Dunmore Hard Rock Quarry

Water Management Plan

Prepared for Boral Resources (NSW) Pty Ltd

September 2024

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Boral Resources (NSW) Pty Ltd

E240888 RP1

September 2024

Version	Date	Prepared by	Reviewed by	Comments
V1	22 March 2019	J O'Brien	C Kuczera	Draft to address Modification 9 consent conditions
V2	10 May 2019	J O'Brien	C Kuczera	Updated to address Boral comments on V1
V3	8 April 2020	J O'Brien	C Kuczera	Updated to address DPIE and NRAR comments on V2
V4	29 April 2020	J O'Brien	C Kuczera	Updated to address Boral comments on V3
V5	5 May 2023	J O'Brien	C Kuczera	Updated to address DPIE comments on water licensing requirements
V6	24 September 2024	J O'Brien	C Kuczera	Updated to include Modification 13

Approved by

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24 September 2024

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1 Introduction

1.1 Background

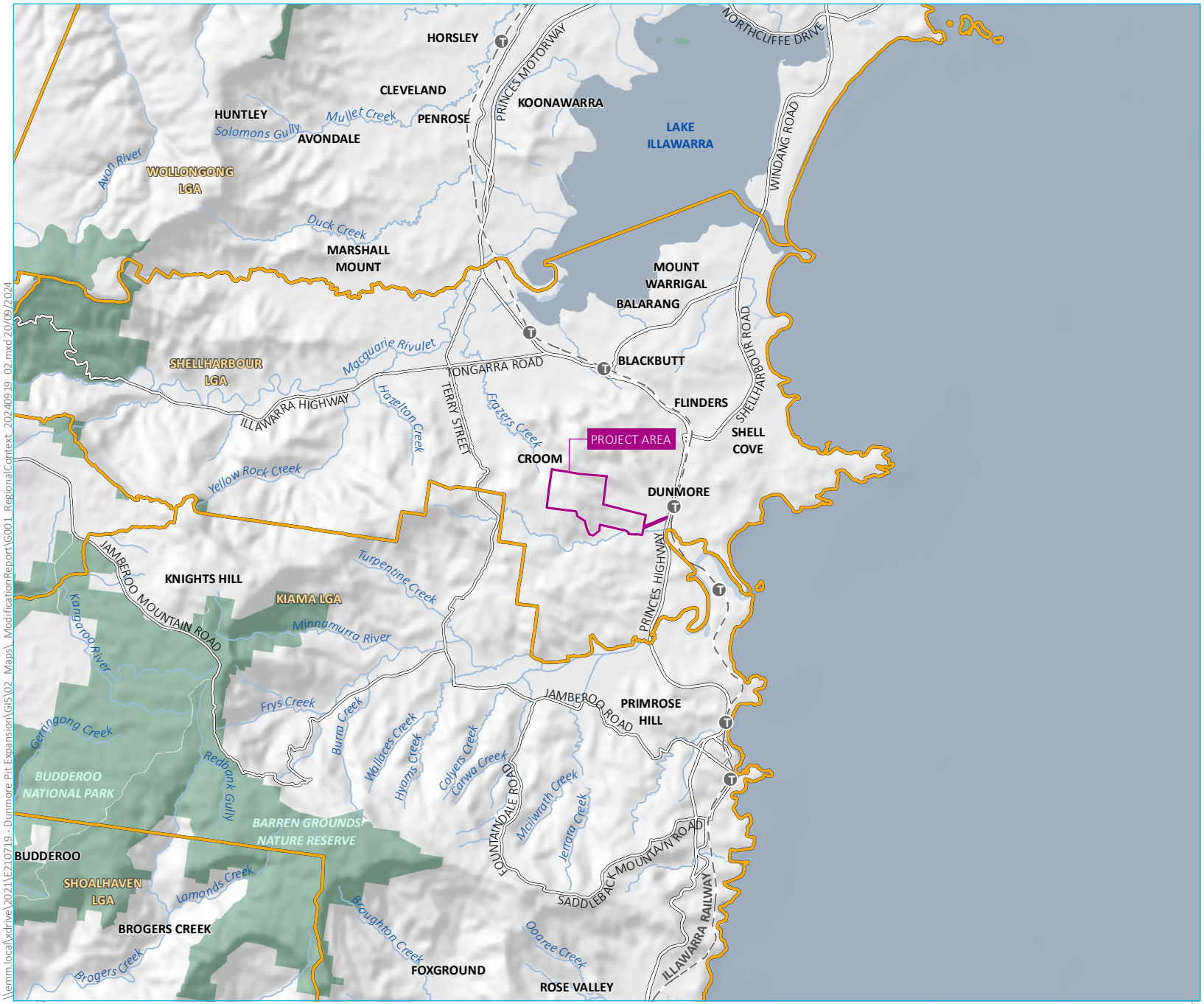
Boral Resources New South Wales (NSW) Pty Ltd (Boral) own and operate the Dunmore Hard Rock Quarry (the quarry) located at the end of Tabbita Road, in the Shellharbour local government area (LGA). The quarry is approximately 8 kilometres (km) north-west of Kiama (refer to Figure 1.1).

