5	123	122	1176	1168
May	8.83	8.90	<5	<5	<5	<5	121	121	1229	1217
Jun	8.63	8.65	<5	<5	<5	<5	139	139	1209	1226
Jul	8.72	8.84	<5	<5	<5	<5	208	206	1170	1122
Aug	8.24	8.41	<5	<5	<5	<5	149	141	840	803
Sep	7.66	8.48	<5	<5	<5	<5	144	143	597	593
Oct	7.5	8.14	<5	<5	<5	<5	111	91	614	513
Average	8.4	8.6	<5	<5	<5	<5	142	138	976	494

Source: RME (2016b) and RME (2017)

The results of the monitoring within the Coxs River illustrate a neutral to slightly alkaline pH without any notable signs of pollution.

Annual monitoring of water quality in the Coxs River will be continued in accordance with **Section 10.0**.

5.1.2 Catchments

Surface water drainage of the Quarry Site is divided into nine separate catchments by site topography, drainage infrastructure or drainage bunds (see **Figure 5.1**). **Table 5.2** identifies and describes each catchment, nominates whether the runoff within each is clean, dirty or a combination and nominates the destination of runoff (either to sediment basin, storage dam or natural discharge).

Table 5.2 also identifies the storage capacity of each structure, which in the case of the Bottom Working Dam (SB2), Western Sediment Basin (SB4), Office Sediment Basin (SB5), Western Sediment Basin (SB6) and Eastern Sediment Basins (SB7a and SB7b) provides in excess of the 5 day 95th percentile design storage capacity (refer to the *Erosion and Sediment Control Plan* – refer to **Appendix 3**).

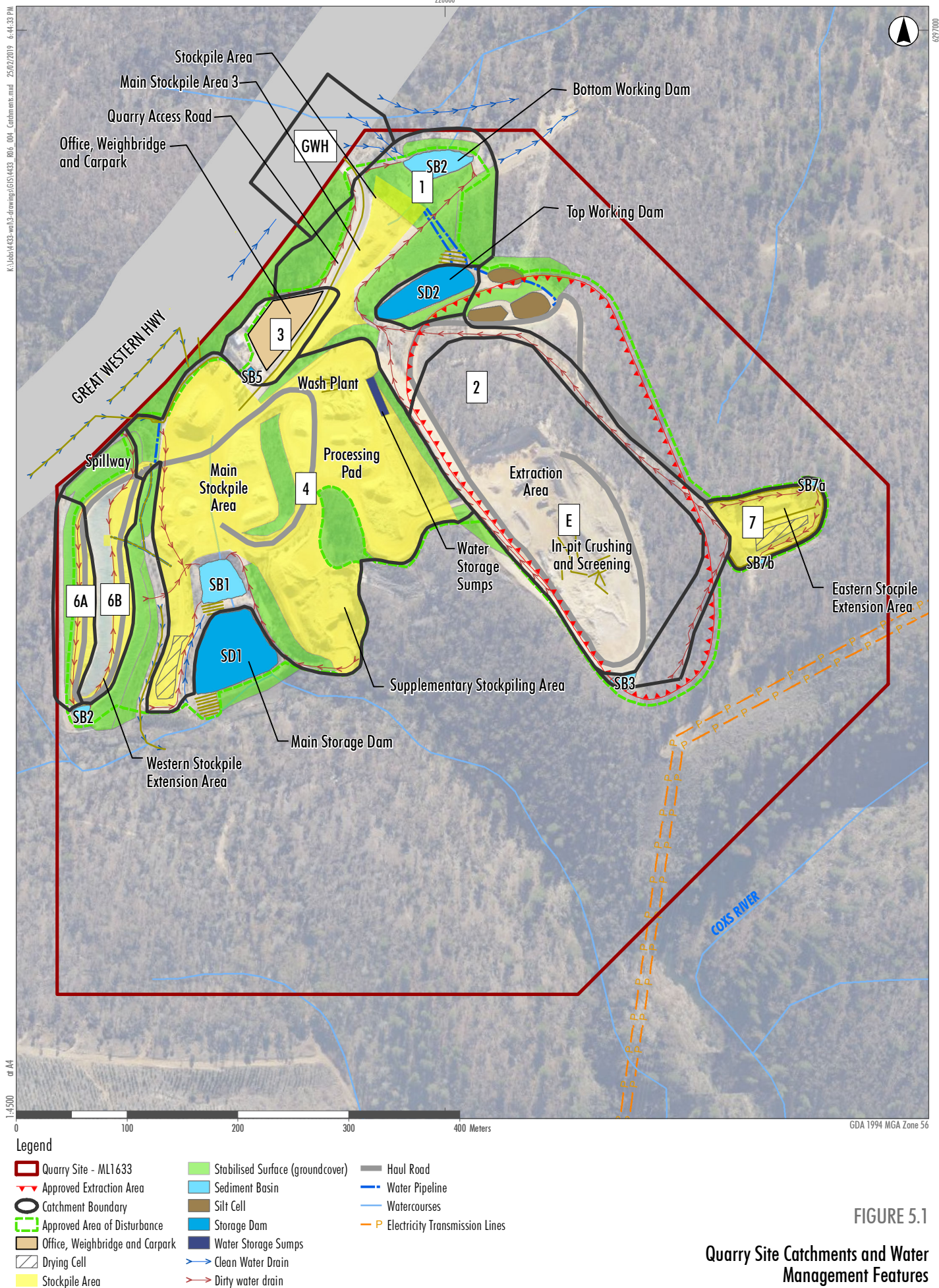


FIGURE 5.1

Quarry Site Catchments and Water Management Features

Table 5.2 Quarry Site Catchment Areas

Name	Area (ha)	Runoff Type	Description	Storage	Volume (ML)
1	3.4	Combined	Entrance road, west facing slope of the extraction area, haul road and miscellaneous disturbance.	Bottom Working Dam (SB2).	2.8
GWH	1.0	Clean	Runoff collected in roadside drains and culverts of the Great Western Highway adjacent to the Quarry Entrance.		
2	2.7 ¹	Combined	Mining area – eastern slope.		
E	1.4 ²	Dirty	Mining area – central section below surface elevation (no runoff).	In-pit.	N/R
	0.2 ³	Dirty	Mining area – southern disturbance area.	Southern Sediment Basin (SB3)	0.3
3	0.5	Dirty	Site office, weighbridge area and selected haul roads.	Office Sediment Basin (SB5).	0.15 ³
4	6.0	Dirty	Processing and stockpiling areas, internal access roads.	Main Sediment Basins (SB1).	2.1
6b	0.9	Dirty	Lower tier of the Western Stockpile Area.		
6a	0.6	Dirty	Upper Tier of the Western Stockpile Area.	Western Sediment Basin (SB6).	0.3
7	0.5	Dirty	Eastern Stockpile Area.	Eastern Sediment Basins (SB7 a/b)	0.3 (each)
<p>Note 1: Catchment to reduce in size as Catchment E increases in size</p> <p>Note 2: Catchment to increase in size as the extraction area is developed below surface elevation</p> <p>Note 3: Catchment to be removed as Catchment E extends to replace Catchment 2</p>					

With reference to the type of runoff identified in **Table 5.2**:

- dirty water refers to runoff from disturbed areas of the Quarry Site; and
- clean water refers to runoff from catchments unaffected by Quarry Site activities (regardless of water quality).

Where the water type is identified as ‘combined’ this refers to catchments receiving both clean and dirty water runoff.

As shown in **Table 5.2**, seven catchments are considered to contain dirty water runoff. With the exception of runoff from Catchment E (the below ground level area of the open cut), this runoff is to be diverted to one of seven sediment basins (SB1, SB2, SB3, SB5, SB6, SB7a and SB7b). Additional capacity for water storage is provided by two storage dams (SD1 and SD2).

One catchment is identified as carrying clean water (Catchments GWH). By virtue of the construction of the Quarry Site intersection with the Great Western Highway, runoff from the small section of the highway drainage (Catchment GWH) is diverted via road side drains to a culvert below the Quarry Site Access Road which also accepts dirty water runoff from Catchment 1. This runoff is diverted to SB2. The remaining clean water runoff from the Great Western Highway is segregated from Quarry Site disturbance, captured within a clean water drain (CWD-5), which includes a section of below ground pipe transfer, and allowed to discharge to natural drainage to the south of the SD1.

Further information on the design, capacities and management of these clean and dirty water structures is provided in Section 9 and the Quarry *Erosion and Sediment Control Plan* (ESCP) (refer to **Appendix 3**)

5.1.3 Water Capture and Storage

As detailed in **Section 5.1**, surface water runoff generated within “dirty” catchments is captured and directed into sediment basins by site topography, drain or bund. This runoff is diverted by rock-lined drains into one of seven sediment basins which have been designed to provide sufficient water settlement and sediment storage capacity up to the design rainfall conditions (56.4 mm in 5 days) (refer to **Section 9.0**). In accordance with the ESCP, these structures will be maintained as ‘dry’ structures, i.e. emptied to reinstate the required storage capacity within 5 days of water accumulation.

A further two storage dams are maintained at the Quarry to which water accumulated in the sediment basins after rainfall will be discharged (either by overflow from SB1 to SD1, or pumping to SD2). Water for dust suppression and processing operations is drawn from these dams.

Three silt cells are operated at the Quarry, these structures accept water from sand washing operations containing elevated silt and fines content. The silty water flows through these cells, allowing for the settlement and collection of silt, before discharge into SD 2 (Top Working Dam) from which the water is redrawn for washing and operations.

Table 5.3 presents information on the permanent water storages on the Quarry Site.

Table 5.3 Quarry Site Water Storage Information

Storage	Volume (ML)	Purpose	Water Use
Sediment Basins			
SB1: Main Sediment Basin	2.1	Collection and storage of runoff Catchment 4 and 6 (Main and Western Stockpile Areas).	Source of water for dust suppression and sand washing. Discharges via spillway to Main Storage Dam (SD1).
SB2: Bottom Working Dam	2.8	Collection and storage of runoff from Catchment 1 (Site Entrance and Roads) and Catchment 2 (Extraction area). Collection of overflow from the drying cell.	Transferred to Top Working Dam (SD2) to maintain design storage for sediment control or discharged to the receiving environment if of suitable quality.
SB3: Southern Sediment Basin¹	0.3	Collection and storage of runoff from the southern extraction area (temporary structure).	Transferred to Top Working Dam (SD2) to maintain design storage for sediment control.
SB5: Office Sediment Basin	0.15	Collection and storage of runoff from the Site office and selected haul roads.	Transferred to Top Working Dam (SD2) to maintain design storage for sediment control or discharged to CWD-5 (subject to compliance with the ESCP – Appendix 3).
SB6: Western Sediment Basin	0.3	Collection and storage of runoff from the upper tier of the Western Stockpile Area.	Either transferred to Top Working Dam (SD2) to maintain design storage for sediment control or captured in collection sump of Catchment 6b for transfer to SB1.

Storage	Volume (ML)	Purpose	Water Use
SB7a and SB7b¹	0.3	Collection and storage of runoff from ESEA.	Transferred to Top Working Dam (SD2) to maintain design storage for sediment control.
Storage Dams			
SD1: Main Storage Dam	8.1	Storage of runoff to ensure sediment basins can retain nominated capacity.	Supplementary supply for processing or dust suppression. Discharge to receiving environment under rainfall conditions exceeding design event or if of suitable quality.
SD2: Top Working Dam	4	Process water supply. Storage of water accumulated within sediment basins.	Primary supply for sand washing and dust suppression.
Silt Cells			
Cells 1 to 3	3 x 2.4 (7.2)	Progressive settlement of silt from water used in sand washing. Discharge to SD2 for re-use in sand washing.	
Note 1: Both sediment basins have been sized to account for all runoff from the ESEA			

EPL 13172 allows for the discharge of water from SB2 and SD1, either following rainfall exceeding the design rainfall event (5-day 95th percentile rainfall, 55.6 mm – refer to **Section 8.0**) or on confirmation of compliance with the quality criteria of EPL 13172 (refer to Section 9.4). As nominated in **Tables 5.2** and **5.3**, water accumulated in the sediment basins will be transferred to the two storage dams from which the water will be drawn for dust suppression and processing operations.

5.2 Local Groundwater

Assessment of the occurrence of groundwater in local setting has concluded the groundwater table occurs at an elevation well below the current extraction area.

- The original EIS for the Quarry (Pacrim, 2001) concluded that the local groundwater table occurs at an elevation below the base of the proposed extraction area.
- The *Environmental Assessment* prepared for modification 1 of DA 344-11-2001 (RWC, 2017) reviewed the records of registered groundwater bores within 3 km of the Quarry Site and established groundwater levels below 910m AHD.
- No interceptions of significant groundwater were recorded during recent exploration drilling completed by Rangott Mineral Exploration (RME) to depths of 890m AHD. This supports the records of the original drilling company (Lord Bros Drilling) who notes no water was encountered during drilling on the Quarry Site dating back to 1997 (pers. comm. Phil Lord of Lord Bros Drilling).
- Hydrogeological investigations undertaken to support a proposed extension to the Quarry (Jacobs, in press) which identify the groundwater table at an elevation of no higher than 890m AHD.

6.0 Site Water Management System

As detailed in previous sections, water is managed in a manner that maximises opportunities for reuse and recycling and minimises the possibility of uncontrolled discharge. The site water management system has been developed in a manner that enables the:

- efficient recovery and use of natural resources;
- effective management of available storage volumes that prevents uncontrolled discharge to receiving environments; and,
- effective water quality management strategies that prevent discharge of impacted water to receiving environments.

This is achieved by utilising strategies and infrastructure to transfer water around the site for use in Quarry activities. Each water storage is utilised in a specific role in the site water management system so that the system can operate in an integrated manner to achieve SWMP objectives.

SB1: Main Sediment Basin

SB1 captures runoff from the Main and Western Stockpile Areas of the Quarry (Catchments 4 and 6), which is diverted by low flow diversion drains (see **Figure5.1**). The design of this storage provides for 2.1ML of storage for the settlement of runoff and storage of sediment generated under 5-day 95th percentile conditions (refer to **Section 9**) prior to discharging into the Main Storage Dam (SD1). By ensuring that all runoff is directed to SB1, the water held in the Main Storage Dam is more likely to achieve the total suspended sediment concentration required of discharged water.

SB1 will be regularly emptied (to SD1 or SD2) with any accumulated sediment removed, allowed to dry on the stockpiling area and either sold as fill or blended with other products prior to sale.

SD1: Main Storage Dam

SD1 will accept overflow, via a stabilised (rock-lined) spillway from SB1, or by pumping. SD1 provides 8.1ML of storage which allows significant settlement time for any accumulated water prior to discharge as well as providing a significant repository of water on-site to account for extended low rainfall periods.

Water held in SD1 may be transferred to the Top Working Dam (SD2) to supplement supply of water for dust suppression and sand washing.

SB2: Bottom Working Dam

SB2 captures runoff from:

- Catchment 1, via rock-lined roadside drains;
- Catchment GWH, via concrete drains and culverts of the Great Western Highway; and
- Catchment 2 via various low flow and road-side drains (see **Figure5.1**).

The design volume of SB2 (2.8ML) provides sufficient settlement and storage volume for runoff generated under 5-day 95th percentile conditions (refer to Section 9). As water accumulates within SB2, it will be pumped to SD2, SD1 or the silt cells, or discharged subject to achieving the water quality criteria nominated in **Section 9.4**, within 5 days of accumulation. The transfer of captured runoff from this storage assists in managing the design storage requirements for sediment control and lowers the possibility of discharge.

SD2: Top Working Dam

This storage is operated as the principal point of draw for dust suppression and sand washing. It is constructed above ground, with no run-on catchment, and accepts overflow from the silt cells as well as water pumped to it from other basins and SD1.

SD2 is the primary source of water for dust suppression and sand washing, and is kept at or close to full capacity as a result. Under rainfall conditions exceeding 5-day 95th percentile conditions (55.6 mm), SD2 may discharge water via a rock-lined spillway. Discharge from the spillway of SD2 flows to SB2.

Silt Cells

The three silt cells (of combined 7.2ML capacity) which provide for the settling of silt from water used to wash sand and other quartzite products.

Additional Sediment Basins (SB3, SB5, SB6, SB7a and SB7b)

These sediment basins are maintained within the three additional dirty water catchments of the Quarry Site (Catchments 3, 6a and 7). Each sediment basin has been designed and will be maintained (by pumping of accumulated water to SD2 or SD1) to accept runoff and sediment following a 5-day 95th percentile rainfall event (refer also to **Section 8.3**).

7.0 Site Water Balance

7.1 Water Sources

The principal source of water on the Quarry Site is rainfall that generates surface runoff with this currently supplemented by water purchased from off-site sources.

As stated in the Pacrim (2001), however, "*it is anticipated that during dry years it may be necessary to import additional water onto site to meet daily requirements*" and Walker Quarries continues to investigate and review additional sources of water for importation and use on the Quarry Site. These sources could include:

- purchase from off-site water storage locations and importation using water trucks;
- purchase of an allocation, either temporary or permanent, from an existing surface Water Access Licence (WAL) of the Wywandy Creek Management Zone;
- extraction under a new surface WAL of the Wywandy Creek Management Zone, obtained on application to WaterNSW should new allocations be released;
- purchasing of an allocation, either temporary or permanent, from an existing groundwater WAL of the Cox's River Fracture Zone groundwater source; or
- extraction under a new groundwater WAL of the Cox's River Fracture Zone groundwater source, obtained on application to WaterNSW should new allocations be released.

If water is obtained through an allocation associated with a surface WAL, and relevant Water Use Approval from WaterNSW, Walker Quarries will then explore whether to install a pump on the Cox's River, either on Walker Quarries land or (with permission) from an adjacent landholder. If water is obtained through an allocation associated with a groundwater WAL, Walker Quarries will undertake the necessary hydrogeological assessment and obtain the necessary approvals for the installation of a bore and pump.

In both cases (surface and groundwater allocation), delivery of water would require the installation of a (poly) pipeline (from the selected water source) to the existing header tank currently in use.

7.2 Water Usage and Losses

Water captured from disturbed areas is recycled on site for reuse in the following site activities.

Sand Processing

Based on the maximum operating capacity of the sand washing plant of the Quarry, up to 100 000t of sand can be washed annually. Based on a wash ratio of 0.5 to 0.625kL water per tonne of sand, and a recovery/reuse rate of 85%¹, up to **9.4MLpa** is required.

Dust Suppression and Wheel Wash

16MLpa of water is applied to potential dust emission sources to manage potential air quality impacts arising from Quarry activities, or the Quarry wheel wash.

¹ Losses include evaporation, retained moisture content of sand products and silt, and pipe losses.

Recycling captured runoff ensures the efficient use of the available water resource and allows for the proper management of sediment control dams, therefore lowering the possibility of uncontrolled discharge of water to the receiving environment in a rainfall event.

Evaporation

Water will also be lost through evaporation from dam/basin surface. To estimate annual losses, the National Centre for Engineering in Agriculture (NCEA), Ready Reckoner (for analysing evaporation and seepage from water storages) was applied to the location (<http://readyreckoner.nceaprd.usq.edu.au/>). Based on a combined dam surface area of 0.857 ha of dam surface area, and an average evaporation of 1527.7 mm (varying between 47.2 mm in June and 211.5 mm in December) for the local setting, evaporation of **13.1MLpa** is expected.

7.3 Water Balance

7.3.1 Water Storage Inputs

As detailed in **Section 6.2** above, all inputs to the site water balance are derived from rainfall and the capture of runoff. **Table 7.1** below details the runoff yield volumes calculated based on statistical analysis (Log Pearson Type III) of the rainfall data derived from the Scientific Information for Land Owners (SILO) database, managed by the Queensland Department of Science, Information Technology and Innovation (DSITI). The program uses historic Bureau of Meteorology (BOM) datasets and interpolation techniques to generate continuous daily time step synthetic rainfall and other climate data for any given location in Australia. The SILO dataset for the period 1 January 1889 to 14 November 2017 was generated for the Quarry Site (Latitude -33.45, Longitude 150.05) on 15 November 2017 for the period commencing 15 November 2017.

Table 7.1 Calculated Runoff Volumes (ML)

Storage	Annual Exceedance Probability				
	95%	90%	50%	10%	5%
SB2: Bottom Working Dam (Catchments 1, 2 & GWH)	18.4	20.4	28.6	38.3	41.3
SD1: Main Storage Dam (Catchments 4 & 6)	17.9	19.9	27.9	37.4	40.3
Total	36.3	40.3	56.6	75.8	81.6

A runoff coefficient (C_v) of 0.48 has been applied to Catchments 1, 2, 4 and 6. This accounts for variation in runoff between rainfall events of 10mm or less, when runoff will be very low ($C_v < 0.25$), and more substantive rainfall (>10mm) when runoff from the hardstand surfaces and steep topography will be high ($C_v \sim 0.74$), reflecting 'soil' with high runoff potential (refer to *Table F2* of the Blue Book).