Development consent (DA 470-11-2003) for the quarry was granted by the Minister for Planning on 19 November 2004. Since consent was issued in November 2004, there have been 13 approved modifications to the development consent.

Modification 9 sought consent to expand the Croome Farm Pit by approximately 14.4 hectares (ha) to enable extraction within the Croome West Pit. Modification 9 was granted development consent in September 2017. Modifications 10, 11 and 12 were subsequently granted development consent in June 2017, March 2019, and September 2021 respectively. These modifications were in relation to administrative changes, such as hours of operation and rail versus road tonnages rather than changes to operational footprint.

Modification 13 sought consent to expand the quarry by approximately 8 ha to the north into land previously owned by the Rail Infrastructure Corporation (RIC). Modification 13 also sought to increase the depth of operations across the quarry to maximise resource extraction. Modification 13 was granted development consent in June 2024.

The project consent is subject to numerous conditions, including a requirement that Boral prepare an updated Water Management Plan (WMP) for the quarry. This document presents an updated WMP and supersedes previous WMPs prepared by Matrix Consulting in 2005, Evans and Peck in 2008, and Arcadis in 2016 and includes references to the surface water and groundwater assessments prepared for Modification 9 and Modification 13 where applicable.



KEY

- Project area
- Train station
- Rail line
- Major road
- Named watercourse
- Named waterbody
- NPWS reserve
- Local government area

INSET KEY

- Major road
- NPWS reserve
- State forest

Source: EMM (2024); DFSI (2017); GA (2011); ASGC (2006)

0 5 10 km

GDA 1994 MGA Zone 56

N

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Regional context

Dunmore Hard Rock Quarry
Water Management Plan
Figure 1.1

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1.2 Site description

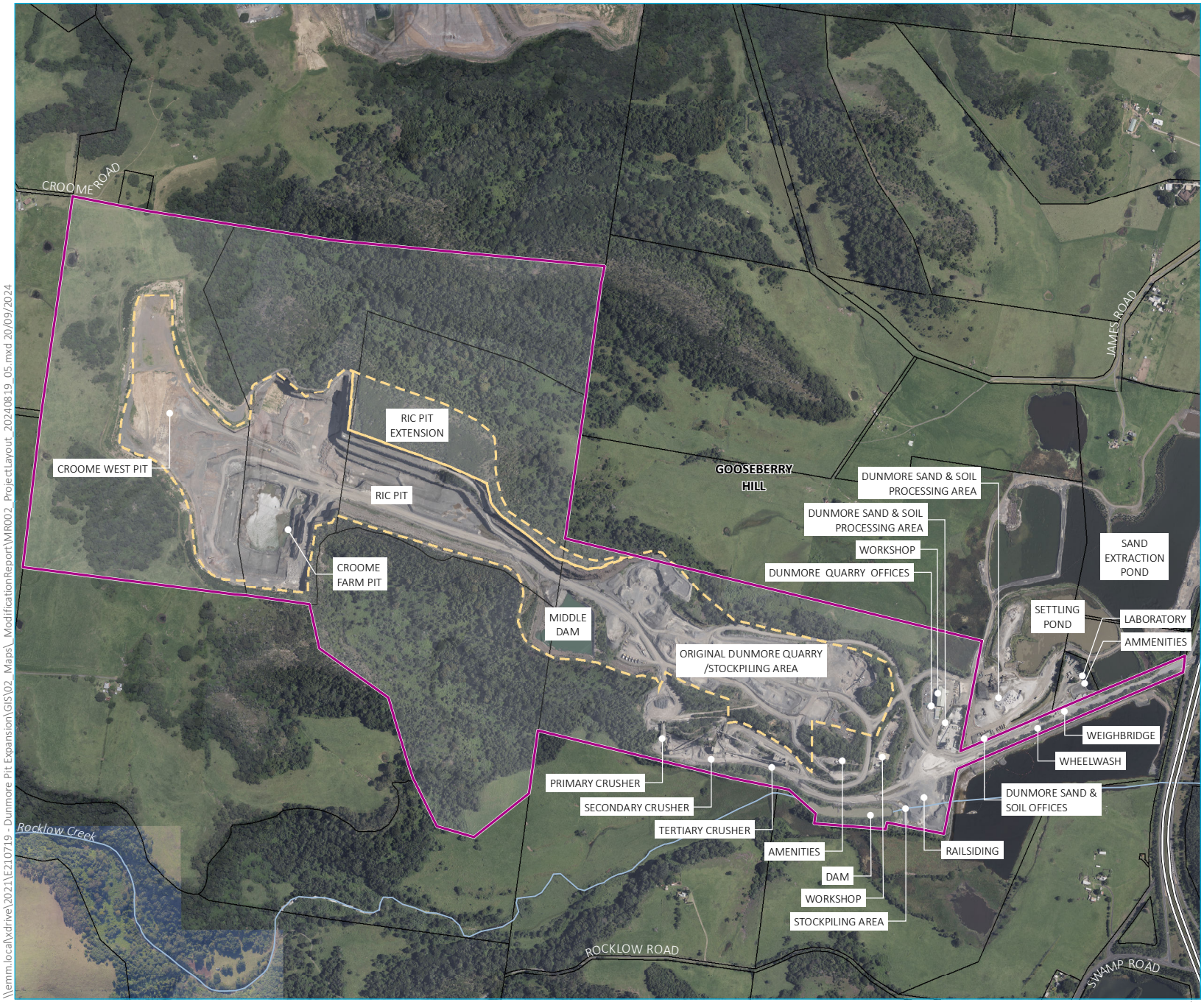
The quarry covers an area of approximately 245 ha and is predominantly surrounded by agricultural and rural residential land users and tracts of remnant native vegetation. Dunmore Sand and Soil (DSS) and the Dunmore Concrete Batching Plant (CBP), both operated by Boral, are located to the east of the quarry. The layout of the quarry is shown in Figure 1.2.