A C_v factor of 0.8 has been applied to Catchment GWH to reflect the fact that runoff is over an impermeable surface with a significant portion of the flow delivered by pipe culvert.

7.3.2 Water Storage Reuse and Evaporation (Site Water Demand)

Water used for processing activities, dust suppression and evaporation are effectively withdrawals from the available water stored on site.

The anticipated annual volumes (ML) required to meet the demand from each of these parameters is as follows:

- Processing (make-up) 9.4 ML
- Dust Suppression 16 ML
- Evaporation 13.1 ML.

7.3.3 Water Balance

Table 7.2 below shows the expected water surplus or deficit for a range of AEPs. This indicates that rainfall greater than the median is sufficient to account for site water demand and evaporative losses. Based on the analysis of rainfall data collected at BoM 063132, rainfall in between 85 and 90% of years would be sufficient to meet site water demand and evaporative loss.

The balance of **Table 7.2** is indicative as site water demand and evaporative losses will vary on an annual basis. Importantly, the balance illustrates that sufficient water will be available to account for operations (38.5 ML) in greater than 95% of years.

Table 7.2 Site Water Balance: Selected AEP Rainfall Years

AEP	Runoff (ML)	Site Water Demand/Loss (ML)	Surplus/Deficit
95%	36.3	38.5	-2.1
90%	40.3		1.9
80%	45.5		5.1
50%	56.6		18.2
10%	75.8		37.4
5%	81.6		43.2

7.4 Off-site Water Transfers

Discharge of water will occur from the Quarry Site under the following circumstances:

1. Under high rainfall conditions, a controlled discharge may be required to ensure the minimum water storage capacity is available within the site sediment basins (refer **Table 9.1** and ESCP of **Appendix 3**).

The maximum discharge under this scenario would be equivalent to the combined minimum water storage requirement of these sediment basins, approximately 4.5ML.

2. Under rainfall conditions exceeding 55.6 mm over 5 consecutive days, when only the minimum water storage capacity is available within the site sediment basins (refer to **Table 9.1** and the ESCP of **Appendix 3**), water may discharge from the sediment basins.

*The volume of discharge under this scenario would be dependent on the rainfall, however, under 1% AEP rainfall conditions over 72 hours (250mm) and assuming a runoff coefficient of 0.48 (as used to establish the sediment basins capacity requirement – refer to Section 9.3 and the ESCP of **Appendix 3**) over the 15.8ha of catchment, 19ML of runoff would be generated resulting in discharge of 14.5ML.*

8.0 Waste Water Management (for Beneficial Use)

Waste water generated at the Quarry is categorised as follows:

- Effluent/ablutions water
- Process water discharge.

Runoff from disturbed areas of the Quarry Site is considered stormwater and managed in accordance with ESCP (refer to **Section 8.0**).

The following reviews the management, beneficial use and monitoring of these waste water streams.

Effluent and Ablutions Water

Several methods of disposal were investigated, including application to a utilisation area, however, following a review of site and soil limitations, the only viable option for management was a monitoring pump out system. The limiting features for on-site land application disposal were the soil permeability, shallow bedrock, soil structure, and textures, run-on and seepage. Each of these features imposes major limitation to the use of an on-site disposal.

As a consequence of the limitations to onsite disposal, all wastewater generated via the effluent and ablutions system is collected and disposed of offsite by a licenced contractor. Therefore, as this stream of waste water is not applied to land on the Quarry, no monitoring will be undertaken.

Process Water Discharge

The water management system (see **Section 6.5**) describes how silt containing water from the wash plant is delivered to three silt cells (constructed in series)². The water flows through these structures, depositing silt in each before discharging into the Top Working Dam (SD 2). The water is then re-used through the wash plant or used for dust suppression.

Monitoring of water quality, including this waste water stream, is described in **Section 9.0**.

² Prior to the extraction extending to its maximum extent, the affected silt cell(s) will be relocated.

9.0 Stormwater Management

9.1 Overview (Stormwater Management Scheme)

As detailed in **Sections 5.1** and **6.5**, stormwater runoff generated in those areas disturbed by Quarry activities is directed via gravity or drainage infrastructure to sediment basins.

Water from undisturbed (clean) catchments, on site or upstream, is directed away from disturbed areas via diversion drains which discharge directly to the receiving environment downstream of the Quarry.

The following sub-sections describe, in general terms, the management of clean and dirty stormwater at the Quarry. Further detail on the design, management, maintenance and monitoring of the various structures described is provided in an ESCP (which incorporates the requirements of a *Stormwater Management Scheme*) for the Quarry (see **Appendix 3**).

9.2 Clean Water Diversions

Three clean water diversion drains are maintained on the Quarry Site (see **Figure 2.1**):

- CWD-1 collects water from the roadside drains of the Great Western Highway, which flow onto the Quarry Site through rock-lined drains and diverts to SB2.
- CWD-2 collects runoff from the undisturbed land to the north of the extraction area and SD2 and diverts via a road-side drain to natural drainage to the north.
- CWD-5 collects runoff from the roadside drainage of the Great Western Highway and diverts this to the south and into a natural tributary of the Cocks River.

Diversion and collection of clean water from Catchment GWH (by CWD-1) is necessary due to the existing drainage created by the construction of the Quarry Site intersection with the Great Western Highway. The capture of this water assists in ensuring sufficient water is accumulated on the Quarry Site for dust suppression and processing activities.

Clean water from the Great Western Highway to the northwest of the Quarry Site is diverted through the Quarry via CWD-5. CWD-5 has been constructed as both an open, rock lined drain which is collected and transferred below the stockpile areas via a 400 mm HDPE pipe, before discharging to an open, rock lined drain again. The clean water is then diverted to the south of the Quarry where it discharges into a natural tributary of the Cocks River. An energy dissipater and outlet protection (equivalent to SD 5-8 of the Blue Book) is to be maintained at the discharge point from the pipeline and open drain sections of CWD-5.

Diversion of water by the clean water drains prevents mixing of disturbed and clean runoff, therefore reducing the volumes of water requiring management on site and lowering the risk of an uncontrolled discharge from site. The diversion of this water around the site also assists in maintaining the local hydrologic regime of the downstream receiving environment.

Further detail on the maintenance of these diversions is provided in the ESCP (**Appendix 3**).

9.3 Sediment Basins and Discharge Protection

As noted in **Section 5.2**, runoff generated on disturbed catchments is to be directed to one of seven sediment basins. Each of these storages effectively acts as Type D (equivalent to SD 6-4 of the Blue Book) sediment basin for their respective catchments.

Type D sediment basins are designed to capture runoff from disturbed catchments and store the runoff for a sufficient period of time to allow the sediment to settle out of suspension prior to discharging water of suitable quality to receiving environments.

The required design volumes for each of the site water storages are presented in **Table 9.1** and are calculated using the following equation.

$$\text{Settling zone} = 10 \times C_v \times A \times R_{(y\%ile, 5 \text{ day})}$$

Where:

10 = unit conversion factor

C_v = coefficient of runoff (volumetric) **(0.48)³**

A = catchment area (ha)

$R_{(y\%ile, 5 \text{ day})}$ = 5 day 95th percentile design rainfall depth (mm) **(55.6mm)**

Table 9.1 Design Sediment Basin Storage Requirements

Catchment	Area (ha)	Reporting to:	Water Settlement (m ³)	Sediment Storage (m ³)	Total Basin Volume Requirement (m ³)
1	3.4	SB2	903	1	2 004
GWH	1.0		225	-	
2	2.7		874	1	
3	0.2	SB3	56	7	63
4	6.0	SB1	1 946	15	1 961
6b	0.9				
6a	0.6	SB6 (SB1)	169	1	170
5	0.5	SB5	141	1	142
7	0.5	SB7 (a/b)	141	1	142

Source: Detailed Calculation Sheets (using RUSLE) of RWC (see Appendix 4)

Comparing the storage volume requirements for water settlement of **Table 9.1** to the design capacities of all sediment basins (see **Table 5.1**), sufficient capacity will be provided for their respective catchments.

Further detail on the maintenance of these sediment basins is provided in the ESCP (see **Appendix 3**). In summary, a marker will be maintained within each sediment basin near the discharge point identifying minimum freeboard requirement. Sediment basins will be inspected monthly to monitor accumulated sediment levels. Prior to the accumulated sediment exceeding this marker, the basin will be cleaned, with the accumulated sediment placed on the stockpiling area for blending and sale.

Under EPL 13172, discharge of water is permitted from the spillways of SD1 and SB2.

³ Due to the presence of significant stockpiles (which will accumulate and therefore reduce runoff), as well as areas containing significant groundcover within each catchment, a low to moderate runoff potential (Soil Hydrologic Group B) has been applied. *Table F2* of the Blue Book has been used to estimate the runoff coefficient based on a Soil Hydrologic Group B, and C_v of 56.4mm.

9.4 Other Erosion and Sediment Control Measures

Other erosion and sediment control measures will be installed as required to reduce the velocity of flows and capture sediments. Additional sediment protection will include the use of one or more of the following:

- **Sediment Fencing**
 - Sediment (silt) fencing consisting of geotextile filter fabric supported by wire and posts will be utilised in areas where the:
 - the area draining to the fence is 0.6 ha or less;
 - the maximum slope gradient behind the fence is 1:2 (V:H); and
 - the maximum slope length behind the fence is 60 m.
 - Sediment fences will generally be installed prior to disturbance activities (e.g. down slope of soil stockpiles) or downslope of areas being rehabilitated and maintained until stabilisation of the area.
- **Straw Bale Filters and Check Dams**
 - In the event that additional erosion control is required at the outlet of a drain or across a swale or channel of a diversion bund, a temporary barrier of straw bales laid end to end across the direction of flow may be utilised to reduce the water velocity and capture sediments. Check dams may also be utilised consisting of rock material. Check dams would primarily be utilised to reduce the velocity of water to prevent erosion rather than as a sediment retention structure.
- **Rock Armouring and Jute Mesh**
 - In the event additional erosion controls are required, other options that will be considered include the use of rock armouring, whereby a channel or outlet is effectively lined with appropriately sized aggregate material to provide a physical barrier to erosion. Similar to rock armouring, jute mesh, a biodegradable erosion control blanket, may be installed, particularly where vegetation growth is preferable.
- **Energy Dissipaters and Outlet Protection**
 - In the event that additional erosion controls are required to reduce water velocity and mitigate erosion at the outlet of pipe drains, the outlet and a section of the receiving drain or watercourse is lined with appropriately sized, angular and durable material to provide a physical barrier to erosion and lower water velocity by obstructing the flow path and absorbing energy (rip rap apron). The rip rap apron will be underlain with geotextile and the rip rap apron level matched to the invert level of the receiving watercourse. The dimensions of the rip rap apron and material will be determined by the flow conditions (water level and peak discharge) and pipe diameter.

These additional measures are applicable to water management structures, active disturbance areas and rehabilitated areas which have not yet stabilised

10.0 Water Monitoring Program

10.1 Monitoring Program Objectives

Table 10.1 presents the objectives and key performance outcomes relating to the surface water and groundwater monitoring program for the Quarry that were introduced in **Section 4.0**.

Table 10.1 Water Management Objectives and Key Performance Outcomes

Objectives	Key Performance Outcomes
To implement appropriate water management and mitigation measures during all stages of the Quarry.	Implementation of this Plan. No discharge of water in breach of licence criteria. No reportable incidents related to water management or pollution.
To implement an appropriate monitoring program which reviews compliance with relevant criteria during all stages of the Quarry.	All identified monitoring is undertaken in accordance with the relevant procedures and at the relevant intervals. Monitoring results are published and reported annually within the Annual Review and/or Annual Return. No unanticipated groundwater inflow to extraction area.

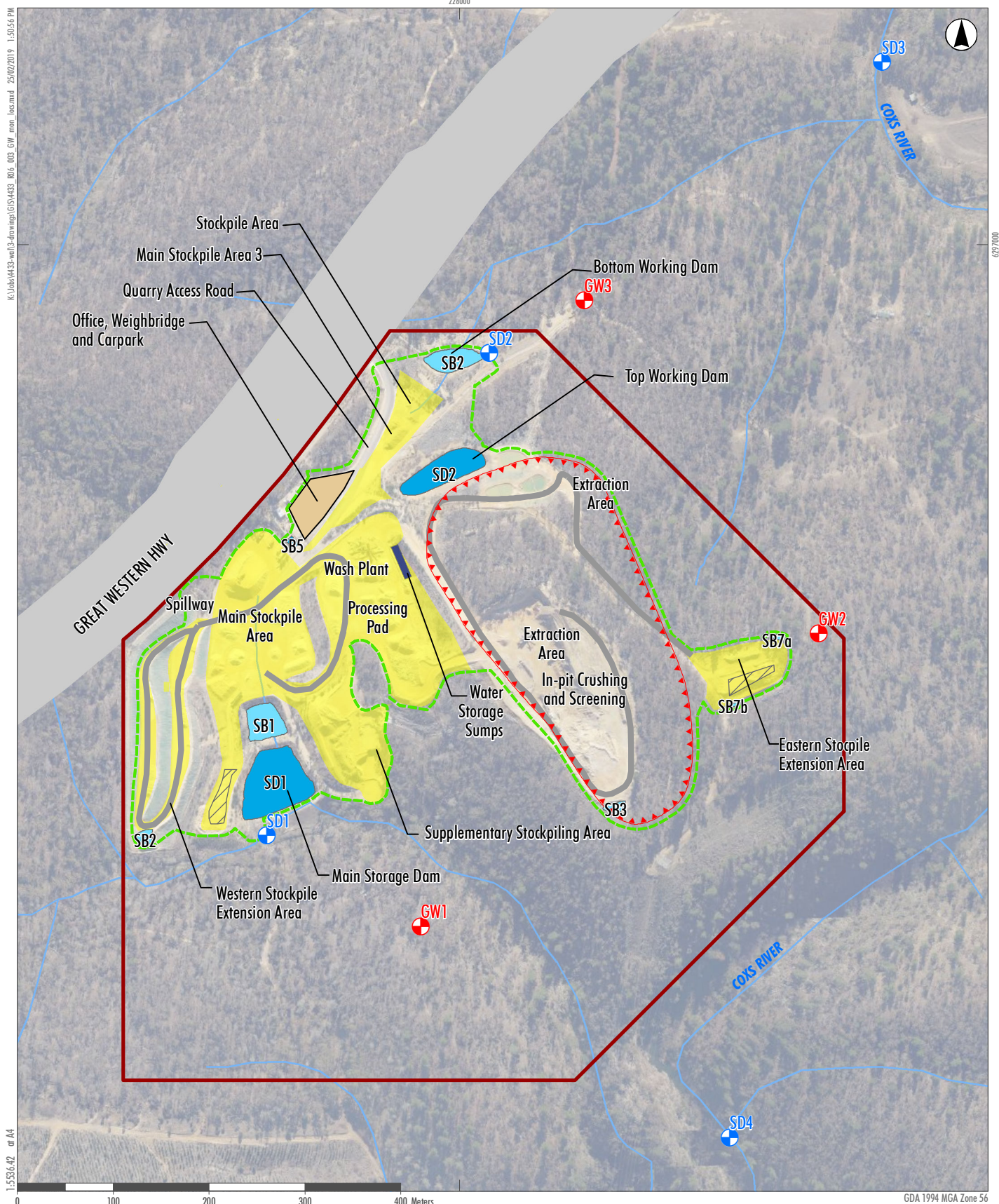
10.2 Monitoring Locations

10.2.1 Surface Water

Surface water monitoring at the Quarry is undertaken at the locations shown on **Figure 10.1** and described in **Table 10.2**. Monitoring is undertaken to assess the quality of water discharged from the Quarry, and in the receiving system (Coxs River) both upstream and downstream of the Quarry.

Table 10.2 Conditional Requirements for Soil and Water Management Plan of DA 344-11-2001

Type	Ref	Location	Description
Discharge	EPL 1 (SD1)	SD 1	Sampled from water discharging over the dam spillway to unnamed tributary of the Coxs River.
	EPL 2 (SD2)	SB 2	Sampled from water discharging over the dam spillway to unnamed tributary of the Coxs River.
Off-site Baseline	SD3	Coxs River	Location upstream of the Quarry.
	SD4	Coxs River	Location downstream of the Quarry.



- Legend**
- Quarry Site - ML1633
 - Approved Extraction Area
 - Approved Area of Disturbance
 - Office, Weighbridge and Carpark
 - Drying Cell
 - Stockpile Area
 - Sediment Basin
 - Silt Cell
 - Storage Dam
 - Water Storage Sumps
 - Haul Road
 - Surface Water Monitoring Location
 - ⊗ Groundwater Bore Location
 - Watercourses

FIGURE 10.1

Monitoring Locations

10.2.2 Groundwater

Based on recent hydrogeological investigations undertaken to support a proposed extension to the Quarry (Jacobs, in press), the groundwater table is expected to occur at an elevation of no higher than 890m AHD. As the Quarry is only approved to an elevation of 930m AHD, it is not expected groundwater will be encountered over the remaining life of the approved Quarry operations and there are no prescribed groundwater monitoring locations in DA 344-11-2001 or EPL 13172.

As part of the hydrogeological investigations of Jacobs, three bores (GW1 – GW3) have been constructed to north, east and southwest of the extraction area. Data loggers have been installed with the data collected for the purpose of better defining the groundwater characteristics and establishing of a median groundwater level prior to future extraction below the groundwater table. **Figure 10.1** provides the location of these groundwater monitoring bores.

10.3 Monitoring Frequency and Parameters

10.3.1 Surface Water

The monitoring frequency or sampling event triggers and the parameters analysed for surface water are presented in **Table 10.3**. All parameters will be monitored monthly during discharge.

Table 10.3 Surface Water Monitoring Frequency and Parameters

Ref	Parameters	Frequency
EPL 1 (SD1)	Total Suspended Solids (TSS), Sulfate, Grease and Oil, Electrical Conductivity, pH and turbidity.	Monthly during discharge
EPL 2 (SB2)		
SD3		Annual
SD4		

10.3.2 Groundwater

Groundwater levels in the three groundwater monitoring bores will be monitored at a minimum daily interval by the data logger for the period of quarrying. The data will be collected bi-monthly and supported with manual groundwater level measurements at time of collection and summarised in an annual report.

10.4 Monitoring Criteria

10.4.1 Surface Water

Quality criteria only apply to water discharged from the Quarry. **Table 10.4** lists the water quality criteria for the Quarry, as provided by EPL 13172. The limits presented below do not authorise the pollution of waters by any other pollutants and the Quarry must comply with Section 120 of the *Protection of the Environment Operations Act* (1997).

Table 10.4 Surface Water Monitoring Criteria

Pollutant	Unit of Measure	Criteria
TSS	mg/L	30
Sulfate	mg/L	250
Grease and Oil	mg/L	10
Electrical Conductivity	µS/cm	1 500
pH	pH	6.5-8.5

In accordance with Conditions L2.5 and L2.6 of EPL 13172, the criteria are deemed not applicable under the following conditions or where the following can be demonstrated:

- A total of 56 mm of rainfall is received at the Quarry Site over any consecutive 5 day period.
- The measured pH of the water is within 6.5 – 8.5 and turbidity <25 NTU at the time of the discharge.

The EPA is to be advised within 3 working days of the completion of the sample testing and analysis where the exclusions apply.

Water flow within the Coss River is a qualitative measure and as such no criteria are attached to this parameter.

10.4.2 Groundwater

There are no prescribed groundwater monitoring criteria in DA 344-11-2001 or EPL 13172. Rather, groundwater monitoring will be undertaken to prevent the unanticipated intersection of the local water table by extraction operations at the Quarry, which is considered unlikely above an elevation of 930m AHD (see **Section 5.2**). In the absence of prescribed criteria, the triggers presented in **Table 10.5** are proposed as mechanisms for action.

Table 10.5 Groundwater Monitoring Action Triggers

Location	Standing Water Level	
	Measured (daily)	Trend (12 month)
GW1 – GW3	Within 2 m of extraction floor elevation	2 m deviation from long-term median

Development of Long-term Median Groundwater Level

Due to the absence of groundwater level information for the Quarry, a long-term, median groundwater level is yet to be established. In order to appropriately account for seasonal and temporal variation in groundwater level, two years of groundwater level monitoring data will be required to establish a long-term median groundwater level. Assuming groundwater occurs at depths below 900m AHD, the current monitoring will provide several years of data before interception of groundwater (should a future extension of the Quarry proceed) is likely. Furthermore, the long-term median groundwater level for each monitoring location would continue to be recalculated as the program of data collection progresses over time.

In the interim, the Quarry will rely upon the “measured (monthly)” criterion (see **Table 10.5**) set out for the action trigger until two years of groundwater level monitoring data has been collected.

Notwithstanding this, the Quarry must comply with Section 120 of the *Protection of the Environment Operations Act* (1997).

10.5 Water Monitoring Procedures

10.5.1 Surface Water

10.5.1.1 In-Field Analyses

A hand-held meter will be used to collect measurements of pH and Turbidity. Prior to use, the meter will be calibrated in accordance with the manufacturers specifications.

10.5.1.2 Sample Collection and Analyses

The procedures water sampling and analysis generally follow those presented in the *Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales* (DEC, 2004).

Monitoring Equipment

The following equipment is used for the collection of surface water samples:

- Chain of custody form (laboratory supplied).
- Labelled sample containers. As supplied by laboratory.
- Marker pen and ink pen.
- Esky (with ice or chilled briquettes).
- Camera.
- Spares kit, including:
 - spare sampling bottles; and
 - marker pen/ink pen.

Due to the types of analyses required, it is anticipated that two separate sampling containers would be required for the purposes of collecting samples:

1. Electrical conductivity, TSS, pH and Sulfate.
2. Oil and Grease.

A minimum of 10 sets of sampling bottles (i.e. sufficient for two rounds of sampling) will be retained on site. Additional bottles are available through the laboratory services provider.

Sampling Procedure

The following procedures apply to surface water sampling.

1. Clearly label each sample bottle **before sampling**, as follows.

Site:	Walker Quarry.
Sampling Location:	e.g. SD1.
Date:	15/10/2019.

Time: 7:00am.
Sampled by: John Smith.

2. Remove lid of TSS, EC, pH and Sulfate sampling container and rinse with at least 500mL of water from the sample area. Ensure rinsed water is tipped away from the sampling area.
3. Fill the sampling container and use it to carefully fill the other sampling container ensuring not to spill the preservative contained within the other sampling container or mix the lids between bottles. Tighten the sampling container lid and place the sample in the chilled esky immediately.
4. Refill the other sampling container to capacity. Tighten the sample bottle lid and place the sample in the chilled esky immediately.
5. Prior to leaving each monitoring site, photograph the site and record observations on stream flow, water colour or any other relevant matter.

Collected water samples will be delivered to laboratory for analysis as soon as possible and submitted with a chain of custody form.

10.5.2 Surface Water Flow Monitoring

The methods for determining flow when sampling for water quality are modified from the Velocity-area method of Part 3 of Australian Standard (AS) 3778-2009: Measurement of water flow in open channels (SA, 2009).

The flow will be recorded as either:

- High: rapid movement of water flowing at, or over the defined channel;
- Medium: moderate movement of water covering >50% of the defined channel;
- Low: slow movement of water covering >50% of the defined channel; or
- None: no movement of water.

A photo will be taken on each occasion for comparison to previous flows.

10.5.3 Groundwater Monitoring

The following provides the equipment and methods to be implemented as part of the groundwater monitoring program.

Monitoring Equipment

The following equipment will be used for the collection of groundwater data from the deployed logger:

- A portable data reader to download logger information (ensure suitability and methods in accordance with data logger manufacturer's instructions prior to use).
- Spares kit, including;
 - pliers;
 - replacement batteries; and
 - spare cable.

Field Measurement and Observations

The data logger will be calibrated prior to redeployment after downloading, and a record of the calibration will be kept.

Once the groundwater level data has been downloaded, the download will be recorded on a field sheet, along with the following information:

1. Monitoring bore identifier;
2. Date and time of download;
3. Extraction floor elevation at time of download;
4. General site observations including presence of algae or vegetation on data logger;
5. Appearance of the water, including water clarity and colour (if possible);
6. Water odour; and
7. Anything else that may be significantly contributing to the groundwater conditions at the location.

10.6 Review and Recording of Monitoring Data

10.6.1 Surface Water

Following receipt of water quality monitoring results, Walker Quarries (or delegated environmental consultant) will review the data against the criteria listed in **Table 10.4**. The results will also be entered into an existing water monitoring database where trends in water quality can be considered. Daily rainfall data from the on-site meteorological station for the previous 5 days will be reviewed and recorded in the water monitoring database beside the water quality monitoring results. As noted in **Section 10.4.1**, where rainfall received at the Quarry Site over the previous 5 days exceeds 56mm, the surface water monitoring criteria presented in **Table 10.4** do not apply.

Original copies monitoring results supplied by the NATA accredited laboratory will be retained by Walker Quarries for at least 4 years.

10.6.2 Groundwater

10.6.2.1 Review and Reporting

Groundwater data obtained from the data loggers would be entered into an existing water monitoring database and reviewed against the action triggers identified in **Section 10.4.2**. The standing water levels would be compared to the current extraction floor elevation. On commencement of groundwater monitoring, Walker Quarries would prepare a quarterly report of results for publishing on Walker Quarries website. A full report on groundwater monitoring will be provided to the DPE and DOI-Water on an annual basis as a component of the Quarry Annual Review.

Review of the groundwater data would also occur to establish the long-term trends in standing water levels in the groundwater monitoring bore(s). If review of the trend data identifies that an action trigger level is met (refer to **Section 10.7**), a review of recent rainfall records (rising trend) and any pit inflow volumes (lowering trend) will be completed to assist in identifying a possible reason for the trend.

If review of the trend data identifies that groundwater inflow to the extraction area is likely to occur, a review of groundwater monitoring data and recent rainfall records will be undertaken to determine if anomalous rainfall events are the cause (rising trend) or if extraction operations will intersect the natural long-term trend in standing water level, as established by the monitoring program.

10.6.2.2 Contingency Response Management

Contingency management would be required in the event of the following events.

Unanticipated Groundwater Inflow

Unanticipated groundwater inflows shall be deemed to be occurring when groundwater inflow to the active section of the extraction area is observed (direct inflow), or if the active extraction area is observed to contain standing water in the absence of a rainfall and runoff event (inferred inflow). If this is observed, the following action/response procedures will be implemented:

- Extraction will be ceased in the immediate vicinity of the identified seepage zone and relocated to an alternate location.
- The Quarry Manager will cordon off the area, to prevent inadvertent access, and take photos of the seepage zone.
- The unanticipated groundwater inflow will be reported immediately to the DPE and DoI-Water.
- Within 7 days of the commencement of inflow, a report to DoI-Water will be prepared that includes the following information:
 - time at which inflow event commenced;
 - time at which inflow event ceased;
 - duration of the inflow event;
 - volume of groundwater inflow; and
 - extraction area floor elevation at which the inflow event occurred.
- The recommendations of DoI-Water will be followed with extraction from the affected areas of the Quarry only recommencing on approval by DoI-Water.

Breach of Threshold Trigger (Standing Water Level)

If the Standing Water Level (SWL) is observed within 2 m of the extraction area floor (Monthly Measured Trigger), extraction will not progress any deeper until the following action/response procedures are implemented:

- The DoI-Water will be notified.
- A methodology to calculate any future inflow of water will be established.
- A Water Access Licence and adequate allocation will be obtained.

If the extraction area is developed below the groundwater table, and the SWL is observed to deviate by greater than 2 m from the long-term median, the following action/response procedures will be implemented:

- The DoI-Water will be notified.

- A qualified hydrogeologist will be commissioned to complete a review of operations and assess:
 - the relationship, if any, between the SWL reduction and Quarry operations; and
 - the potential impact of the SWL reduction on other groundwater users.
- The results of the assessment, along with recommendations for additional contingency or mitigation measures if required, will be provided to DoI-Water for review.
- Unless instructed otherwise by DoI-Water, the recommended contingency or mitigation measures will be implemented.

10.7 Reporting and Publication of Monitoring Data

In the event that water is discharged from the Quarry (from the licensed discharge points at either the Main Storage Dam or the Bottom Working Dam) during the annual reporting period of EPL 13172, the results of water quality monitoring will be included within an Annual Return, submitted to the EPA within 60 days of the Anniversary date of EPL 13172 (21 October) each year, in accordance with *Condition R1.1* of EPL 13172, and Annual Review, submitted by the end of September each and required by *Condition 5(12)* of DA 344-11-2001. The results included in the Annual Return will be assessed by an independent reviewer prior to submission to confirm accuracy.

In the event that the results of water quality monitoring identify an exceedance of the criteria nominated in **Section 10.4**, the Quarry Manager will immediately notify the DPE⁴, the EPA and WaterNSW.

In the event the groundwater monitoring threshold triggers are breached, Walker Quarries will immediately notify the DPE and DoI-Water. A report will be prepared and submitted to the DoI-Water (and DPE if requested) within 7 days of the breach being identified.

Additionally, results of water quality monitoring required by DA 344-11-2001 and other regulatory approvals will be made publicly available on the Walker Quarries website in accordance with the current version of EPA's guideline "*Requirements for publishing pollution monitoring data*", within 14 days of analysis being received by Walker Quarries. The Quarry Manager is responsible for publication of this monitoring information.

In the event in-field pH and turbidity is measured and the results confirm the water quality criteria as not applicable (refer to **Section 10.4.1**), these results will be provided in writing to the EPA within three working days of water sampling.

10.8 Inspections and Maintenance

Regular inspections are undertaken of all water management (erosion and sediment control) structures. Inspections are undertaken on a monthly basis and following a rainfall event of >25mm/24hr. The inspections of water management structures record the following details:

- Storage volumes held in each dam.
- Evidence of overflow and condition of downstream catchment of SD 1 and SB 2.
- Water colour of all dams, especially SD 1 and SB 2 (e.g. highly turbid, brown, clear).
- Presence of any oily film.

⁴ Using the contact name, email address and phone number provided by the DPE.

- The general condition of the water management structures and / or the soil surface of the rehabilitation area. This will include recording of any areas of active erosion and the level of any sedimentation.

In any areas where active erosion is observed, consideration will be given to installation of additional erosion and sediment controls as described in **Section 8.4**.

11.0 Incident Management

11.1 Incident Identification

Condition R2 of EPL 13172 requires that Walker Quarries must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident.

In accordance with the definition provided by Section 147 of the POEO Act, harm to the environment is deemed to be material if:

- it involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial; or
- it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding \$10,000 (or such other amount as is prescribed by the regulations).

An incident which causes or threatens to cause material harm to the environment (and may or may not result in an exceedance of water quality criteria) is referred to as a **Pollution Incident**.

An incident which is only as a result of an exceedance of water quality criterion, is referred to as a **Non-compliance Incident**.

11.2 Incident Management and Notification

11.2.1 Non-compliance Incident

On identification of non-compliance against water quality criteria, which may follow receipt of a complaint, the Quarry Manager will be notified who, in accordance with *Condition 9* of *Schedule 5* of DA 344-11-2001, will immediately notify the Secretary of the DPE⁵, the EPA and WaterNSW. Following notification, an investigation into the source of the non-compliance or complaint commenced in accordance with the response and corrective actions described in *Sections 6.2* and *6.3* of the Quarry *Environmental Management Strategy*.

11.2.2 Pollution Incident

In the event of a discharge of or to water which is deemed a Pollution Incident, the Quarry Manager will be notified who, in accordance with *Condition 9* of *Schedule 5* of DA 344-11-2001, will immediately⁶ notify the Secretary of the DPE⁵, the EPA and WaterNSW.

Following notification, the Quarry Manager will initiate the Quarry *Pollution Incident Response Management Plan* (PIRMP) procedures. A copy of the PIRMP is maintained on the Walker Quarries website (<http://walkerquarries.com.au/statutory-information/>). *Condition 9* of *Schedule 5* of DA 344-11-2001 requires the incident is reported immediately to the DPE (refer to http://majorprojects.planning.nsw.gov.au/page/development-categories/mining--petroleum---extractive-industries/extractive-industries/?action=view_job&job_id=8443 for the current departmental contact) and EPA (using the Environmental Line 131 555).

⁵ Using the contact name, email address and phone number provided by the DPE.

⁶ Immediately being the first opportunity following identification of the exceedance and establishment of initial actions to prevent further pollution.

An investigation into the cause of the exceedance will be immediately commenced and once identified the Quarry Manager or delegate will implement corrective measures (to be identified as part of the investigation).

Within 7 days of the incident, the Applicant will provide the DPE, EPA and any other relevant agencies, e.g. Natural Resources Assessment Regulator (NRAR), with a detailed report on the incident which includes:

- the time and date of the incident;
- relevant details of the incident; and
- measures taken to (or to be taken) prevent re-occurrence.

Where the incident resulted in a non-compliance against DA 344-11-2001 or EPL 13172, the report must identify this.

Additional reports will be prepared and provided as may be requested by DEP, EPA or NRAR (in satisfaction of *Condition 10 of Schedule 5* of DA 344-11-2001 and *Condition R2.2* of EPL 13172).

In the event that a non-compliant discharge is identified, Walker Quarries will investigate the use of flocculant as a means of reducing the concentration of suspended solids in water stored at the Quarry.

11.2.3 Complaint

A Complaints Management Procedure is provided in *Section 6.2* of the *Environmental Management Strategy*. Following receipt of a complaint, appropriate action will be taken within two working days to determine the cause and identify appropriate actions to remediate the complaint source. The following details will be recorded following receipt of any dust-related complaint:

- The date and time of the complaint.
- The method by which the complaint was made.
- Any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect.
- The nature of the complaint.

Within 48 hours of receipt of a complaint, action to identify the cause of the complaint and identify appropriate actions to remediate this will be commenced. On completion of actions to address the complaint, the following information will be added to the complaint register:

- The action taken in relation to the complaint, including any follow-up contact with the complainant.
- If no action was taken, the reasons why no action was taken.

Complaints of a general nature, e.g. “turbid water from the Quarry” will be investigated and an appropriate response provided to the complainant.

The complaints register maintained on the Walker Quarries website and is updated monthly (<http://walkerquarries.com.au/complaint-register/>).

11.2.4 Groundwater Inflow

It is not anticipated that extraction activities at the Quarry will encounter groundwater. However, any unanticipated groundwater inflows to the extraction area will be immediately reported to the DPE and DOI-Water. In accordance with the contingency management measures nominated in **Section 10.6.2.2**, a report will be issued to DOI-Water within 7 days of the commencement of inflow and include the following information:

- time at which direct inflow event observed or inferred;
- time at which inflow event ceased;
- duration of the inflow event;
- estimated volume of groundwater inflow; and
- pit floor elevation at the time which the groundwater inflow event occurred.

The recommendations of DOI-Water will be followed with extraction from the affected areas of the Quarry only recommencing on approval by DOI-Water.

11.3 Incident Reporting

Following implementation and review of the corrective measures, a short description of the incident, actions taken and results of the corrective actions will be documented by the Quarry Manager.

Within three months of the submission of an incident report to the DPE, the Quarry Manager will review this SWMP and any other relevant strategies, plans and programs required under DA 344-11-2001 and revise them if required. Walker Quarries will notify the DPE in writing that this review is being undertaken. If the review does lead to revision, Walker Quarries will submit the revised SWMP to the DPE within 3 months of the incident for approval.

A summary of all incidents, including dates of occurrence, corrective measures taken and success of these measures will be compiled and reported in the Annual Return to the EPA and the Annual Review to the DPE.

12.0 Data Management and Reporting

12.1 Review and Recording of Monitoring Data

Walker Quarries will retain records of water quality monitoring for a minimum period of four years. Monitoring records will be made available to relevant government authorities following a written request.

12.2 Reporting and publication of monitoring data

Walker Quarries will include all water quality monitoring reports as appendices to the AEMR. That document, once approved by the relevant government agencies, would be published on Walker Quarries website.

In accordance with the requirements of Section 66(6) of the *Protection of the Environment Operations Act 1997*, each month Walker Quarries will publish all pollution monitoring data on their website. The information will be published within 14 days of the last sample for that period being collected. These requirements are presented in detail in *Requirements for Publishing Pollution Monitoring Data* (EPA, 2013). A summary of all monitored data will be included in the Annual Return submitted to the EPA.

13.0 Plan Implementation

13.1 Roles and Responsibilities

Table 13.1 outlines the roles and responsibilities of personnel with reference to water management.

Table 13.1 Roles and Responsibilities of Personnel with Respect to Management of Water

Role	Responsibilities
Managing Director	<p>Ensure compliance with the SWMP.</p> <p>Ensure adequate resources are available to implement the SWMP.</p> <p>Ensure suitably trained personnel are available to implement the responsibilities of the Quarry Manager during any time of the Quarry Manager's absence from site.</p>
Quarry Manager, or his/her nominee	<p>Ensure the implementation of the SWMP.</p> <p>Ensure monitoring results are regularly reviewed/evaluated.</p> <p>Review of meteorological forecasts are undertaken on a daily basis prior to the commencement of operations.</p> <p>Implementation of the Water Quality Management System (see Section 5).</p> <p>Relocate or postpone relevant activities in the event of adverse weather conditions.</p> <p>Provide primary contact for complaints and supply follow-up information to any complainant.</p> <p>Initiate investigations of complaints as received from the public or government agency.</p> <p>Prepare a report to government agencies following a notifiable pollution incident (see Section 10).</p> <p>Inform the Managing Director of identified causes of elevated water in storage and any alterations to site operations that may or has influenced stored water volumes.</p> <p>Ensure employees are aware through training and awareness programs.</p>
All On-site Personnel	<p>Operate in manner that minimises risks of incidents to themselves, fellow workers or the surrounding environment.</p> <p>Fully implement the relevant control measures within the SWMP.</p> <p>Report any extraordinary events to the Quarry Manager.</p> <p>Follow any instructions provided by the Quarry Manager.</p>

13.2 Competence Training and Awareness

All personnel and contractors working at the Quarry undergo an induction. This induction includes information on the management of water while working on site.

Regular toolbox meetings are held to discuss whole-of-site production, management, safety and environmental issues. Matters relating to water and water quality are raised during these meetings, when necessary.

13.3 Plan Review

In accordance with *Schedule 5 Condition 5* of DA 344-11-2001, this Plan will be reviewed within three months of the submission of an:

- incident as defined by **Section 11.1**;
- Annual Review⁷;
- an Independent Environmental Audit completed in accordance with *Condition 5(13)* of DA 344-11-2001; and
- any modifications to this consent.

Walker Quarries will notify the DPE in writing of any review being undertaken and if this review results in any revisions to the SWMP, submit a copy to the Secretary of the DPE for approval (within 6 weeks of the review).

Each review will also evaluate the effectiveness of the overall water quality monitoring program and whether there is scope for modification. This will ensure the adequacy of the SWMP and allow for opportunities for adaptive management and continual improvement.

⁷ The Annual Review is due by 30 September each year.

14.0 References

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Rangott Mineral Exploration Pty Ltd (RME) (2017). Annual Environmental Management Report and Annual Review for the Wallerawang Quarry, for the period 1 July 2016 to 30 June 2017.

RW Corkery & Co Pty Limited (RWC) (2017) Environmental Assessment for the Modification to the Operations at the Wallerawang Quarry (DA 344-11-2001).

Sitegoal Pty Ltd (2014). Water Management Plan for Wallerawang Quarry.



APPENDIX 1

**Endorsement of Author as Suitably
Qualified and Experienced**



Mr Alex Irwin
RW Corkery & Co Pty Limited
PO BOX 239
Brooklyn NSW 2083

Alex
Dear Mr Irwin

**Wallerawang Quarry (DA 344-11-2001)
Soil and Water Management Plan**

I refer to your email dated 21 December 2017 nominating yourself to prepare the Soil and Water Management Plan for the Wallerawang Quarry, in accordance with condition 18 of Schedule 3 of DA 344-11-2001.

The Secretary has approved your appointment.

If you have any enquiries about this matter, please contact Jessie Evans.