The quarry has been in operation for approximately 100 years. Over this time, the extraction area has moved in a westerly direction with the original quarry area now used for site infrastructure and stockpiling. Extraction from the western area of the quarry (referred to as the Croome Farm Pit) commenced in 2000 and was estimated to have rock reserves until the end of 2017 (EMM 2017). Modification 9 extended the extraction area to the west of the Croome Farm Pit (referred to as the Croome West Pit) while Modification 13 extended the extraction area to the north into the RIC land (referred to as the RIC Pit). It is estimated the Croome West Pit and RIC Pit resources will allow extraction to occur up to 2043 (EMM 2023).

The hard rock produced at the quarry is crushed on-site to supply construction materials to markets in the Illawarra, Southern Highlands and Sydney Regions. The quarry comprises of an elongated open cut pit with a disturbance area of approximately 100 ha comprising of the approved extraction area, access roads and site infrastructure. Site infrastructure includes a crushing and screening plant, product stockpiles, workshop and site offices located to the east of the pit. An overview of the existing operation is provided in Table 1.1.

Table 1.1 Overview of existing operation

Quarry component	Currently approved
Quarry life	Until 2043
Limits of production	2.5 million tonnes per annum
Approved extraction area	84 ha (shown in Figure 1.2)
Processing of extracted material	Crushed and stored in stockpile areas in the eastern portion of the quarry (shown in Figure 1.2)
Hours of operation	**Extraction and processing** 6:00 am – 10:00 pm Monday – Saturday **Product transfer to stockpiles** 6:00 am – 12:00 am Monday – Saturday **Distribution** 24 hours Monday – Saturday Sunday[1] **Maintenance** 24 hours Monday – Sunday **Construction** 7:00 am – 6:00 pm Monday – Friday 8:00 am – 1:00 pm Saturday
Transport[1]	Road: up to 2.5 million tonnes per year Rail: up to approved production level
Site access	Off Tabbita Road



KEY

- Project area
- Approved extraction area
- Major road
- Cadastral boundary

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Source: EMM (2024); DFSI (2017); SixMaps (2024); ICSM (2011); GA (2011)

0 250 500 m

GDA 1994 MGA Zone 56

N

Site layout

Dunmore Hard Rock Quarry
Water Management Plan
Figure 1.2

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1.3 Purpose and objectives

The purpose of this WMP is to describe the water management strategies, procedures, controls and monitoring programs at the quarry. The objectives of this WMP are to:

- establish Water Quality and River Flow Objectives to provide a benchmark for assessing residual impacts associated with water discharges from the quarry
- describe the quarry's water management system and discharge mechanisms using a site water balance and other means
- describe water quality characteristics within the water management system and receiving waters
- assess residual impacts of the existing water management system and investigate water management improvement options to reduce impacts
- establish a surface water and groundwater monitoring program
- describe proposed actions, operating protocols and response measures
- establish water licencing requirements for the quarry.

1.4 Document structure

This WMP is structured as follows:

- Section 2 discusses the statutory context and relevant guidelines
- Section 3 describes the existing environment
- Section 4 describes the existing water management system
- Section 5 contains a discharge impact assessment
- Section 6 describes an erosion and sediment control plan
- Section 7 describes the surface water and groundwater monitoring program
- Section 8 describes water access licencing requirements
- Section 9 describes a site action plan and reporting and review requirements
- Section 10 contains a summary of this WMP.

2 Statutory requirements

2.1 Development consent

Table 2.1 reproduces the relevant development consent conditions relating to water management and describes how each condition is addressed within this WMP. The development consent (Modification 13) is provided in Appendix A.