Yours sincerely

Howard Reed

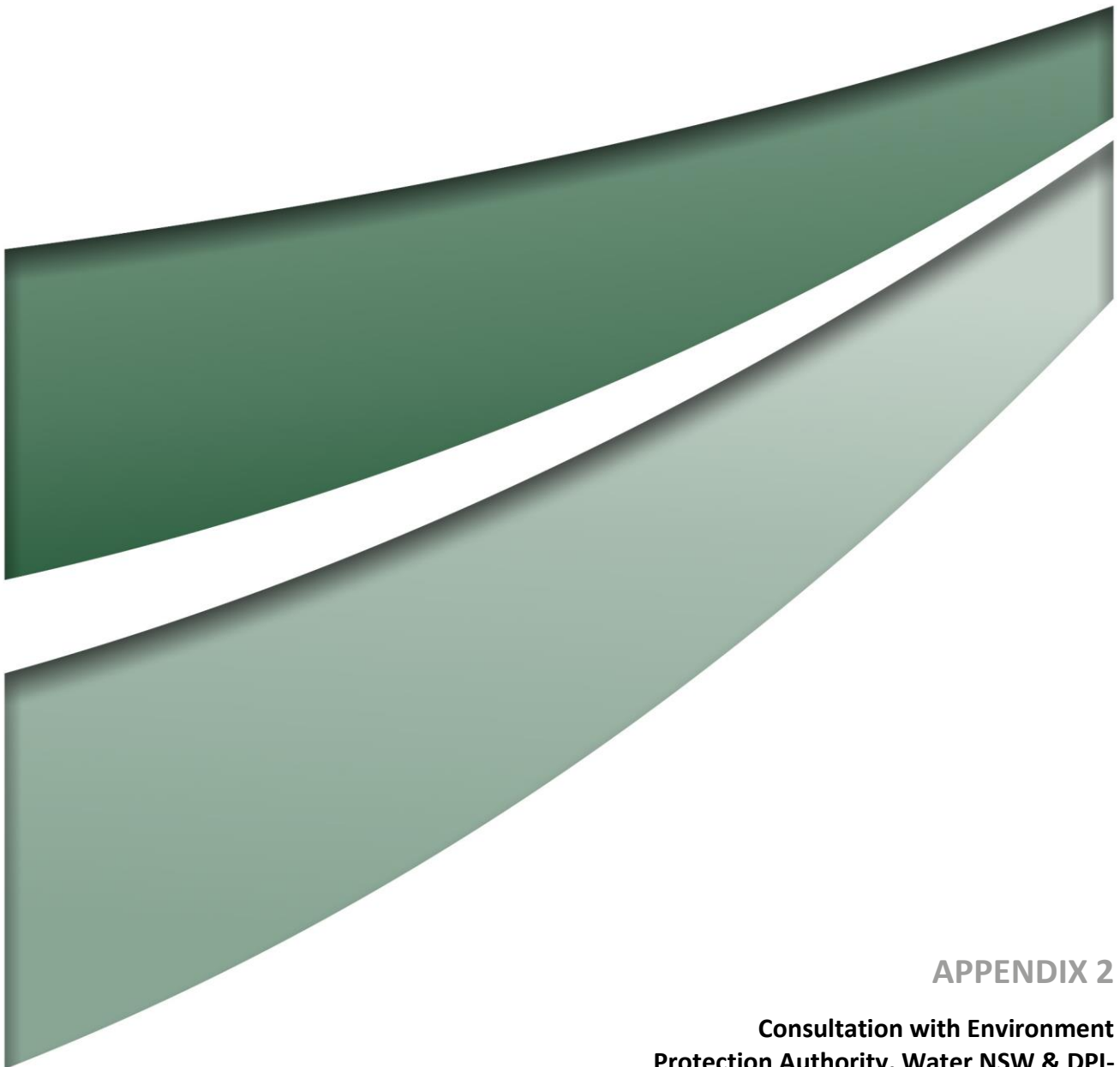
Howard Reed

Director

Resource Assessments

as nominee of the Secretary

21.12.17



APPENDIX 2

**Consultation with Environment
Protection Authority, Water NSW & DPI-
Water**

From: Alex Irwin
Sent: 20 October 2017 12:41 PM
To: 'central.west@epa.nsw.gov.au'
Cc: Allan Adams
Subject: 949 - Wallerawang Quarry - Consultation required for Management Plans
Attachments: Notice of Modification_25 August 2017.pdf; 94902b_Noise MP - September 2016.pdf; 94902f_WMP 2016 - September 2016.pdf

Good afternoon Allan,

Walker Quarries Pty Ltd received approval for a modification to the project approval for the Wallerawang Quarry (DA 344-11-2001) on 25 August 2017 (attached). Walker Quarries Pty Ltd holds EPL 13172 for the Wallerawang Quarry.

Conditions 3(5) and 3(18) of DA 344-11-2001 require Walker Quarries to consult with the EPA in the preparation of a Noise Management Plan and Soil and Water Management Plan respectively.

With respect to the nominated conditions, and noting that Walker Quarries is currently operating under a Noise Management Plan and Water Management Plan (also attached), can you provide any specific requirements of the EPA for the preparation or update of these.

I note DA 344-11-2001 requires these plans to be submitted to the Secretary for approval by 25 November 2017 and so we would appreciate any advice as soon as possible.

Regards,

Alex Irwin
Senior Environmental Consultant
(Mobile 0429 635 975)

RW Corkery & Co Pty Limited

Geological and Environmental Consultants



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Licence Variation

Licence - 13172



WALKER QUARRIES PTY LTD
ABN 82 003 061 890 ACN 003 061 890
PO BOX 307
LITHGOW NSW 2790

Attention: Trevor Hoffman

Notice Number 1560572
File Number EF13/4384
Date

NOTICE OF VARIATION OF LICENCE NO. 13172

BACKGROUND

- A. WALKER QUARRIES PTY LTD ("the licensee") is the holder of Environment Protection Licence No. 13172 ("the licence") issued under the *Protection of the Environment Operations Act 1997* ("the Act"). The licence authorises the carrying out of activities at LOT 6 GREAT WESTERN HIGHWAY, WALLERAWANG, NSW, 2785 ("the premises").
- B. Whereas the EPA undertook an inspection of the premises on the 19 December 2017 in response to a report from the Department of Planning and Environment (DPE) that a dam identified as a clean water dam on the premises was receiving dirty water.
- C. The inspection found that dirty water had entered the clean water dam as a result of an extreme rainfall event that had caused dirty water to overtop the dirty water system. Prompt action required by the licensee to ensure that overtopping of the dirty water system did not re-occur were agreed during the inspection.
- D. The inspection of the dirty water system also found that the licence did not contain the standard conditions that apply to the management of sediment basins.
- E. By this notice, the EPA introduces the required standard conditions that apply to the management of sediment basins.

VARIATION OF LICENCE NO. 13172

1. By this notice the EPA varies licence No. 13172. The attached licence document contains all variations that are made to the licence by this notice.
2. The following variations have been made to the licence:
 - introduces conditions L2.5, L2.6, O5.1, O5.2, O5.3

Licence Variation



.....

(by Delegation)

INFORMATION ABOUT THIS NOTICE

- This notice is issued under section 58(5) of the Act.
- Details provided in this notice, along with an updated version of the licence, will be available on the EPA's Public Register (<http://www.epa.nsw.gov.au/prpoeo/index.htm>) in accordance with section 308 of the Act.

Appeals against this decision

- You can appeal to the Land and Environment Court against this decision. The deadline for lodging the appeal is 21 days after you were given notice of this decision.

When this notice begins to operate

- The variations to the licence specified in this notice begin to operate immediately from the date of this notice, unless another date is specified in this notice.
- If an appeal is made against this decision to vary the licence and the Land and Environment Court directs that the decision is stayed the decision does not operate until the stay ceases to have effect or the Land and Environment Court confirms the decision or the appeal is withdrawn (whichever occurs first).

From: Paul Hensley <pfhensley@gmail.com>
Sent: 21 January 2018 9:04 AM
To: central.west@epa.nsw.gov.au
Cc: Alex Irwin
Subject: Walker Quarries (EPA Licence 13172)
Attachments: 18 02 05 Wallerawang Quarry EPA Licence 13172.pdf; 94902f_SWMP_Rev 2.1_January 2018 - Figure 4.pdf; 94902f_SWMP_Rev 2.1_January 2018.pdf

Attn: Daryll Clift

This email is in regard to your recent visit to the Wallerawang Quarry (15th January 2018) and the variation to the EPA Licence 13172 (Walker Quarries)

Pleased be advised that Walker Quarries accepts the variations (to the EPA Licence 13171) as proposed by the EPA.

Walker Quarries would like to advise that the Department of Planning has recently approved a revised set of Consent Conditions for the Wallerawang Quarry (23rd August 2017). As part of those conditions a Soil & Water Management Plan (see attached) has recently been submitted to the Department of Planning for approval (January 2018).

As part of the Soil & Water Management Plan, Figure 4 (see attached) has been updated from the Water Management - July 2002 figure, supplied with the Licence Application, dated 12 August 2009.

Walker Quarries requests that Figure 4 - 2012, be referenced on Pages 8 & 9 (see attached EPA Licence Variation), on Walker Quarries EPA Licence 13172.

Regards

Paul Hensley
0418680022
On behalf of Walker Quarries Pty Ltd

Licence Variation

Licence - 13172



WALKER QUARRIES PTY LTD
ABN 82 003 061 890 ACN 003 061 890
PO BOX 307
LITHGOW NSW 2790

Attention: Trevor Hoffman

Notice Number 1560572
File Number EF13/4384
Date

NOTICE OF VARIATION OF LICENCE NO. 13172

BACKGROUND

- A. WALKER QUARRIES PTY LTD ("the licensee") is the holder of Environment Protection Licence No. 13172 ("the licence") issued under the *Protection of the Environment Operations Act 1997* ("the Act"). The licence authorises the carrying out of activities at LOT 6 GREAT WESTERN HIGHWAY, WALLERAWANG, NSW, 2785 ("the premises").
- B. Whereas the EPA undertook an inspection of the premises on the 19 December 2017 in response to a report from the Department of Planning and Environment (DPE) that a dam identified as a clean water dam on the premises was receiving dirty water.
- C. The inspection found that dirty water had entered the clean water dam as a result of an extreme rainfall event that had caused dirty water to overtop the dirty water system. Prompt action required by the licensee to ensure that overtopping of the dirty water system did not re-occur were agreed during the inspection.
- D. The inspection of the dirty water system also found that the licence did not contain the standard conditions that apply to the management of sediment basins.
- E. By this notice, the EPA introduces the required standard conditions that apply to the management of sediment basins.
- F. Further, Section 8 of the Wallerawang Quarry Soil and Water Management Plan 2018 states in relation to Effluent and Ablutions Water that as soil permeability, shallow bedrock, soil structure, and textures, run-on and seepage each imposed major limitation to the use of an on-site disposal, all wastewater generated via the effluent and ablutions system is not applied to land on the quarry and is instead collected and disposed of offsite by a licensed contractor. As such, by this notice, the EPA also removed licensed discharge point 3 being the utilisation area.

VARIATION OF LICENCE NO. 13172

Licence Variation



1. By this notice the EPA varies licence No. 13172. The attached licence document contains all variations that are made to the licence by this notice.
2. The following variations have been made to the licence:
 - introduces conditions L2.5, L2.6, O5.1, O5.2, O5.3
 - removes licensed discharge point 3 (LDP3).

.....

(by Delegation)

INFORMATION ABOUT THIS NOTICE

- This notice is issued under section 58(5) of the Act.
- Details provided in this notice, along with an updated version of the licence, will be available on the EPA's Public Register (<http://www.epa.nsw.gov.au/prpoeo/index.htm>) in accordance with section 308 of the Act.

Appeals against this decision

- You can appeal to the Land and Environment Court against this decision. The deadline for lodging the appeal is 21 days after you were given notice of this decision.

When this notice begins to operate

- The variations to the licence specified in this notice begin to operate immediately from the date of this notice, unless another date is specified in this notice.
- If an appeal is made against this decision to vary the licence and the Land and Environment Court directs that the decision is stayed the decision does not operate until the stay ceases to have effect or the Land and Environment Court confirms the decision or the appeal is withdrawn (whichever occurs first).

From: Alex Irwin
Sent: 20 October 2017 2:04 PM
To: John Galea
Subject: 949 - Wallerawang Quarry
Attachments: Notice of Modification_25 August 2017.pdf; 94902f_WMP 2016 - September 2016.pdf

Good afternoon John,

Walker Quarries Pty Ltd received approval for a modification to the project approval for the Wallerawang Quarry (DA 344-11-2001) on 25 August 2017 (attached).

Conditions 3(5) and 3(18) of DA 344-11-2001 require Walker Quarries to consult with DPI-Water in the preparation of a Soil and Water Management Plan and Rehabilitation Management Plan respectively.

With respect to the nominated conditions, and noting that Walker Quarries is currently operating under a Water Management Plan (also attached), can you provide any specific requirements of DPI-Water for the preparation and/or update of these.

I note DA 344-11-2001 requires these plans to be submitted to the Secretary for approval by 25 November 2017 and so we would appreciate any advice as soon as possible.

Regards,

Alex Irwin
Senior Environmental Consultant
(Mobile 0429 635 975)

RW Corkery & Co Pty Limited

Geological and Environmental Consultants



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From: Alex Irwin
Sent: 20 October 2017 2:13 PM
To: 'Miles Ellis'
Subject: 949 - Wallerawang Quarry - Requirement to Consult with WaterNSW
Attachments: Notice of Modification_25 August 2017.pdf; 94902f_WMP 2016 - September 2016.pdf

Good afternoon Miles,

Walker Quarries Pty Ltd received approval for a modification to the project approval for the Wallerawang Quarry (DA 344-11-2001) on 25 August 2017 (attached).

Condition 3(18) of DA 344-11-2001 requires Walker Quarries to consult with DPI-Water in the preparation of a Soil and Water Management Plan.

With respect to the nominated condition, and noting that Walker Quarries is currently operating under a Water Management Plan (also attached), can you provide any specific requirements of WaterNSW for the preparation and/or update of this plan.

I note DA 344-11-2001 requires these plans to be submitted to the Secretary for approval by 25 November 2017 and so we would appreciate any advice as soon as possible.

Regards,

Alex Irwin
Senior Environmental Consultant
(Mobile 0429 635 975)

RW Corkery & Co Pty Limited

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From: Ravi Sundaram <ravi.sundaram@waternsw.com.au>
Sent: 31 October 2017 11:55 AM
To: Alex Irwin
Cc: Peter Dupen
Subject: RE: 949 - Wallerawang Quarry - Requirement to Consult with WaterNSW regarding Soil and Water Management

Hello Alex

Thank you for consulting with WaterNSW with regards to preparation of a Soil and Water Management Plan for Wallerawang Quarry as required by the modification project approval for the Wallerawang Quarry (DA 344-11-2001) granted on 25 August 2017. This is proposed to be addressed by updating the existing Water Management Plan (WMP) dated September 2016.

The modification project involves:

- Construction and operation of the Western and Eastern Stockpile Extension Areas (WSEA and ESEA).
 - WSEA:**
 - Stockpiling of less in-demand product on two benches
 - In-fill of the existing clean water diversion drain passing through the WSEA and piping this clean water diversion beneath the WSEA.
 - Dirty water drains to new Sediment Basin SB6
 - ESEA:**
 - Stockpiling of less in-demand product
 - Drying of excavated fines from silt dams
 - Dirty water drains to two new Sediment Basins SB7a and SB7b.
- Operation of a screening and washing circuit and associated silt cells (including drying cell) to enable the production of washed aggregate (<7mm) and sand (<5mm) products.
- Rehabilitation of the Quarry inclusive of stockpile areas.

The existing Water Management Plan needs to be updated with regards to the above changes. The Modification application project Environmental Assessment main report notes that:

- The existing WMP already accounts for the disturbance associated with the WSEA and water use and management associated with the operation of the fine aggregate and sand processing operations (and silt cells).
- The WMP however does not include the ESEA or the additional silt drying cell proposed as an additional measure for managing the silt removed from the fine aggregates and sand by washing.

The EA therefore proposes to conduct further assessments in relation to updating the current WMP including:

- Review of modified catchment and design of erosion and sediment control features;
- Review of the site water balance and assessment of potential for impacts associated with the surplus or deficit of water at the quarry site; and
- Review of the potential for impacts on the receiving environment as a result of the modified features.

WaterNSW agrees and supports the above approach.

WaterNSW also notes that silt dams, sediment dam (SB3) and some dirty water diversion drains in Figure 2, Page 3 of the EA main report appear to be within approved extraction area shown in Figure 8, page 31 of the EA main report. This matter should be addressed as part of the proposed update of the existing WMP.

WaterNSW would appreciate receiving a draft copy of the updated Soil and Water Management Plan for review.

Please contact me if you wish to discuss any matter discussed above.

Regards.

Ravi
Dr Ravi Sundaram
Mining Catchment Specialist
WaterNSW
Level 14 169 Macquarie Street
PO Box 398
Parramatta, NSW 2124
www.waternsw.com.au

p.: +61 2 9865 2507
m.: +61 428 226 152/ +61 451 510 194
email: Ravi.Sundaram@waternsw.com.au

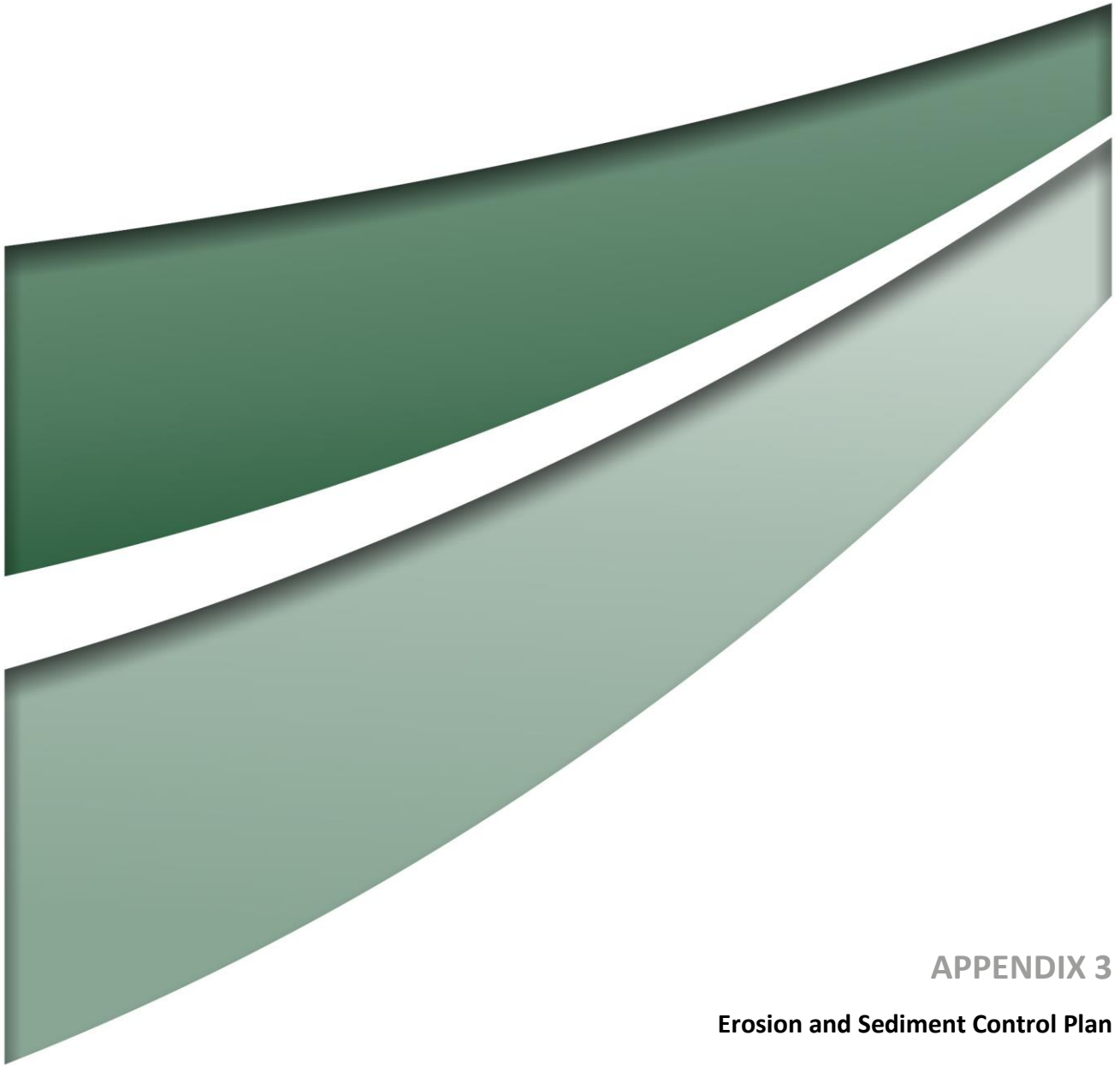
From: Alex Irwin [<mailto:alex@rwcorkery.com>]
Sent: Friday, 20 October 2017 2:13 PM
To: Miles Ellis
Subject: 949 - Wallerawang Quarry - Requirement to Consult with WaterNSW

Good afternoon Miles,

Walker Quarries Pty Ltd received approval for a modification to the project approval for the Wallerawang Quarry (DA 344-11-2001) on 25 August 2017 (attached).