Table 2.1 Summary of water related consent conditions

Consent condition	Requirement	How consent condition is addressed in WMP	Relevant section(s)
Pollution of Waters			
27	Except as may be expressly provided by an Environment Protection Licence (EPL), the Applicant must comply with section 120 of the *Protection of the Environment Operations (POEO) Act 1997* during the carrying out of the development.	A discharge impact assessment has been undertaken.	Section 5
Water Supply			
28A	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of quarrying operations to match its available water supply. Note: Under the *Water Act 1912* and/or the *Water Management Act 2000*, the Applicant is required to obtain the necessary water licences for the development.	Water licencing requirements have been established.	Section 8
Water Discharge Limit			
28	The Applicant must comply with the discharge limits in any EPL, or with section 120 of the POEO Act.	A discharge impact assessment has been undertaken.	Section 5
Site Water Balance			
29	In each Annual Review, the Applicant must: a) recalculate the site water balance for the development; and b) provide information on evaporative losses, dust suppression, dam storage levels and implications of obtaining any water supplies from off-site; and c) evaluate water take against licensing requirements.	A site water balance is provided. A site monitoring program is provided. Reporting requirements are provided.	Section 4.3 Section 7 Section 9.2
Storm Water Management System			
30	The Applicant must ensure that the storm water management system for the development is designed, constructed and operated to capture and treat polluted waters from storm event(s) of up to and including the 5-day, 95th percentile rainfall event.	Options to improve the capture and treatment of runoff from the quarry are assessed.	Section 5.3
31	The Applicant must ensure that the basins in the storm water management system are managed in accordance with the operating principles within the revised Water Management Plan prepared by Evans and Peck, dated April 2008, or any subsequent Water Management Plan approved by the Secretary, to maintain the required storm water storage volume.	This water management plan supersedes previous plans. Accordingly, consent condition 31 requires review.	Not applicable

Consent condition	Requirement	How consent condition is addressed in WMP	Relevant section(s)
Offline Dam			
32	By 18 May 2008, or as otherwise agreed to by the Secretary, the Applicant must: a) modify the existing dam at the site to create increased capacity offline from Rocklow Creek; b) construct dams within the site of sufficient capacity to ensure that the water quality criteria in condition 29 can be met for all rainfall events up to and including the 5-day duration 95th percentile rainfall event; c) ensure the discharge and overflow points of the dams do not cause erosion at the point of discharge/overflow; d) rehabilitate and stabilise the banks of the dams; and e) ensure the integrity of the dams would not be compromised by flooding; to the satisfaction of the Environmental Protection Agency (EPA) and the Secretary.	Modification of existing dam layout and operational procedures to increase storage volume, reduce flood water ingress and sediment treatment functionality are proposed.	Section 5.3
33	Prior to carrying out any of these works, the Applicant must prepare a Dam Upgrade Plan in consultation with the EPA, and to the satisfaction of the Secretary. This plan must include: a) the detailed design and specifications of the proposed works, which have been certified by a practicing registered engineer; b) an erosion and sediment control plan for the proposed works, that is consistent with the requirements in the Department of Housing's Managing Urban Stormwater: Soils and Construction manual; c) a vegetation and rehabilitation plan, setting out how the banks of the dams and other relevant pollution control features would be rehabilitated and stabilized; d) an acid sulfate soil management plan that is consistent with the NSW Acid Sulfate Soil manual; e) a construction program for the proposed works; and f) a program setting out how the modified dam and associated revegetation works would be maintained during the life of the development. The Applicant must implement the approved management plan as approved from time to time by the Secretary.	This is a legacy consent condition relating to taking the Lower Dam offline from Rocklow Creek. Accordingly, consent condition 33 requires review.	Not applicable
34	Within 1 month of completing the construction works in the Dam Upgrade Plan, the Applicant must submit an as-executed report, certified by a practicing registered engineer, to the satisfaction of the EPA and Secretary.	As-executed report to be submitted following construction works.	Section 9.1