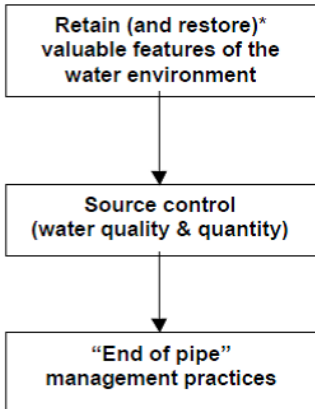


Condition 3(18) of DA 344-11-2001 requires Walker Quarries to consult with DPI-Water in the preparation of a Soil and Water Management Plan.

Agency	Consulted on:	Replied on	Requests / Requirements	Addressed
EPA	20/07/2016	4/08/2016	None	
	20-Oct-17	No reply		
EPA	5/08/2016	19/08/2016	None	
	20-Oct-17	No reply		
DPI-Water	20/10/2017	Referred within agency on 20/10/2017	No further response received	
WaterNSW	5/08/2016	24/08/2016	None	
	20/10/2017	31/10/2017	The existing Water Management Plan needs to be updated with regards to the modified Quarry operations.	Complete (refer to Figure 3)
			Review of modified catchment and design of erosion and sediment control;	Complete (refer to Appendix 3)
			Review of the site water balance and assessment of potential for impacts associated with the surplus or deficit of water at the quarry site; and	Complete (refer to Section 7)
			Review of the potential for impacts on the receiving environment as a result of the modified features.	Complete (refer to Sections 5, 6, 9 and 10)



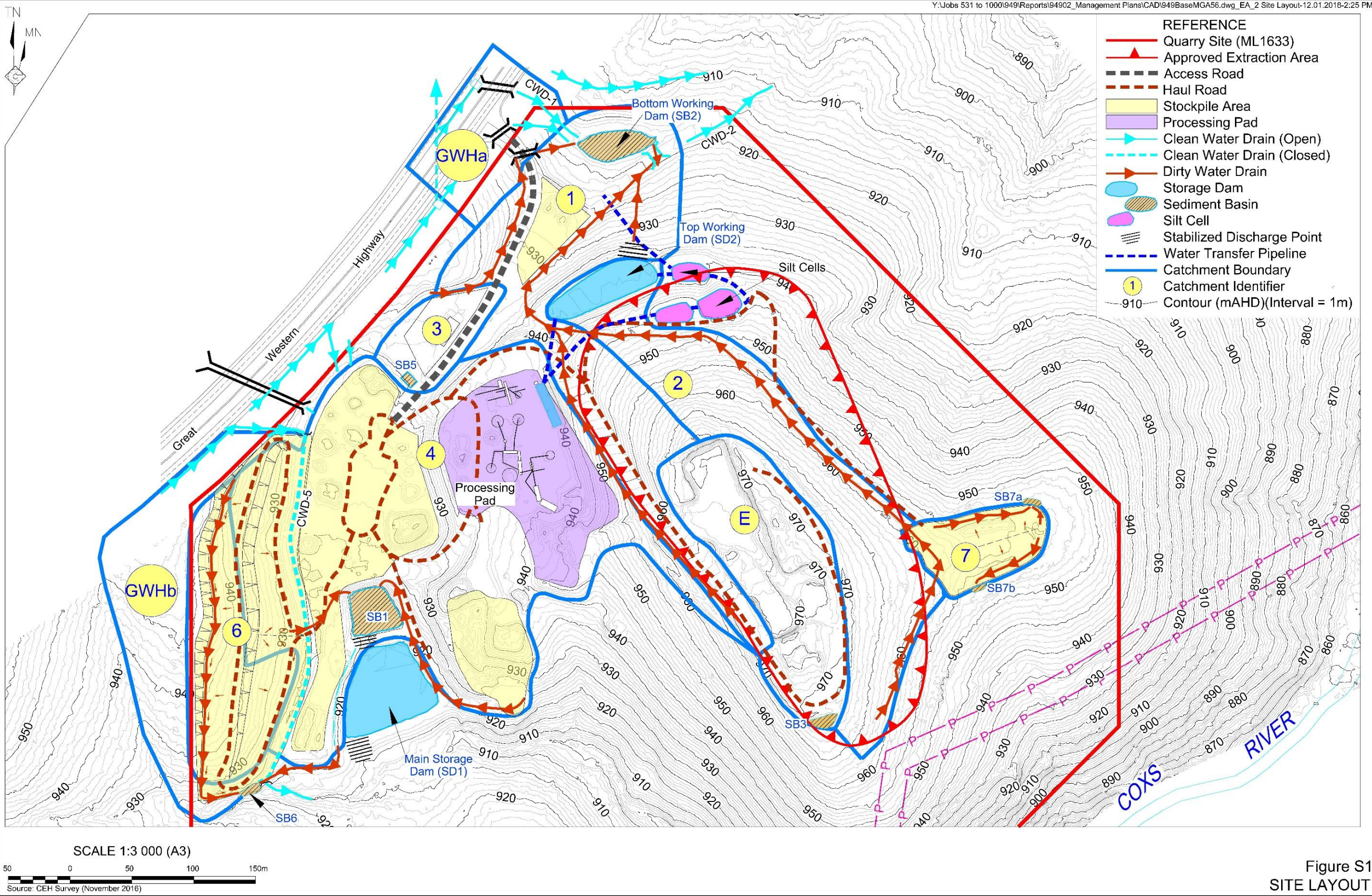
APPENDIX 3

Erosion and Sediment Control Plan

WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN															
(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)															
GENERAL NOTES															
SCOPE <ul style="list-style-type: none">This Erosion and Sediment Control Plan (ESCP) has been prepared to satisfy <i>Schedule 3 Condition 18(d)</i> of Development Consent DA 344-11-2001 for the Wallerawang Quarry (“the Quarry”) of Walker Quarries. Specifically, this ESCP provides for a detailed description of the surface water management system on site.The ESCP provides for the management of rainfall and runoff (Stormwater Management), management of erosion and sediment control (Erosion and Sediment Control Management) and mitigation of associated impacts, during the operation of the Quarry.The ESCP has been prepared with reference to:<ul style="list-style-type: none">Managing Urban Stormwater: Soils and Construction, Vol. 1 Second ed., Landcom, NSW, Sydney (Landcom, 2004) (“the Blue Book”);Managing Urban Stormwater: Soils and Construction, Volumes 2C and 2E (DECC, 2008); andManaging Urban Stormwater: Council Handbook (EPA, 1997) (“the Council Handbook”) (in lieu of a Stormwater Management Plan for the Coxs River Catchment).The ESCP describes the Best Management Practices (BMPs) that will be employed to minimise soil erosion and discharge of sediment and other pollutants to lands and/or waters associated with activities at the Quarry.The BMPs, i.e. diversion banks, sediment fencing, drains and sediment basin are to remain in place and be maintained for the life of the Quarry or unless otherwise instructed.The ESCP is valid for the life of DA 344-11-2001, but is to be updated at least every three years, or in response to significant modification to operation of the Quarry.				MANAGEMENT OBJECTIVES (Cont’d) <p><i>Erosion and Sediment Control Management</i></p> As identified in Volume 2E of the Blue Book, the principle management objective for erosion and sediment control is: <ul style="list-style-type: none">to minimise the water-quality impacts from erosion and sedimentation through implementing best practice management techniques. The following specific management objectives have been defined with respect to erosion and sediment control management for the Quarry. <ul style="list-style-type: none">To minimise the impact of construction and operational activities on erosion and the sedimentation of disturbed land, watercourses and water bodies.To minimise the loss of topsoil from areas disturbed by mining activities.To restrict disturbance to those areas identified in the Mining Operations Plan (MOP).To ensure runoff from disturbed (and unrehabilitated) catchments is controlled and captured by sediment control systems.To prevent active erosion of stabilised areas.To ensure no increase in sediment deposition of receiving waters.To have no other detrimental impact on the water quality of downstream watercourses and water bodies.				MANAGEMENT PRINCIPLES (Cont’d) <p><i>Stormwater Management (Cont’d)</i></p> <ul style="list-style-type: none">These management principles are applied in a hierarchical manner, whereby valuable features of the natural environment are identified and retained or restored. Preventative measures are then implemented initially with ‘end of pipe’ measures only applied for residual impacts that cannot be cost-effectively mitigated by source control. <p><i>Erosion and Sediment Control Management</i></p> Erosion and Sediment Control Management is based on the broad management principals of <i>Section 3.2</i> of Volume 2E of the Blue Book. <p><u>Planning Phase</u></p> <ul style="list-style-type: none">Assess the soil and water implications of the planning stage.Plan for erosion and sediment control before any earthworks begin, including assessment of site constraints. <p><u>Operations Phase</u></p> <ul style="list-style-type: none">Minimise the area of soil disturbed and exposed to erosion.Conserve topsoil for later site rehabilitation or regeneration (in a stabilised stockpile).Control water flow from the top of and through the project area by diverting up-slope ‘clean’ water away from disturbed areas and ensuring that concentrated flows are below erosive levels and sediment is retained from disturbed areas. <p><u>Maintenance and Rehabilitation Phase</u></p> <ul style="list-style-type: none">Rehabilitate disturbed lands as soon as possible following disturbance.Maintain erosion and control measures appropriately.				IMPLEMENTATION (CONT’D) <ol style="list-style-type: none">Establish sediment fencing or straw bale protection down-slope of any new disturbance (refer to <i>BMP Notes - Sediment Fencing and Straw Bale Protection</i>) or soil stockpiles (Refer to <i>BMP Notes - Stockpiling</i>).Complete construction of Bottom Working Dam (SB2) extension (to create 2.8ML storage).Establish low bund walls around perimeter of the Stockpile Area to contain runoff to Sediment Basin (SB) 1 (refer to Figure S1).Construct Sediment Basins 4 and 5 for the capture of runoff from the future stockpile area and office and car park areas respectively. Ensure design capacities exceed that required to store and settle water generated by a 5 day 95th percentile rainfall event (refer to <i>BMP Notes - Sediment Basins, Figure S1</i> and Table S4).Place a vertical marker representing minimum Water Settlement Zone Requirements within the sediment basins (refer to <i>BMP Notes - Sediment Basins</i>).Construct Dirty Water Diversion Drains to capture runoff from disturbed catchments as identified on Figure S1 (refer to Sheet 02) (refer to <i>BMP Notes - Diversion Drains</i>). Ensure drainage is to the nominated Sediment Basin.Stabilise all drains and batters (refer to <i>BMP Notes - Diversion Drains</i>).Construct outlet protection on the discharge point from sediment basins (refer to <i>BMP Notes - Outlet Protection Notes</i>).Mine rehabilitation to be completed in accordance with the MOP. Install sediment fencing down-slope of rehabilitation under maintenance (see also SD 6-8 on Sheet 12) (refer to <i>BMP Notes - Sediment Fencing and Straw Bale Protection</i>).Ensure all monitoring and maintenance procedures are implemented and adhered to (refer to <i>BMP Notes - Water Quality Monitoring and Maintenance</i>).Undertake a self-auditing program (refer to <i>BMP Notes - Self-auditing Program</i>).			
MANAGEMENT OBJECTIVES <p><i>Stormwater Management</i></p> In accordance with the primary goal for stormwater management nominated by the Council Handbook, the objective of the SMS is to facilitate the movement, storage and discharge of rainfall and runoff within and from the Range to:				MANAGEMENT PRINCIPLES <p><i>Stormwater Management</i></p> <ul style="list-style-type: none">The management of stormwater is based on the three broad management principals for stormwater management identified by <i>Table 4.1</i> of the Council Handbook (see adjacent).				MANAGEMENT TECHNIQUES <ul style="list-style-type: none">Five broad management practices are applied (in accordance with the Council Handbook).Table S1 identifies the stormwater management techniques to be applied for each of the five management practices and with reference to the principles of stormwater management hierarchy.				WATER DISTRIBUTION <ul style="list-style-type: none">Water is required for the suppression of dust and product washing.Water is sourced from rainfall and runoff captured within catchments of the Quarry.Water is stored with the Main Storage Dam (SD1) and Top Working Dam (SD2).Water is drawn from SD2.Two licensed discharge points are maintained at the outlet of SD1 and SB2 (to tributaries of the Coxs River).			
				<p>Table 4.1 – Stormwater Management Hierarchy</p> <p>Source: EPA (1997) (the Council Handbook)</p>											
REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS			ESCP - GENERAL NOTES 1							
0	04/08/16	AI		Original	DESIGN BY:	N/A									
1	08/09/16	AI			DRAWN BY	N/A									
2	22/01/18	AI			FINAL APPROVAL	N/A									
								PROJECT NO. 949/02f		SHEET NO. 01		REV 2.2			

WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN
(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)

GENERAL NOTES





REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS		
0	4/8/2016	AI		Original	DESIGN BY:	AI	25/8/2017
1	08/09/16	AI			DRAWN BY	MA	12/1/2018
2	22/01/18	AI			FINAL APPROVAL		



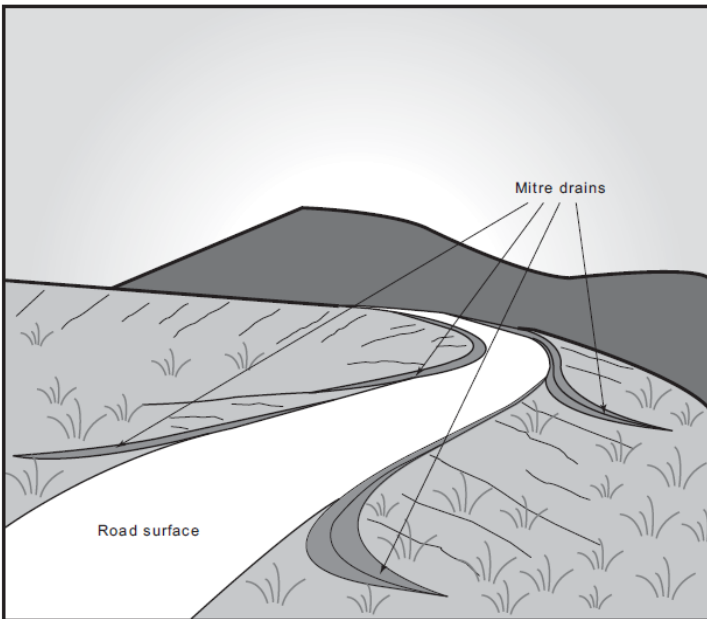


Walker Quarries

ESCP - GENERAL NOTES 2

PROJECT NO. 949/02f SHEET NO. 02 REV 2.2

WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN												
(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)												
GENERAL NOTES												
TABLE S1 STORMWATER MANAGEMENT SCHEME												
Page 1 of 2												
Management Practice	Management Techniques						Monitoring	Maintenance and Contingency Management				
	Retention and Restoration	Source Control		End-of-Pipe Mitigation								
Flow	Reduce the catchment of the Quarry by diverting runoff from Catchment 5 through the Quarry Site by Clean Water Drains (refer to <i>BMP Notes - Diversion Drains</i>).	Reduce the total disturbed catchment of the Quarry (reduction in flow) by only clearing in immediate advance of mining or ancillary activities.		Install outlet protection at discharge points from Clean Water Diversion Drains (CWD-1, CWD-2 and CWD-5) (refer to <i>BMP Notes - Outlet Protection</i>).		Implement a Self-Auditing Program to confirm the continued implementation of the nominated management techniques, in particular source control and 'End-of-Pipe' techniques (refer to <i>BMP Notes - Self-Auditing Program</i>). Inspect erosion and sediment control structures at least monthly and immediately following heavy rainfall.	Implement maintenance measures in accordance with <i>BMP Notes - Monitoring and Maintenance</i> . If repeated failures of structures are identified, engage a qualified erosion and Sediment control specialist to review design and implement recommended modifications or additions.					
		Construct clean water drains CWD-1, CWD-2 and CWD-5 to divert water as nominated Figure S1 and <i>BMP Notes - Diversion Drains</i> to control accumulated flow and allow for non-erosive discharge to the catchment.		Construct sediment basins in accordance with SD 6-4, i.e. wet basin (water retention) structure, in the locations nominated in Figure S1 , with the minimum capacities nominated in Table S4 and in accordance with <i>BMP Notes - Sediment Basins</i> .								
Channel Morphology	Reduce the erosive force of flows within Diversion Drains and discharge points to natural drainage by establishing ground cover (with average retardance height as noted in Table S3) to achieve the C-Factor nominated in Table S2 .	Establishing ground cover (with average retardance height as noted in Table S3) to achieve the C-Factor nominated in Table S2 .		Maintain Diversion Drains in accordance with the design features nominated in <i>BMP Notes - Diversion Drains</i> .								
		Where groundcover cannot be established to achieve the nominated C-Factor, install rock check dams or straw bale protection to reduce flow velocity.		Install outlet protection at discharge points from Clean Water Diversion Drains (CWD-1, CWD-2 and CWD-5) and licensed discharge points (SD1 & SB2) (refer to <i>BMP Notes - Outlet Protection</i>).								
Water Quality	Divert runoff away from disturbed ground of the Quarry	Construct and maintain CWD-2 and CWD-5 as nominated Figure S1 and <i>BMP Notes - Diversion Drains</i> .		Install and maintain sediment fences downslope of disturbance areas prior to stabilisation in accordance with Table S2 (refer to <i>BMP Notes - Sediment Fencing and Straw Bale Protection</i>).		Implement a Self-Auditing Program to confirm the continued implementation of the nominated management techniques (refer to <i>BMP Notes - Self-Auditing Program</i>).	Implement maintenance measures in accordance with <i>BMP Notes - Monitoring and Maintenance</i> . If stabilisation using grass or ground cover fails to achieve the required C-factor, engage a rehabilitation specialist to provide advice on alternative revegetation strategies or an appropriately qualified erosion and Sediment control specialist to review alternative surface stabilisation options.					
	Reduce runoff from disturbed catchments of the Quarry	Reduce the total disturbed catchment of the Quarry (reduction in flow) by only clearing in immediate advance of mining or ancillary activities.	Clearly mark 'No Go Areas' to prevent unnecessary clearing.									
			Maintain a C-Factor of 0.1 or less on non-active disturbed areas, i.e. soil stockpiles, bunds (refer to <i>BMP Notes - Site Stabilisation</i>).									
			Progressively rehabilitate non-operational areas of the Quarry.									
	Ensure only water compliant with EPL 13172 conditions discharged from the Quarry (under rainfall conditions not exceeding 56.4mm in 5 days).	Sample and analyse water contained within SD1 and SB2 prior to 'controlled discharge'.						Undertake sampling and analysis in accordance with a Surface Water Monitoring Program (refer also to <i>BMP Notes - Monitoring and Maintenance</i>).	In the event of water quality exceeding quality criteria, the following contingency management would be implemented. 1. Transfer (pump) to the Top Working Dam (SD2). If capacity unavailable then; 2. transfer to the silt cells (if capacity available) and cease washing. If capacity unavailable then: 3. transfer to the open cut sump. If sufficient storage capacity is unavailable, review the requirement to discharge. If a discharge is required to maintain Blue Book minimum capacity within SD1 and SB2, the contingency measures will vary based on the elevated parameter. 1. For TSS, dose the water with an EPA approved flocculent, resample, analyse and repeat as required. 2. For sulphate, does the water with hydrated lime (Ca(OH) ₂), resample, analyse, and repeat as required 4. For pH, buffer using appropriate alkaline or acidic reagent, resample, analyse and repeat as required. 5. For Grease and oil / EC, provide for dilution on discharge to reduce the effective concentration.			
REV	DATE	BY	APP.	REVISION DETAILS		DRAWING STATUS		 		ESCP - GENERAL NOTES 3		
0	4/8/2016	AI		Original		DESIGN BY:	N/A					
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WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN											
(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)											
GENERAL NOTES											
TABLE S1 (Cont'd) STORMWATER MANAGEMENT SCHEME											
Page 2 of 2											
Management Practice	Management Techniques			Monitoring	Maintenance and Contingency Management						
	Retention and Restoration	Source Control	End-of-Pipe Mitigation								
Water Quality (Cont'd)	Ensure only water compliant with EPL 13172 conditions discharged from the Quarry (under rainfall conditions not exceeding 56.4mm in 5 days).	Sample and analyse water discharged from SD1 and SB2 during 'wet weather discharge', i.e. event exceeding 5-day 95 th percentile rainfall event.		Undertake sampling and analysis in accordance with a Surface Water Monitoring Program (refer also to <i>BMP Notes - Monitoring and Maintenance</i>).	Provide for reinstatement of required capacities within SD1 and SB2 with 5 days of rainfall event. Implement contingency measures nominated for controlled discharges if insufficient capacity retained on the Quarry Site for internal transfer.						
Riparian Vegetation	Retain and prevent disturbance to native vegetation external to disturbance areas nominated in the Mining Operations Plan.	None required.	Not applicable.								
Aquatic Habitat	Reduce the catchment of the Quarry by diverting runoff around and through the Quarry by Clean Water Drains (refer to <i>BMP Notes - Diversion Drains</i>).	Construct CWD-2 and CWD-5 as nominated Figure S1 and <i>BMP Notes - Diversion Drains</i> to control accumulated flow and allow for non-erosive discharge to the catchment.	Construct sediment basins in accordance with SD 6-4, i.e. wet basin (water retention) structure, in the locations nominated in Figure S1 , with the minimum capacities nominated in Table S4 and in accordance with <i>BMP Notes - Sediment Basins</i> .	Implement a Self-Auditing Program to confirm the continued implementation of the nominated management techniques (refer to <i>BMP Notes - Self-Auditing Program</i>).	Implement maintenance measures in accordance with <i>BMP Notes - Monitoring and Maintenance</i> . If repeated failures of structures are identified, commission an appropriately qualified erosion and Sediment control specialist to review design and implement recommended modifications or additions.						
	Ensure the quality of water discharged under conditions not exceeding 56.4mm in 5 days meets the water quality criteria of EPL 13172.	Sample and analyse water contained within SD1 and SB2 prior to 'controlled discharge'.	Undertake sampling and analysis in accordance with a Surface Water Monitoring Program.	Undertake sampling and analysis in accordance with a Surface Water Monitoring Program (refer also to <i>BMP Notes - Monitoring and Maintenance</i>).	See contingency measures nominated above for Water Quality.						

WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN																																
(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)																																
GENERAL NOTES					BEST MANAGEMENT PRACTICES																											
<p>TABLE S2 LIMITATIONS TO ACCESS DURING CONSTRUCTION</p> <table><tr><th>LAND USE</th><th>LIMITATION</th><th>REMARKS</th></tr><tr><td>Construction Areas</td><td>Limited to 5m from the edge of any essential construction activity as shown on the engineering plans</td><td>All site workers should clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope) or similar materials.</td></tr><tr><td>Access Areas</td><td>Limited to a maximum width of 5m</td><td>The site manager will determine and mark the location of these zones on the site. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.</td></tr><tr><td>Remaining lands including revegetation areas</td><td>Entry prohibited except for essential management works.</td><td>Thinning of growth might be necessary in accordance with bushfire management requirements or weed reduction strategies.</td></tr></table>					LAND USE	LIMITATION	REMARKS	Construction Areas	Limited to 5m from the edge of any essential construction activity as shown on the engineering plans	All site workers should clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope) or similar materials.	Access Areas	Limited to a maximum width of 5m	The site manager will determine and mark the location of these zones on the site. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.	Remaining lands including revegetation areas	Entry prohibited except for essential management works.	Thinning of growth might be necessary in accordance with bushfire management requirements or weed reduction strategies.	<p>FACILITY ACCESS AND BARRIER FENCING</p> <ul style="list-style-type: none">A sealed access road ensures all vehicles entering and leaving the Quarry use the designated site entrance.Internal access and haul roads delineate access to operational areas of the Quarry.Figure S1 (see Sheet 02) identifies the location of additional barrier fencing / tape, drainage structures and sediment fencing to control access and prevent entry to No Go Areas.Soils erosion hazard of the Mine will be kept as low as practicable by minimizing land disturbance in accordance with Table S3. <p>SEDIMENT FENCING OR STRAW BALE PROTECTION</p> <ul style="list-style-type: none">Sediment fencing or straw bale protection are to be established in the location identified on Figure S1 (see Sheet 02) and down-slope of any new disturbance where earth bank diversion drains are not established.Install sediment fencing as described by SD 6-8 (see Sheet 11) or straw bale protection as described by SD 6-7 (see Sheet 11). <p>MITRE DRAINS</p> <p>The construction and compaction of the roads and tracks within the Mine Access Corridors will create a preferential drainage path for runoff.</p> <p>Mitre drains enable runoff captured from clean water catchments to be divert accumulated runoff away from the roadside drain to prevent flow concentration and erosion.</p> <ul style="list-style-type: none">Construct and maintain each mitre drain as required.The ‘tail’ of the mitre drain should extend at least 5m from the road surface.Construct with V-shaped cross section and grade of 1% or less.If erosion within the mitre drain is observed, install a rock check dam (see SD 5-4 of Sheet 09) approximately midway between the road and discharge point of the drain. <p>SOIL STRIPPING AND STOCKPILING</p> <ul style="list-style-type: none">Where an identifiable topsoil layer is identified, this will be stripped to a depth of at least 200mm ahead of excavation.Soil stripping will not be undertaken during or following rainfall when soil likely to be damp.Soil stripping will not be undertaken during hot, windy conditions.Stripped topsoil will either be temporarily stockpiled or immediately transferred to active rehabilitation areas (refer to Notes on <i>Soil Respreding and Vegetation Establishment</i>).					 <p>Figure 5.9 Runoff dispersal using mitre drains (redrawn from Garden 1988)</p> <p>Figure S3 Schematic Illustration of Mitre Drain</p> <ul style="list-style-type: none">Soil stockpiles will be located at the discretion of the Quarry Manager within the defined perimeter of the extraction area, i.e. not beyond the No Go Areas. Figure S1 (see Sheet 02) provides indicative locationsAll stockpiles must be constructed in accordance with SD 4-1 (see Sheet 09).Stockpiles must have sediment fencing, straw bale protection or a grass buffer strip installed around the downslope base.Stockpiles must be placed at least 5m from a watercourse.Stockpiles are to be stabilized to achieve a C-Factor of 0.1 within 10 days of formation (refer to Table S3).Soil stockpiles will remain less than 3m in heightSlopes of the stockpiles will be battered to provide a slope no steeper than 2:1 (H:V). <p>DIVERSION DRAINS AND LEVEL SPREADERS</p> <ul style="list-style-type: none">Two types of diversion drains will be constructed (refer to Figure S1 on Sheet 02).<ul style="list-style-type: none">Clean Water Diversion Drains will be constructed and maintained to divert surface flows from land undisturbed by the Mine to the south.Dirty Water Diversion Drains will be constructed and maintained to capture runoff from disturbed areas and divert to sediment basins (refer to Notes on <i>Sediment Basins</i>).										
LAND USE	LIMITATION	REMARKS																														
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Remaining lands including revegetation areas	Entry prohibited except for essential management works.	Thinning of growth might be necessary in accordance with bushfire management requirements or weed reduction strategies.																														
<p>TABLE S3 MAXIMUM ACCEPTABLE C-FACTORS AT NOMINATED TIMES DURING WORKS</p> <table><tr><th>LANDS</th><th>MAXIMUM C-FACTOR</th><th>REMARKS</th></tr><tr><td>Waterways and other areas subjected to concentrated flows (e.g. table drains), post construction and during operation.</td><td>0.05</td><td>Applies after ten working days from completion of formation and before they are allowed to carry any concentrated flows. Flows will be limited to those shown in <i>Table 5.2</i> of Landcom (2004). Foot and vehicular traffic will be prohibited in these areas.</td></tr><tr><td>Stockpiles and batters, post construction and during operation.</td><td>0.10</td><td>Applies after ten working days from completion of formation. Maximum C-Factor of 0.10 equals 60% ground cover.</td></tr><tr><td>All lands, including waterways and stockpiles during construction and operation.</td><td>0.15</td><td>Applies after 90 working days of reseeding. Maximum C-Factor of 0.15 equals 50% ground cover. Modified after <i>Table 7.2</i> of Landcom (2004).</td></tr><tr><td>All lands, including waterways and stockpiles during construction and operation.</td><td>0.05</td><td>Applies after 120 working days of reseeding Maximum C-Factor of 0.05 equals 70% ground cover. Modified after <i>Table 7.2</i> of Landcom (2004).</td></tr></table>					LANDS	MAXIMUM C-FACTOR	REMARKS	Waterways and other areas subjected to concentrated flows (e.g. table drains), post construction and during operation.	0.05	Applies after ten working days from completion of formation and before they are allowed to carry any concentrated flows. Flows will be limited to those shown in <i>Table 5.2</i> of Landcom (2004). Foot and vehicular traffic will be prohibited in these areas.	Stockpiles and batters, post construction and during operation.	0.10	Applies after ten working days from completion of formation. Maximum C-Factor of 0.10 equals 60% ground cover.	All lands, including waterways and stockpiles during construction and operation.	0.15	Applies after 90 working days of reseeding. Maximum C-Factor of 0.15 equals 50% ground cover. Modified after <i>Table 7.2</i> of Landcom (2004).	All lands, including waterways and stockpiles during construction and operation.	0.05	Applies after 120 working days of reseeding Maximum C-Factor of 0.05 equals 70% ground cover. Modified after <i>Table 7.2</i> of Landcom (2004).	 					<p>ESCP - BEST MANAGEMENT PRACTICES 1</p> <table><tr><td>PROJECT NO. 949/02f</td><td>SHEET NO. 05</td><td>REV 2.2</td></tr></table>					PROJECT NO. 949/02f	SHEET NO. 05	REV 2.2
LANDS	MAXIMUM C-FACTOR	REMARKS																														
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WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN

(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)

BEST MANAGEMENT PRACTICES

DIVERSION DRAINS AND LEVEL SPREADERS (Cont'd)

- Clean water from the Great Western Highway is diverted away from the disturbed Quarry catchment by rock lined drains.
- The discharge point of each Clean Water Diversion Drain will be constructed and maintained as a Level Spreader with dimensions meeting the design standards of SD 5-6 (see **Sheet 10**), namely:
 - drain slope of <1% for >6m on approach to discharge;
 - sill width of >4m;
 - sill grade of 0%; and
 - sill to be maintained with grass cover.
- Dirty Water Diversion Drains will be constructed in accordance with SD 5-5.
 - The channel and bank will be grassed where practical to achieve a C-Factor of 0.05 (see **Table S3**).
 - If grassing of channel and bank not possible, rock check dams (constructed in accordance with SD 5-4 – **Sheet 09**) or straw bales (installed in accordance with SD 6-7 – **Sheet 10**) will be constructed at regular intervals.
 - Where the channel slope of the diversion drain exceeds 10% (~6°), rock check dams will be installed in accordance with SD 5-4 (see **Sheet 09**).

SEDIMENT BASINS

- SB1 to SB5 will be constructed and maintained in accordance with SD 6-4 (for fine and/or dispersible soils) (see **Sheet 11**).
- The design rainfall event considered in the design of each sediment basin is the 5-day, 95th percentile rainfall for the Lithgow (being closest long-term meteorological station of the far western region) (56.4mm).
- With exception of runoff from the Great Western Highway (to which a coefficient of 0.8 is applied), a volumetric runoff coefficient (C_v) of 0.48 has been applied to account for the presence of significant stockpiles (which will accumulate and therefore reduce runoff), as well as areas containing significant groundcover within each catchment, a low to moderate runoff potential (Soil Hydrologic Group B) has been applied.
- Table S4** provides the minimum storage and settlement capacities for each of the sediment basins.
- A marker will be maintained within each sediment basin near the discharge point identifying minimum freeboard requirement. The minimum freeboard is equivalent to the water settlement zone design requirement (see **Table S4**).
- Except during, and for a maximum of five days after a rainfall event, the water level within each sediment basin will not exceed this mark.
- Prior to the accumulated sediment exceeding this marker, the basin will be cleaned with the accumulated sediment placed on the stockpiling area for blending and sale.

OUTLET PROTECTION AND ENERGY DISSIPATION

- Maintain a rock-lined apron at the discharge point of SD1 and SB2 (see **Figure S1**) (EPL Points 1 and 2).
- The toe of the apron is to be keyed into the ground a minimum of 900mm.

SITE STABILISATION

- Undertake progressive stabilisation of disturbed ground surfaces as completed (refer to **Table S2**).
- Appropriate seedbed preparation will be carried out, i.e. in accordance with SD 7-1 (see **Sheet 12**).
- Diversion Drains will be stabilized as nominated in **Table S3**.
- Stabilisation measures and products will comply with **Table A3** (of the Landcom, 2004) (see **Sheet 07**).
- As surfaces are stabilized, temporary water management structures can be removed, e.g. diversion drains (or portions of).

SOIL RESPREADING AND VEGETATION ESTABLISHMENT

- Paddock dump soil at top of slope and push down by bulldozer.
- Lightly rip parallel to the contour to assist in keying the soil into the landform below.
- Native seed will be sown and watered as seasonal conditions dictate. Seedbed preparation will be carried out, i.e. in accordance with SD 7-1 (see **Sheet 12**).

Refer to the Mining Operations Plan (MOP) for further detail on rehabilitation.

BMP REHABILITATION

Sediment Fencing

- Confirm C-factor ≤0.1 (refer to **Table S2**) established upslope of fencing.
- Remove fencing taking care not to damage the material (such that it can be reused).
- Lightly scarify along the contour where required to level off surface and spread any vegetative debris.

Dirty & Clean Water Drains

- Consider stability of each drain and discharge point. Where stable and not inhibiting surface flows of the final landform, retain.
- Gently push bank component of the drain into the channel and grade using dozer blade, excavator bucket or other means until level.
- Lightly scarify and allow to re-seed naturally.

Sediment Basins

- Consider use for water storage in the final landform and retain where not inhibiting surface flows of the final landform.
- Backfill with available screening reject or other stockpiled material and allow to compact.
- Cover with 100mm to 200mm of previously stockpiled soil and either sow with native species or allow to revegetated naturally.



**TABLE S4
DESIGN CAPACITIES FOR SEDIMENT BASINS**



Basin Identification	Surface Area (m ²)	Basin Volume (m ³)	Minimum Water Settlement Volume (m ³)	Minimum Sediment Storage Volume (m ³)	Total Minimum Storage Requirement (m ³)	Comments
SB1	1 200	2 100	1 895	41	1 936	Provides for the collection and settlement of runoff from the Processing and Stockpiling Area. As accumulated, water will be transferred to SD1. If water retained within SB1, a combined minimum capacity of 2 000m ³ will be maintained between SB1 and SD1.
SB 2	1 400	2 800	2 255	47	2 302	Provides for the collection and settlement of runoff from the Great Western Highway (adjacent to the Quarry Site intersection), Extraction Area and sections of the Quarry Access Road and haul roads. To be operated as a dry structure, with accumulated water transferred to other storages (SD1 and/or SD2) with 5 days of a runoff generating rainfall event.
SB3	200	300	108	1	109	This temporary structure will only be required as long as Catchment 2b generates runoff from the southern section of the extraction area.
SB4	400	1 000	839	34	873	Provides for the collection and settlement of runoff from a future stockpile area of the Quarry.
SB5	25	140	135	0	135	Provides for the collection and settlement of runoff from the unsealed areas of the office are and haul roads.

REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS			ESCP - BEST MANAGEMENT PRACTICES 2		
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Walker Quarries