Consent condition	Requirement	How consent condition is addressed in WMP	Relevant section(s)
Lower Dam Transition Plan			
35A	Within 3 months of the determination of Modification 9, or as otherwise agreed by the Secretary, the Applicant must prepare a Lower Dam Transition Plan in consultation with the EPA and to the satisfaction of the Secretary. The plan must include a program to: a) undertake a broader assessment of the site's water management system and potential water pollution impacts; and b) investigate reasonable and feasible mitigation measures to improve water quality outcomes for the site, including altering the design of the Lower Dam or else transitioning away from its use, within two years. The Applicant must not alter the Lower Dam until this plan is approved by the Secretary. The Applicant must implement the approved plan as approved by the Secretary.	Site water management system and potential water pollution impacts have been assessed. Feasible mitigation measures have been investigated.	Section 5
Flocculant Management			
35	The Applicant must not use flocculants on the site.	Flocculants are not proposed as part of this water management plan.	Not applicable
36	Deleted	Not applicable	Not applicable
Other Water Management Works			
37	Within 18 months of the date of this consent, the Applicant must carry out the following works: a) Workshop and Fuel Storage Area • desilt drains and culverts upstream of the workshop to limit flooding; • construct a first flush collection basin to capture and store the first 13 mm of run-off from the external service bays before it is treated by the oil/water separator; and • bund and roof the drum storage area; b) Magazine Area • reinstate drain through access road to magazines to direct stormwater flows to the main drain; c) deleted to the satisfaction of EPA and the Secretary.	Management requirements for workshop and fuel storage areas are provided.	Section 4.1.7
Bunding			
38	Impervious bunds must be constructed around all fuel, oil and chemical storage areas and the bund volume must be large enough to contain 110 per cent of the volume held in the largest container. The bund must be designed and installed in accordance with the requirements of the EPA Environment Protection Manual Technical Bulletin Bunding and Spill Management.	Bunding requirements for fuel, oil and chemical storage areas are provided.	Section 4.1.7

Consent condition	Requirement	How consent condition is addressed in WMP	Relevant section(s)
Monitoring			
39	The Applicant must: a) measure: • the volume of water discharged from the site via licenced discharge points; • water use on the site; • water transfers across the site; • dam and water structure storage levels; b) monitor the quality of the surface water: • discharged from the licence discharge point/s of the development; • upstream and downstream of the development; c) monitor flows in Rocklow Creek; and d) monitor regional groundwater levels and quality; to the satisfaction of the EPA and the Secretary. Note: On the provision of two years of monitoring data that shows negligible impact on the regional groundwater network, the Secretary may agree to suspend monitoring of regional groundwater levels and/or quality.	A site monitoring program is provided.	Section 7
Site Water Management Plan			
40	Within 12 months of the date of this consent, the Applicant must prepare a Site Water Management Plan for the development, in consultation with the Water Group, and to the satisfaction of the Secretary. This plan must include: a) the predicted site water balance; b) an Erosion and Sediment Control Plan; c) a Surface Water Monitoring Program d) a Ground Water Monitoring Program; and e) an Integrated Water Management Strategy. The Applicant must implement the approved management plan as approved from time to time by the Secretary.	A site water balance is provided. An erosion and sediment control plan is provided. Surface water and groundwater monitoring programs are provided. An Integrated Water Management Strategy is provided throughout this WMP.	Section 4.3 Section 6 Section 7
41	The Erosion and Sediment Control Plan must: a) be consistent with the requirements of the Department of Housing's Managing Urban Stormwater: Soils and Construction manual; b) identify activities that could cause soil erosion and generate sediment; c) describe measures to minimize soil erosion and the potential for the transport of sediment to downstream waters; d) describe the location, function, and capacity of erosion and sediment control structures; and e) describe what measures would be implemented to maintain the structures over time.	An erosion and sediment control plan is provided.	Section 6

Consent condition	Requirement	How consent condition is addressed in WMP	Relevant section(s)
42	The Surface Water Monitoring Program must include: a) detailed baseline data on surface water flows and quality in Rocklow Creek; b) surface water impact assessment criteria; c) a program to monitor surface water flows and quality in Rocklow Creek; c1) a program to monitor and minimise surface water and groundwater ingress into the Lower Dam and water egress into Rocklow Creek; d) a program to monitor bank and bed stability in Rocklow Creek; and e) a program to monitor the effectiveness of the Erosion and Sediment Control Plan.	A surface water monitoring program is provided.	Section 7.1
43	The Groundwater Monitoring Program must include: a) detailed baseline data on ground water levels and quality, based on statistical analysis; b) ground water impact assessment criteria; c) a program to monitor regional ground water levels and quality; and d) a program to monitor groundwater inflows. Note: On the provision of two years of monitoring data that shows negligible impact on the regional groundwater network, the Secretary may agree to suspend monitoring of regional groundwater levels and/or quality.	A groundwater monitoring program is provided.	Section 7.2
44	The Integrated Water Management Strategy must: a) explore a range of options for a sustainable resource alternative for water supply to the site; b) identification of all possible and available sources of water; c) consistency with Government Water Reform initiatives and policies; d) quality of water to meet usage requirements including any possible effects on product; e) costs of supply; f) health and environmental impacts; g) legislative requirements; h) assessment of the feasibility, benefits and costs of options; i) a process to identify and evaluate preferred options for implementation; and j) the identification of a timetable for implementation of the selected options.	Alternative water sources are identified and investigated. Government water access and licencing requirements are described. An assessment and evaluation of options that considers a range of factors (environment, cost, etc) is provided. An implementation action plan is provided.	Section 4.1.3 Section 8 Section 5.3 Section 9

2.2 Environmental Protection Licence

Environmental Protection Licence (EPL) No. 77 applies to the quarry. The EPL includes five reference points for which specific discharge and monitoring conditions are applied. The five EPL points are described in Table 2.2 and shown in Figure 2.1.