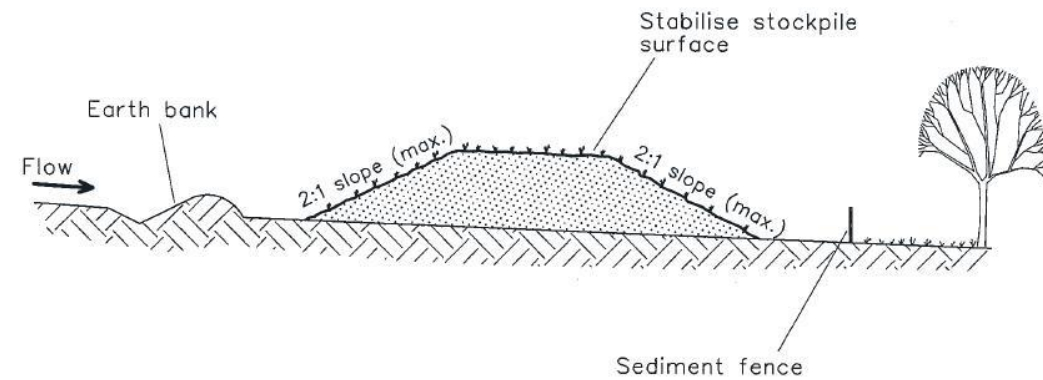
WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN																	
(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)																	
BEST MANAGEMENT PRACTICES																	
MONITORING AND MAINTENANCE <i>Water Quality</i> <ul style="list-style-type: none">Monitoring will be undertaken in accordance with <i>Section 9</i> of the Walker Quarry Water Management Plan.In the event a discharge of water is proposed from SD1 or SB2, a water sample will first be taken to confirm water quality meets criteria of the Environment Protection Licence. No discharge will occur prior to the receipt of results confirming compliance. <i>BMPs</i> <ul style="list-style-type: none">Diversion Drains, mitre drains, sediment basins, sediment fencing and other erosion and sediment control structures will be inspected (at least monthly and immediately following heavy rainfall) to ensure adequate capacity is retained (where applicable) and are not eroding or causing erosion.Ensure there is no build up of sediment or vegetation against sediment fencing or straw bale protection. If present, remove as soon as practically possible.If observed, remove sediment build-up from drains to reduce the potential for these to overtop and by-pass the Containment Dam.If erosion observed within drains, install rock check dams (see SD 5-4 of Sheet 08).					SELF-AUDITING PROGRAM A self-auditing program will be initiated. The Quarry Manager (or delegate) is to inspect the site at least monthly and maintain a written log of inspections, paying particular attention to the following. <ul style="list-style-type: none">Ensure barrier fencing is maintained and exclusion zones are being observed by all workers and contractors.Ensure sediment fencing is maintained as illustrated on SD 6-8 (see Sheet 12).Water settlement and sediment storage capacity in sediment basins remains below the marker levels.Provide for discharge of water or removal of sediment if capacities reduced below the minimum requirements of Table S4 (see Sheet 06).Ensure accumulated sediment is excavated from sediment basins and disposed to safe.Ensure the outlet protection of SD1 and SB2 remains intact and continues to protect against erosion.					SELF-AUDITING PROGRAM (Cont'd) <ul style="list-style-type: none">Maintain erosion and sediment control measures in their functioning condition for the duration of the mining activities. Identify areas of localised soil erosion and taking appropriate preventative measures. These might include:<ul style="list-style-type: none">planting additional stabilising vegetation or wind breaks;stabilising soils with mulches or alternative soil binders;taking steps to minimise any unnecessary concentrated stormwater flow; orinstalling formalised drainage channels or pipes.Remove spilled soils or other materials and dispose to safe areas, e.g. stabilized stockpile.Construct additional erosion and/or sediment control works as become necessary to ensure the desired water control is achieved.Ensure any waste materials (such as rocks and debris) are to be removed from any publicly trafficked road surface as soon as possible.Ensure waste receptacles are emptied as necessary. Disposal of waste must be in a manner approved by the superintendent.Ensure records of water usage, rainfall, water quality and auditing are being kept.							
REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS					ESCP - BEST MANAGEMENT PRACTICES 3							
0	4/8/2016	AI		Original	DESIGN BY:	N/A											
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WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN																			
(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)																			
BEST MANAGEMENT PRACTICES																			
Table A3 Soil Stabilisation Control Matrix (adapted from various sources, including Meyer and Ports (1976), Israelson et al. (1980), Goldman et al. (1986), URS Greiner Woodward Clyde (1999) and the North American Green website).																			
Class	Type	Suitable for Vegetation Type ^[1]	Design Life (months)	Use in Concentrated Flow ^[2]	Availability (days) ^[3]	Relative Cost Bracket ^[4]	Residual Impact ^[5]	C -factor ^[6] <33%, <6m	C -factor <33%, 6-15m	C -factor <33%, >15m	C -factor 33-50%, <6m	C -factor 33-50%, 6-15m	C -factor 33-50%, >15m	Notes					
BIODEGRADABLE MULCHES ^[7]																			
Straw (anchored)	4.5 tonnes per hectare	Grass	1 to 6	No	< 5days	Low	Moderate	0.17	0.17	0.20	0.20	0.20	0.20	1 Whether vegetation is required and its type if so, will affect the technique used. Biodegradable mulches, RECPs and hydraulic soil stabilisers can all be used on their own to provide short term protection. However, their effectiveness is less when used in isolation than when used with vegetative growth. Most techniques are used to help establish vegetative growth using sown grasses. Should the client specify shrubs (primarily planted as tubestocks), then thicker mulches, RECPs or biodegradable mulches should be used. Non biodegradable RECP's are used to reinforce grasses (turf) permanently. They are not suitable for use with individual shrubs. They can work synergistically with the established grass to increase its resistance to shear stress and, therefore, increase its resistance to erosion by concentrated flow.					
Wood Chip	16 tonnes per hectare	Grass/Shrubs	1 to 6	No	< 5days	Low	Moderate	0.08	0.08	0.08	No data								
Wood Chip	27 tonnes per hectare	Shrubs	1 to 6	No	< 5days	Low	Moderate	0.05	0.05	0.05	No data								
Wood Chip	56 tonnes per hectare	Shrubs	1 to 6	No	< 5days	Low	Moderate	0.02	0.02	0.02	0.02	0.02	0.02						
Hydromulching	1.5 tonnes mulch + 300 litres binder per hectare	Grass	1 to 3	No	< 5days	Low	Low	0.00	0.03	0.07	0.03	0.06	0.10	2 Products might or might not be suitable for use in areas of concentrated flow. All products are suitable for sheet flow conditions, although some would be over designed in such cases.					
Bonded Fibre	5 tonnes fibre per hectare	Grass	1 to 6	No	< 5days	Low	Moderate	0.00	0.03	0.07	0.03	0.06	0.10						
ROLLED EROSION CONTROL PRODUCTS (RECPs) ^[7]																			
Biodegradable	Jute mesh	Grass	6 to 12	Yes	< 5days	Low	Moderate	0.10	0.20	0.40	0.20	0.40	0.60						
	Coconut fibre mesh	Grass	6 to 12	Yes	< 5days	Low	Moderate	0.10	0.20	0.40	0.20	0.40	0.60	3 Whether or not a product is readily available is critical to the selection process. Many RECP and hydraulic soil stabiliser techniques use products that might be "off the shelf" and available from several suppliers. Biodegradable mulches can be affected by seasonal variation, although they might also be available on site after initial clearing and grubbing. Temporary seeding might also be seasonal.					
	Curled wood fibre	Grass	6 to 12	Yes	< 5days	Medium	Moderate	0.01	0.05	0.10	0.10	0.15	0.20						
	Jute matting (~350 gsm)	Grass	6 to 12	Yes	< 5days	Medium	Moderate	0.00	0.03	0.07	0.03	0.06	0.10						
	Jute matting (~600 gsm)	Shrubs	6 to 12	Yes	< 5days	Medium	Moderate	0.00	0.03	0.07	0.03	0.06	0.10						
	Coconut fibre matting (~450 gsm)	Grass	6 to 12	Yes	< 5days	Medium	Moderate	0.00	0.03	0.07	0.03	0.06	0.10	4 For any given technique, cost can vary greatly depending on geographic location, size of project and installation requirements. In addition, costs can vary over time. Because of these factors, giving accurate installed costs is not possible. However, if a product is relatively inexpensive to purchase and install close to its point of manufacture, it will still be relatively inexpensive to purchase and install remote from it.					
	Coconut fibre matting (~900 gsm)	Shrubs	6 to 12	Yes	< 5days	Medium	Moderate	0.00	0.03	0.07	0.03	0.06	0.10						
Photodegradable	Mesh (< 5 mm openings)	Grass	1 to 6	Yes	< 5days	Low	Moderate	0.01	0.05	0.10	0.10	0.15	0.20						
Non Biodegradable	Plastic fibres with netting	Grass	> 12	Yes	< 5days	High	High	0.00	0.05	0.10	0.03	0.05	0.10						
	Composite with biodegradable	Grass/Shrubs	> 12	Yes	< 5days	High	High	0.00	0.03	0.07	0.03	0.06	0.10	5 This criterion relates to the impact that a particular practice might have on construction activities once they are resumed on an area that was temporarily stabilised.					
HYDRAULIC SOIL STABILISERS ^[7]																			
	Polymers/Polyacrylamide (rate depends on type)	Grass	1 to 6	No	< 5days	Low	Low	0.01	0.05	0.10	0.10	No data							
	Bitumen emulsion (12,000 l/ha)	Grass	1 to 6	No	< 5days	Low	Low	0.01	0.05	0.10	0.10	No data							
TEMPORARY SEEDING																			
	Annual	NA	6 to 12	No	< 5days	Low	Low	0.05	0.05	0.10	0.10	No data							
	Perennial	NA	> 12	No	< 5days	Low	Low to moderate	0.05	0.05	0.10	0.10	No data							
INSTANT TURF ^[7]																			
	Kikuyu	Grass	> 12	Yes	< 5days	Medium	Low	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6 The performance of an erosion control technique is quantified by assigning it with a C-factor (Appendix A). The C-factor will vary from close to zero for full cover, to 1.0 for no cover on highly disturbed soils. The C-factor strongly affects the soil loss calculation (RUSLE) and users need to be careful in specifying its value, particularly when values <0.01 are quoted. Note that the C-factor does not apply to concentrated flow.					
	Reinforced turf (pregrown)	Grass	> 12	Yes	5 - 15 days	High	High	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						
Values for the C-factor are given for various slopes gradients and lengths and show that it can change dramatically with them. The values given are compiled from existing data and from inference between products of a similar nature. They are given as a guide only and do not profess to be accurate in all respects. Overall, accurate C-factors are only available for manufactured products, primarily from the USA (RECP's in particular) where extensive independent testing has been undertaken. Unfortunately, very little data is available for the "lower cost" options such as biodegradable mulches, jute mesh and hydraulic soil stabilisers. Wherever possible, the manufactures should be contacted for their latest data on acceptable C-factors.																			
For the RECP's in particular, the C-factors given here are for the product as installed with no vegetation. Note however that lower C-factors can be expected if vegetation is promoted with many RECP's. Indeed, non biodegradable RECP's are designed to work synergistically with turf and must be used with it.																			
7 For information on trade names and suppliers of these products, please phone the office of Australasian Chapter of the International Erosion Control Association on 1800 354 322 or (+61 2) 4677 0901.																			
REV	DATE	BY	APP.	REVISION DETAILS		DRAWING STATUS			<div><div></div><div></div></div>						ESCP - BEST MANAGEMENT PRACTICES 4				
0	4/8/2016	AI		Original	DESIGN BY:	N/A		PROJECT NO. 949/02f										SHEET NO. 08	REV 2.2
1	08/09/16	AI			DRAWN BY	N/A													
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WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN

(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)

STANDARD DRAWINGS

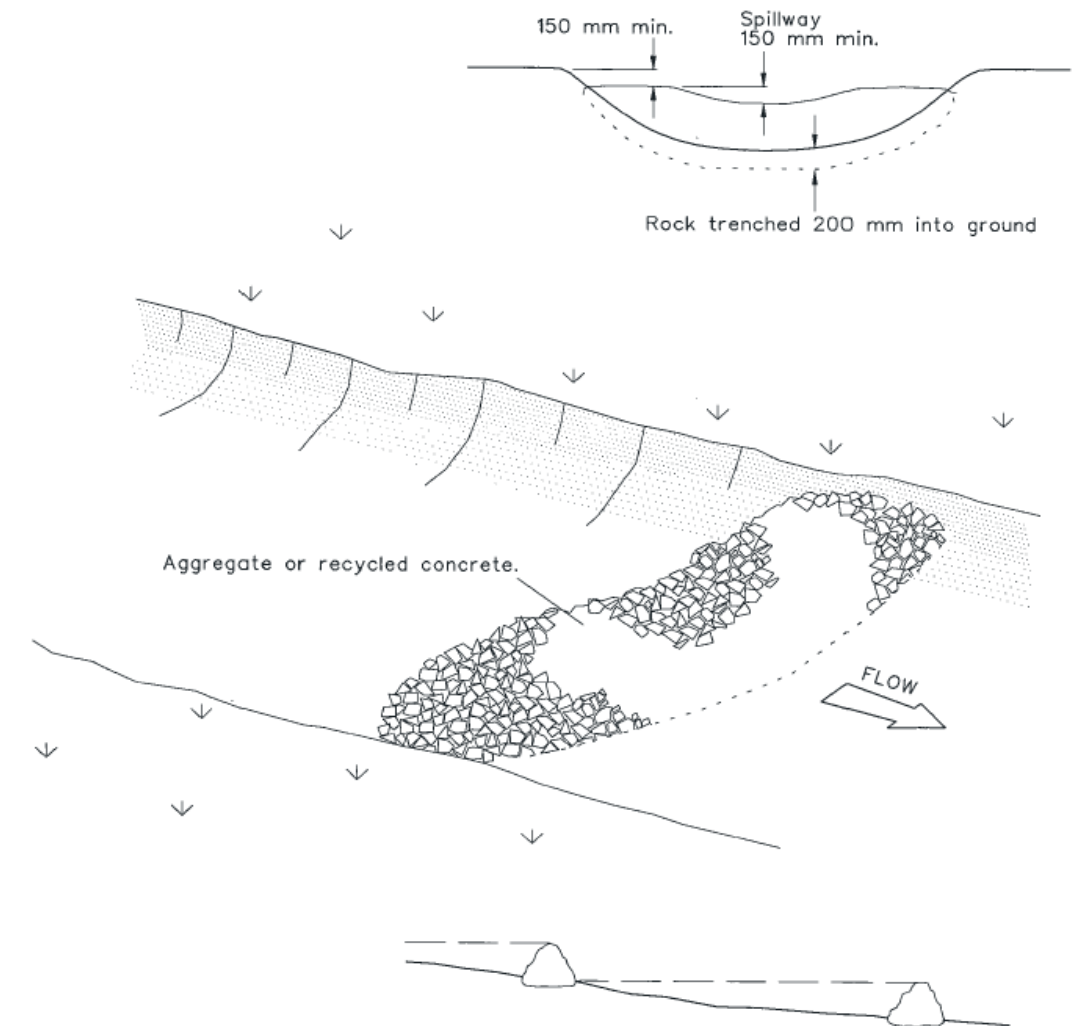


Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES

SD 4-1



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

REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS
0	4/8/2016	AI		Original	DESIGN BY: N/A
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ESCP – STANDARD DRAWINGS 1

PROJECT NO. 949/02f

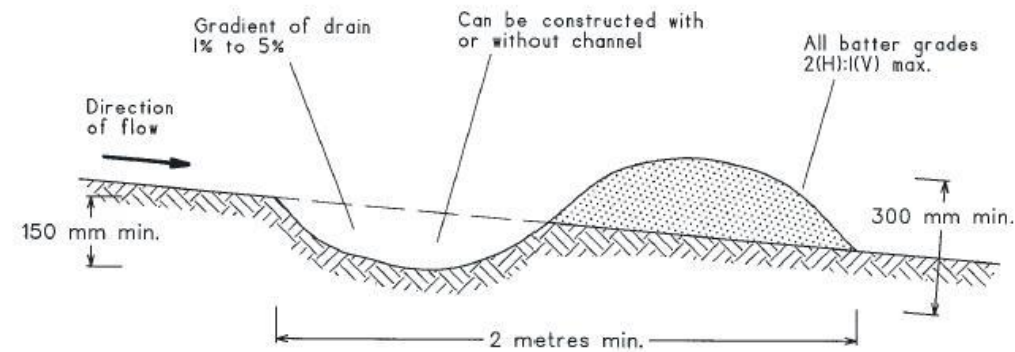
SHEET NO. 09

REV 2.2

WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN

(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)

STANDARD DRAWINGS



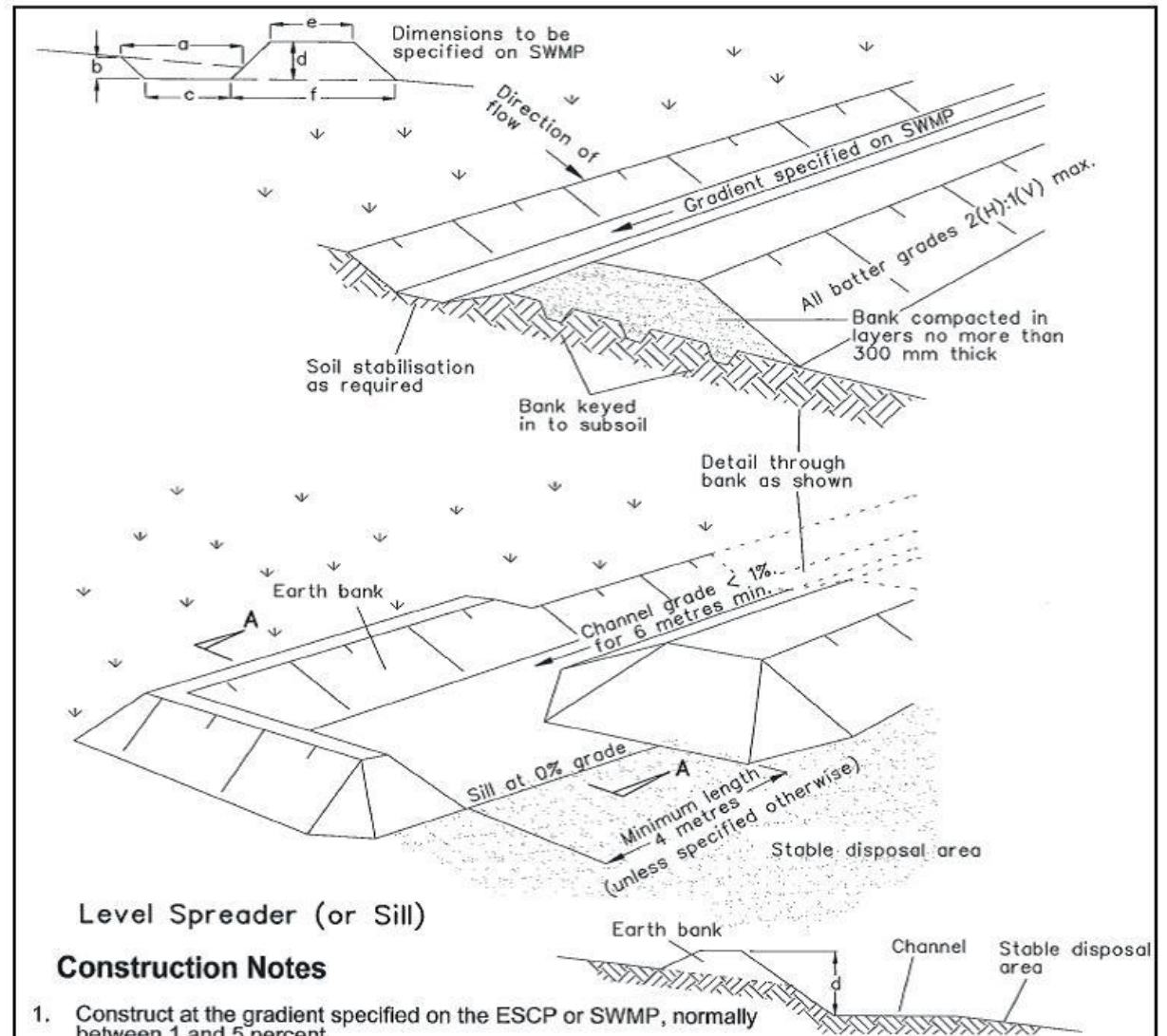
NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

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



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

REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS
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ESCP - STANDARD DRAWINGS 2

PROJECT NO. 949/02f

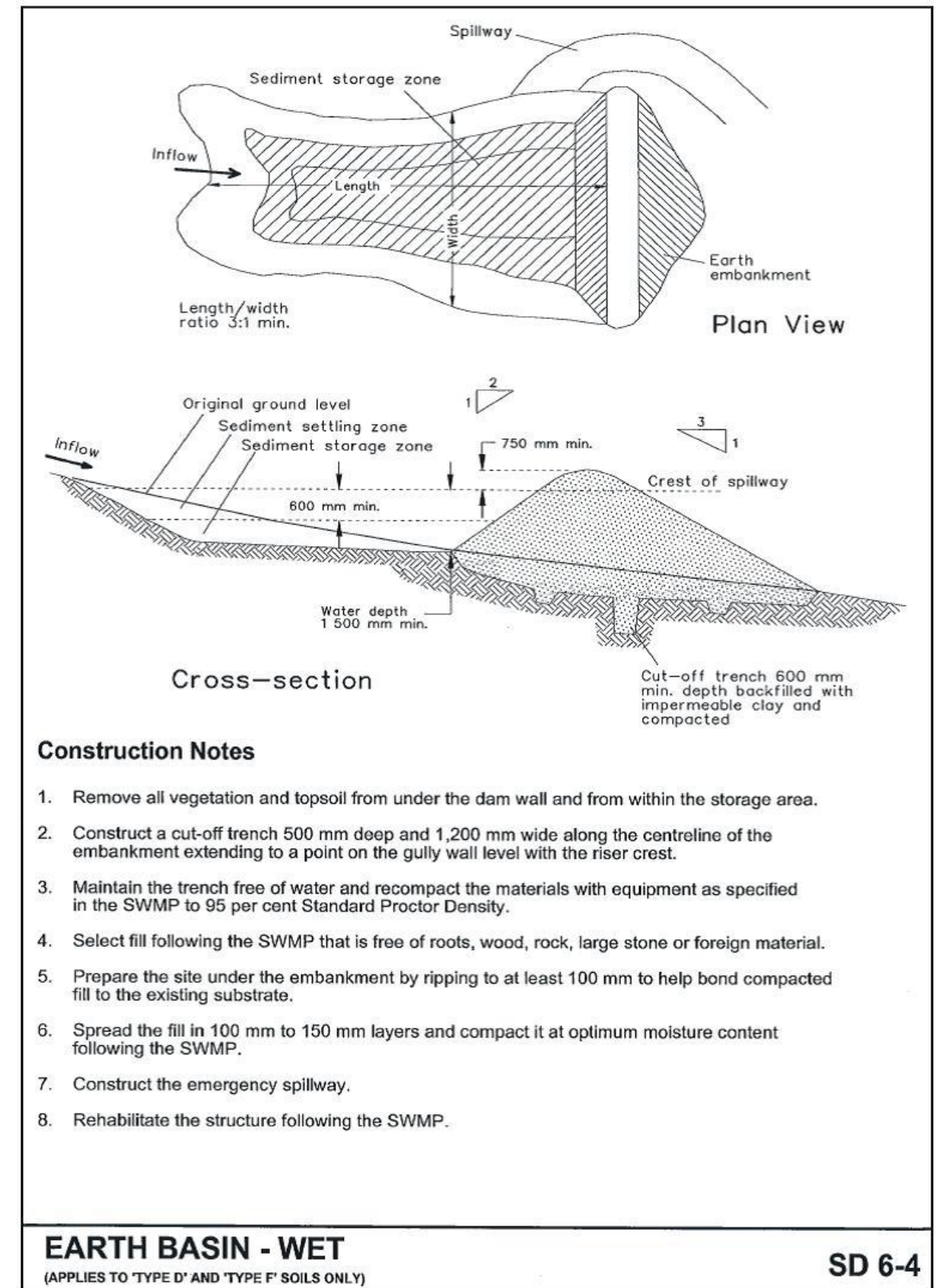
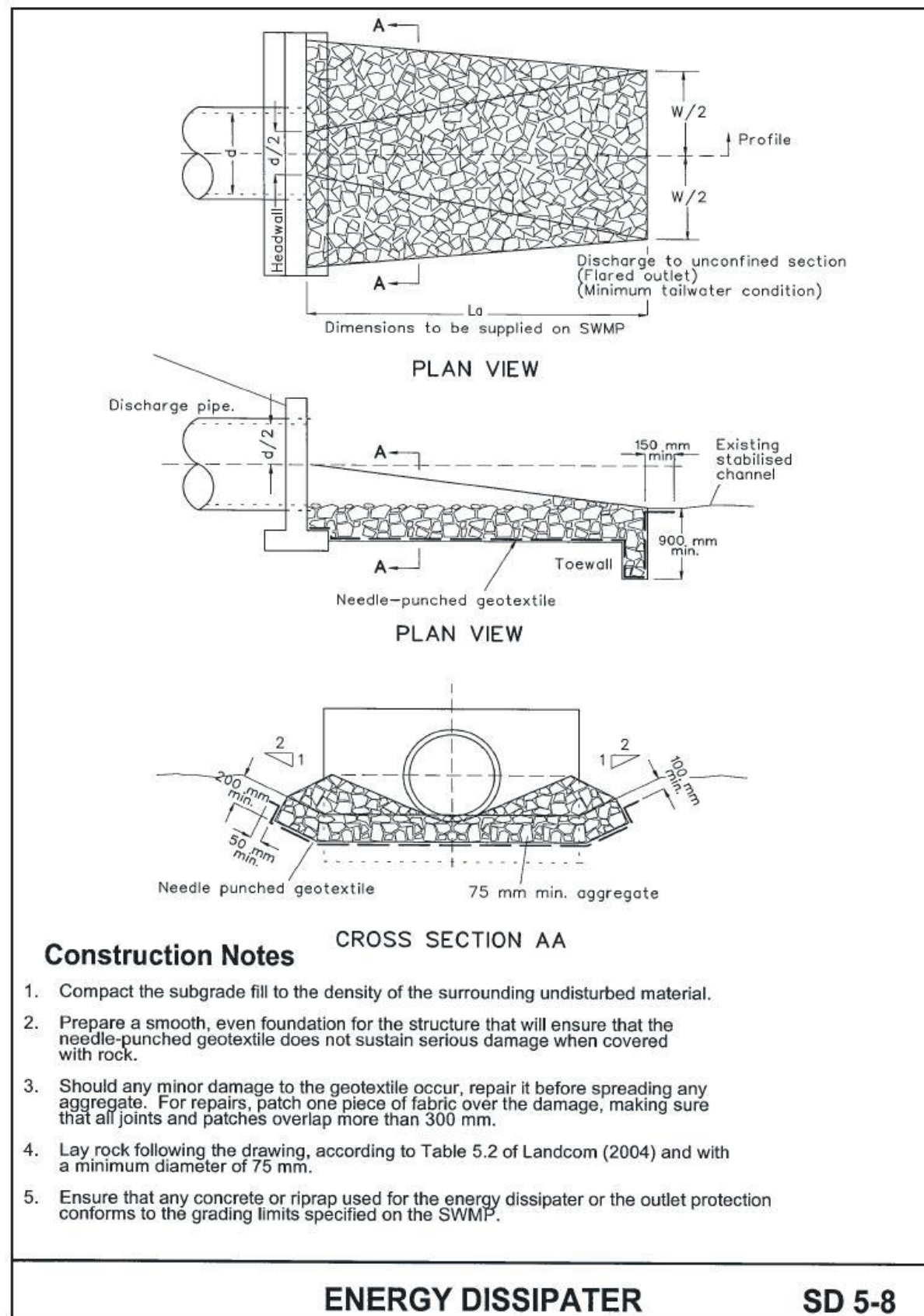
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REV 2.2

WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN

(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)

STANDARD DRAWINGS



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0	4/8/2016	AI		Original	DESIGN BY: N/A
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ESCP - STANDARD DRAWINGS 3

PROJECT NO. 949/02f

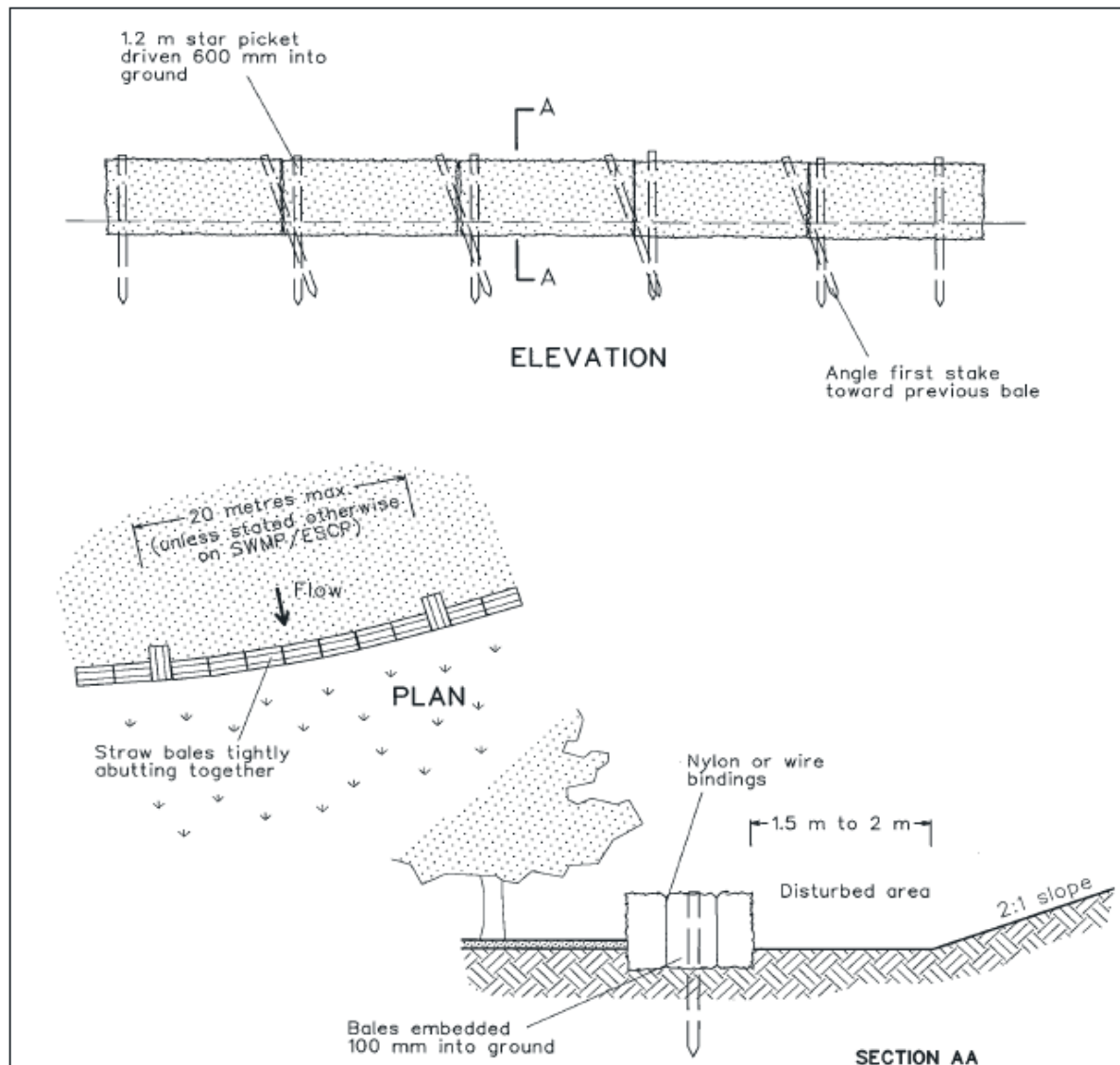
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WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN

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STANDARD DRAWINGS

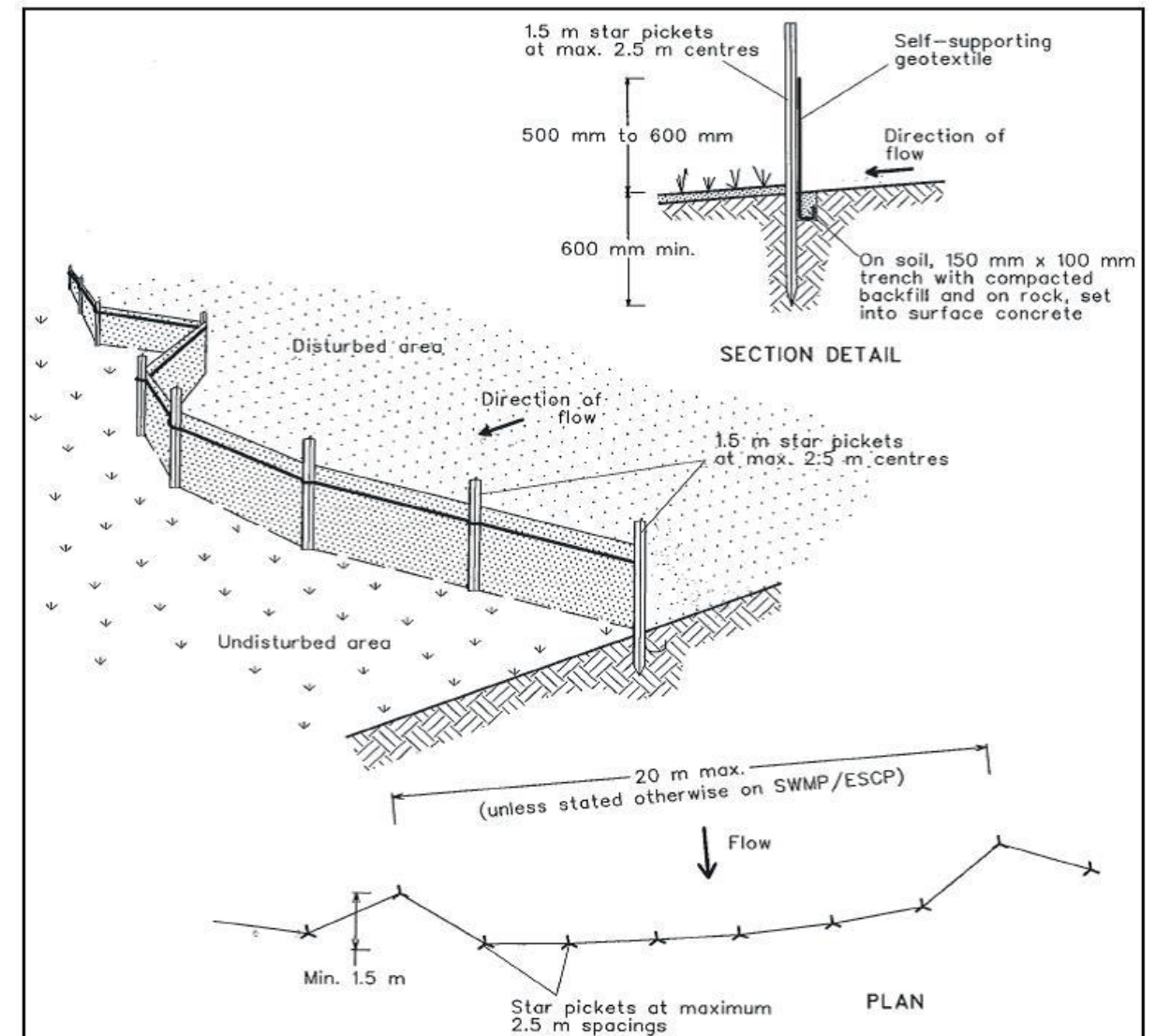


Construction Notes

- Construct the straw bale filter as close as possible to being parallel to the contours of the site.
- Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
- Ensure that the maximum height of the filter is one bale.
- Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
- Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
- Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

STRAW BALE FILTER

SD 6-7



Construction Notes

- 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.
- Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
- 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.
- 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.
- Join sections of fabric at a support post with a 150-mm overlap.
- Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE

SD 6-8

REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS
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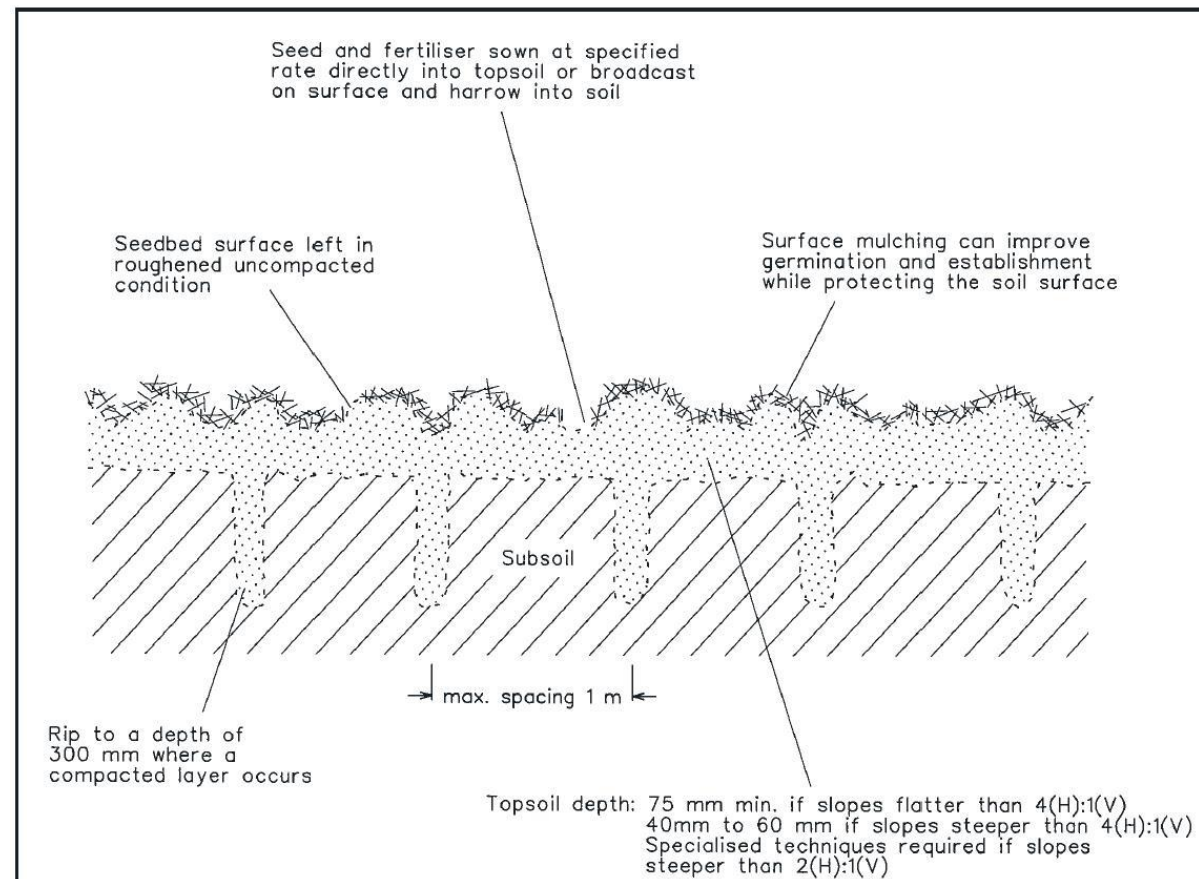
ESCP - STANDARD DRAWINGS 4

PROJECT NO. 949/02f SHEET NO. 12 REV 2.2

WALLERAWANG QUARRY: EROSION AND SEDIMENT CONTROL PLAN

(In Satisfaction of Schedule 3 Condition 18(d) of DA 344-11-2-001)

STANDARD DRAWINGS





Construction Notes

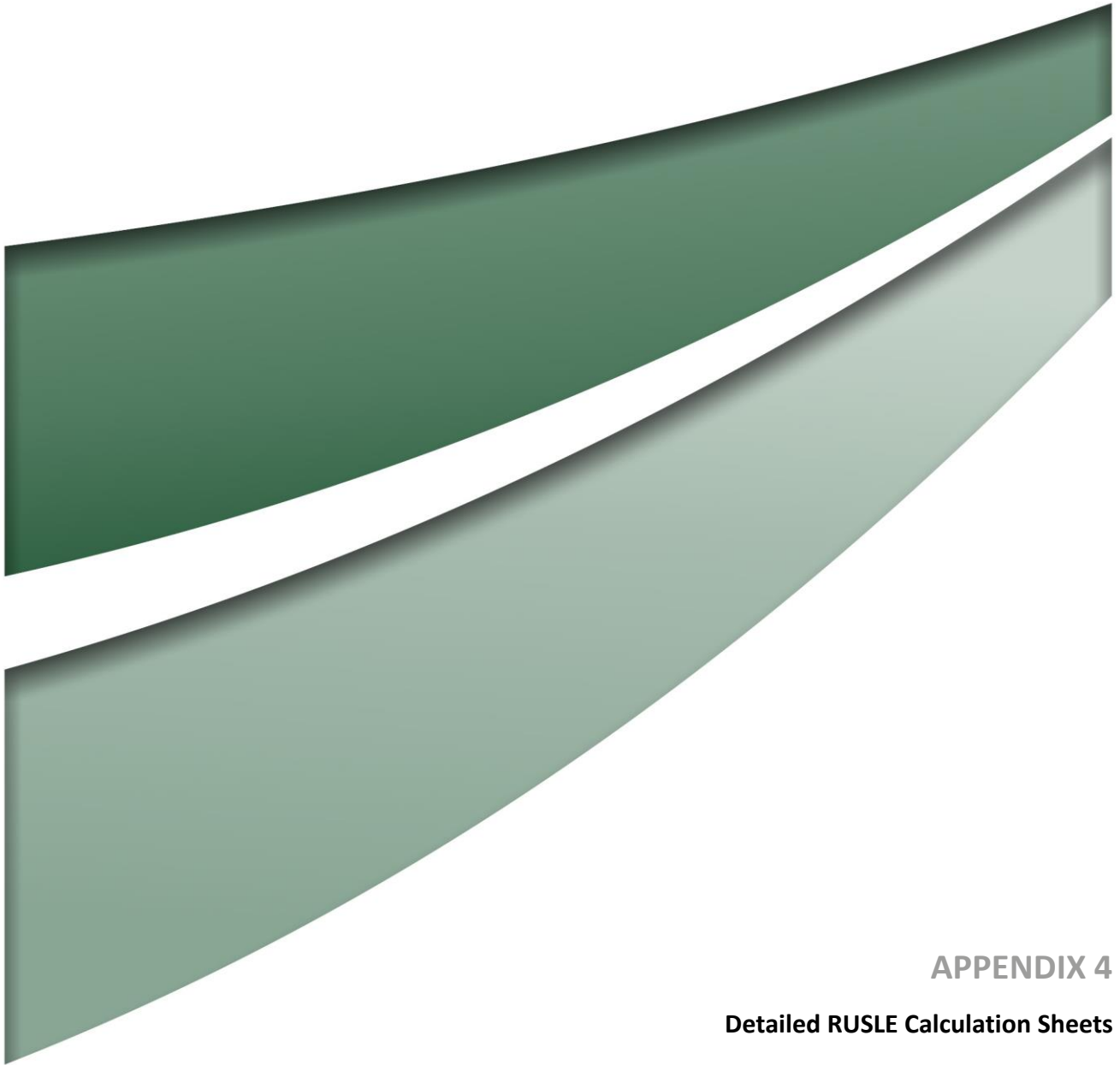
1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

SEEDBED PREPARATION

SD 7-1

REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS	<div></div>		
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						PROJECT NO. 949/02f	SHEET NO. 12	REV 2.2

ESCP - STANDARD DRAWINGS 5



APPENDIX 4

Detailed RUSLE Calculation Sheets

Appendix 4

Detailed Calculation Sheets

(RUSLE Equation)

1. Site Data Sheet

Site Name:	Wallerawang Quarry						
Site Location:	Great Western Highway						
Precinct:	Wallerawang						
Description of Site:	Quartzite Quarry						
Site area	Sub-catchments						Remarks
	SB-1	SB-6	SB-7	SB-2	SB-5	SB-3	
Total catchment area (ha)	7.5	0.6	0.5	7.1	0.5	0.2	
Disturbed catchment area (ha)	7.5	0.6	0.5	0.8	0.5	0.2	
Soil analysis (enter sediment type if known, or laboratory particle size data)							
Sediment Type (C, F or D) if known:	D	D	D	D	D	D	From Appendix C
% sand (fraction 0.02 to 2.00 mm)							Soil texture should be assessed through mechanical dispersion only. Dispersing agents (e.g. Calgon) should not be used
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
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	D	D	D	D	D	D	Automatic calculation from above
Rainfall data							
Design rainfall depth (days)	5	5	5	5	5	5	See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	95	95	95	95	95	95	See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	56.4	56.4	56.4	56.4	56.4	56.4	See Section 6.3.4 (h)
Rainfall R-factor (if known)	1500	1500	1500	1500	1500	1500	See Appendix B
IFD: 2-year, 6-hour storm (if known)	7.79	7.79	7.79	7.79	7.79	7.79	See IFD chart for the site
RUSLE Factors							
Rainfall erosivity (R-factor)	1500	1500	1500	1500	1500	1500	Auto-filled from above
Soil erodibility (K-factor)	0.05	0.05	0.05	0.05	0.05	0.5	RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	50	30	30	30	20	25	
Slope gradient (%)	1	1	1	1	1	2	
Length/gradient (LS-factor)	0.17	0.15	0.15	0.15	0.13	0.26	
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)	17	15	15	15	13	252	
Soil Loss Class	1	1	1	1	1	3	See Section 4.4.2(b)
Soil loss (m ³ /ha/yr)	13	11	11	11	10	193	
Sediment basin storage volume, m ³	16	1	1	2	1	7	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:

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

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	$R_{x\text{-day}, y\text{-}\%ile}$	Total catchment area (ha)	Settling zone volume (m ³)	Sediment storage volume (m ³)	Total basin volume (m ³)
SB-1	0.50	56.4	7.5	2115	16	2131
SB-6	0.50	56.4	0.6	169.2	1	170.2
SB-7	0.50	56.4	0.5	141	1	142
SB-2	0.50	56.4	7.1	2002.2	2	2004.2
SB-5	0.50	56.4	0.5	141	1	142
SB-3	0.50	56.4	0.2	56.4	7	63.4

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

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