Boral advise that the biofiltration system (EPL Point 6) has not been used in recent years and is not considered part of the quarry's existing water management system.

The *Modification 9 Surface Water Assessment* (RHDHV 2017) identified that the quarry also discharges to the DSS water management system to the east of the site, to the wetland area north-east of the site and to Rocklow Creek via seepage from the quarry's water management dams. The EPL does not currently recognise these discharge locations.

The EPL discharge and monitoring conditions are provided in Table 2.2. The EPL is provided in Appendix B.

Table 2.2 EPL point descriptions and discharge conditions

EPL point	Description	Concentration limits[2]	EPL monitoring conditions
6	Discharge from the biofiltration swale to Rocklow Creek	Total suspended solids (TSS) concentration less than 50 mg/L	Flow rate and quality monitoring during discharge
7	Uncontrolled discharge from Lower Dam spillway to Rocklow Creek	Nil	Quality monitoring during discharge
8	Effluent quality monitoring at discharge point at eastern end of Lower Dam	Nil	Standing water quality monitoring
9[1]	Rocklow creek receiving water monitoring location	Nil	Quality monitoring during discharge
10	Uncontrolled discharge from Middle Dam spillway to Rocklow Creek	Nil	Quality monitoring during discharge

Notes: 1. EPL 77 does not specify any monitoring requirements for EPL Point 9. Monitoring conditions for this point are based on Boral's existing monitoring program.

2. Refers to concentration limits specified in EPL condition L2.4. EPL condition L1 applies to all discharge points.

2.3 Water licencing

Water Access Licence (WAL) requirements, existing WALs and water supply works approvals relevant to the quarry are described in Section 8. Information obtained from NSW Water Register relating to the WAL (25152) and WAL (44509) is provided in Appendix C. The water supply works approval (10WA103611) relevant to the quarry is provided in Appendix D.

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Source: EMM (2024); DFSI (2017); SixMaps (2024); ICSM (2011); GA (2011)

Water related EPL points

Dunmore Hard Rock Quarry
Water Management Plan
Figure 2.1

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2.4 Aquifer Interference Policy

The purpose of the *Aquifer Interference Policy* (AIP) *2012* is to explain the role and requirements of the Minister administering the *Water Management Act 2000* in the water licencing and assessment process for aquifer interference activities. The AIP:

- clarifies the requirements for licensing of water intercepted during aquifer interference activities (such as mining, quarrying, and dewatering for construction)
- defines and establishes 'minimal impacts' for water related assets (such as landholder bores and groundwater dependent ecosystems).

The minimal impact considerations defined in the AIP provide the basis for the assessment of groundwater impacts to sensitive receptors (environmental and landholder) from water table, water pressure and water quality change. The AIP categorises groundwater sources as either 'highly productive' or 'less productive'. A further division is made based on geological providence. The local groundwater at the quarry meets the criteria of 'less productive' porous or fractured rock (EMM 2022) due to marginal water quality and potential for resource development. The 'less productive' porous and fractured rock minimal impact thresholds for sensitive receptors are provided in Table 2.3. Groundwater impact assessment criteria are provided in Section 7.2.

Table 2.3 Minimal impact criteria for 'less productive' porous and fractured rock

Water table	Water pressure	Water quality
1. Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: a) high priority groundwater dependent ecosystem; or b) high priority culturally significant site listed in the schedule of the relevant water sharing plan. A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "postwater sharing plan" variations, 40 m from any: a) high priority groundwater dependent ecosystem; or b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan if appropriate studies demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than a 2 m decline cumulatively at any water supply work then make good provisions should apply.	1. A cumulative pressure head decline of not more than a 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. 2. If condition 1 is not met, then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

2.5 Relevant guidelines

Table 2.4 provides a summary of guidelines relevant to the quarry operation.

Table 2.4 Relevant guidelines

Guideline name	Reference	Description
Australian Rainfall and Runoff: A guide to flood estimation	Ball J et al. 2016	This document provides practitioners with the best available information on design flood estimation and is widely accepted as a design guideline for all flood and stormwater related investigation and design in Australia.
Australian and New Zealand Guidelines for Fresh and Marine Water Quality	ANZECC[1] & ARMCANZ[2] 2000	These guidelines are the benchmark documents of the *National Water Quality Management Strategy* which is used for comparison of water quality monitoring data throughout Australia.
Groundwater monitoring and modelling plans – information for prospective mining and petroleum exploration activities	NSW DPI-Water 2014	Advises industry users on the required baseline monitoring data to inform impact assessment to meet the Australian Institute of Petroleum criteria. The document defines the purpose of the monitoring network as identifying hydrogeological strata and their depths and thicknesses, hydraulic behaviours, interaction between layers, and connection to surface waters.
Guidelines for riparian corridors on waterfront land	NSW DPI-Water 2014	Refers to a series of guidelines that provide information on the design and construction of a controlled activity, and other ways to protect waterfront land.
Liquid Chemical Storage, Handling and Spill Management: Review of Best Practice Regulation	DECC[3] 2005	Details best practice storage, handling and spill management procedures for liquid chemicals.
Managing Urban Stormwater: Soils and Construction, Volume 1	Landcom 2004	Describes best practice erosion and sediment control measures, including the calculation methodologies for sizing sedimentation basins.
Managing Urban Stormwater: Soils and Construction, Volume 2E – Mines and Quarries	DECC 2008	Describes best practice erosion and sediment control measures with a focus towards mines and quarries.
Storing and Handling Liquids: Environmental Protection: Participant's Manual	DECC 2007	Details best practice storage, handling and spill management procedures for liquid chemicals.

Notes: 1. Australian and New Zealand Environment and Conservation Council.

2. Agriculture and Resource Management Council of Australia and New Zealand.

3. NSW Department of Environment and Climate Change.

2.6 Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives (DECCW 2006) provides Water Quality Objectives (WQOs) that are consistent with ANZECC/ARMCANZ (2000) water quality guidelines for the protection of the aquatic environment. The Water Quality Objectives are "primarily aimed at maintaining and improving water quality, for the purposes of supporting aquatic ecosystems, recreation and where applicable water supply and the production of aquatic foods suitable for consumption and aquaculture activities" (DECCW 2006).

Water Quality Objectives are provided for catchments throughout NSW (DECCW 2006). Rocklow Creek, the primary watercourse that can potentially be impacted by the quarry, is within the Illawarra Catchment. Specifically, Rocklow Creek is classified as an "Uncontrolled Stream". The quarry operations may also potentially impact an unclassified waterway/wetland area to the north-east of the quarry.

Table 2.5 summarises the Water Quality and River Flow Objectives for "Uncontrolled Streams" and applicability to the quarry.

Table 2.5 Application of Water Quality and River Flow Objectives

Environmental value	Objective	Application to the quarry
Water Quality Objectives		
Aquatic ecosystems	Maintaining or improving the ecological condition of water bodies and their riparian zones over the long term.	There are aquatic ecosystems immediately downstream of the quarry. The Minnamurra River Estuary, a high priority groundwater dependent ecosystem, is located further downstream of the quarry, to the east of the Princes Highway. The protection of aquatic ecosystems is assessed.
Visual amenity	Aesthetic qualities of waters.	There are no public views or access to Rocklow Creek adjacent to the quarry or immediate downstream areas. Notwithstanding, this WQO is assessed.
Secondary contact recreation	Maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed.	There is no public access to Rocklow Creek adjacent to the quarry or immediate downstream areas. Notwithstanding, this water quality objective is assessed.
Primary contact recreation	Maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed.	There is no public access to Rocklow Creek adjacent to the quarry or immediate downstream areas. Notwithstanding, this WQO is assessed.
Livestock water supply	Protecting water quality to maximise the production of healthy livestock.	Some downstream users may extract water from Rocklow Creek for livestock water supply. This WQO is assessed.
Irrigation water supply	Protecting the quality of waters applied to crops and pasture.	Some downstream users may extract water from Rocklow Creek for agricultural purposes. This WQO is assessed.
Homestead water supply	Protecting water quality for domestic use in homesteads, including drinking, cooking and bathing.	It is unlikely that any downstream users extract water from Rocklow Creek for homestead water supply. Hence, impacts to homestead water supply are not assessed.
River Flow Objectives		
Protect pools in dry times	Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows.	The flow regimes in Rocklow Creek have been modified by land clearing, quarrying, agricultural practices, instream structures, water harvesting and extraction within the catchment. Discharges from the quarry will enter Rocklow Creek. Hence, the quarry has potential to impact existing flow regimes in Rocklow Creek. These impacts are discussed in Section 5.
Protect natural low flows	Share low flows between the environment and water users and fully protect very low flows.	
Maintain natural flow variability	Maintain or mimic natural flow variability in all streams.	
Manage groundwater for ecosystems	Maintain groundwater within natural levels and variability, critical to surface flows and ecosystems.	
Minimise the effects of weirs and other structures	Minimise the impact of instream structures.	No instream structures are proposed.

2.6.1 Trigger values

The trigger values applicable to each WQO are provided in the NSW Water Quality and River Flow Objectives (DECCW 2006). The trigger values vary depending on the environmental value, with the trigger values for the protection of aquatic ecosystems generally being the lowest. Default trigger values for Rocklow Creek are provided in Table 2.6. These include an expanded list of analytes that are applicable to the visual amenity, secondary recreational contact and primary recreational contact.

The default trigger values have been applied to this water management plan and are referred to as WQO values in the remainder of the report. The WQO values do not make allowance for site specific factors that may influence water quality. Site specific water quality characteristics are discussed further in Section 5.2.2.

Table 2.6 Default trigger (WQO) values

Indicator	WQO value	Basis (most sensitive use)
Physico-chemical		
pH	6.5-8.5	Aquatic ecosystems
Turbidity	6-50 NTU	Aquatic ecosystems
Salinity (electrical conductivity)	200-300 µS/cm[1]	Aquatic ecosystems
Dissolved oxygen	85-110%	Aquatic ecosystems
Surface films and debris	Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour. Waters should be free from floating debris and litter.	Visual amenity
Chemicals		
Filterable reactive phosphate (FRP)	20 µg P/L	Aquatic ecosystems
Total phosphorus	25 µg P/L	Aquatic ecosystems
Total ammonia	20 µg N/L	Aquatic ecosystems
Oxides of nitrogen (NO_x)	40 µg N/L	Aquatic ecosystems
Total nitrogen	350 µg N/L	Aquatic ecosystems
Chemical contaminants/toxicants	ANZECC/ARMCANZ (2000), Chapter 3.4 and Table 3.4.1 – see Section 2.6.2 below.	Aquatic ecosystems
Biological		
Chlorophyll-a	3 µg/L	Aquatic ecosystems
Nuisance organisms	Macrophytes, phytoplankton scums, filamentous algal mats, blue-green algae, sewage fungus and leeches should not be present in unsightly amounts.	Visual amenity
Faecal coliforms	Median over bathing season of <150 faecal coliforms per 100 mL, with four out of five samples <600/100 mL (minimum of five samples taken at regular intervals not exceeding one month).	Primary contact recreation
Enterococci	35 enterococci per 100 mL (maximum number in any one sample: 60 - 100 organisms/100 mL).	Primary contact recreation

Indicator	WQO value	Basis (most sensitive use)
Protozoans	Pathogenic free-living protozoans should be absent from bodies of fresh water. (Note: it is not necessary to analyse water for these pathogens unless temperature is greater than 24°C).	Primary contact recreation

Notes: 1. Table 3.3.3 of ANZECC/ARMCANZ (2000) specifies NSW coastal rivers typically have salinity values in the range of 200-300 µS/cm. The default trigger value for salinity in lowland rivers is 125-2200 µS/cm.

2.6.2 Aquatic ecosystem protection

The ANZECC/ARMCANZ (2000) guidelines (refer to Table 3.4.1) present default trigger values for toxicants for the protection of 99%, 95%, 90% and 80% of aquatic species. This table also presents default trigger values for the protection of slightly-moderately disturbed ecosystems that are based on the default trigger values for the protection of 95% of species, but which use the lower default trigger values for the protection of 99% of species for chemicals for which possible bioaccumulation and secondary poisoning effects should be considered.

The ANZECC/ARMCANZ (2000) guidelines (refer to Section 3.1.3) describe slightly-moderately disturbed ecosystems as “ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity’’. Rocklow Creek and its catchment has been modified by land clearing, quarrying, instream structures, introduced flora and fauna and water extraction. Hence, Rocklow Creek is considered to be a slightly-moderately disturbed ecosystem and the default trigger values for the protection of slightly-moderately disturbed ecosystems have been applied.

3 Existing environment

3.1 Topography

The regional topography rises from coastal flats to the east of the quarry to the range where the quarry is situated. Further to the west, this range descends to a shallow and broad valley that lies at the foot of a larger rise to the Southern Highlands region of the Great Dividing Range. Macquarie Rivulet flows through this valley.

The quarry is set on a north south-west trending range. The peak is named Locking Hill and is partially incised by the quarry's Croome Farm Pit. The quarry rises from approximately 10 metres Australian Height Datum (m AHD) in the south-east of the site to approximately 165 m AHD in the west.

3.2 Climate data

This section provides a review of available rainfall and evaporation information and establishes representative databases for the quarry.

3.2.1 Rainfall records

There are number Bureau of Meteorology (BoM) operated rainfall gauges that provide representative rainfall records for the quarry. Albion Park Post Office (station number 68000) is located 5 km north-west of the quarry while Kiama Bowling Club (station number 68038) is located 8.5 km to the south-east. Additionally, Boral has been collecting meteorological data at the quarry since January 2002. Table 3.1 presents key information and statistical data from three rainfall gauges.

Table 3.1 Rainfall statistics

Rainfall statistics (annualised)		Albion Park Post Office (68000)	Kiama Bowling Club (68038)	Quarry weather gauge
Rainfall record		1892 – present	1897 – 2011	2002 – present
Distance from the quarry		5 km north-west	8.5 km south-east	At the quarry
Elevation (m AHD)	(m AHD)	8 m	10 m	30 m[1]
Average rainfall	(mm/year)	1100	1248	1,084
Lowest rainfall	(mm/year)	469	602	676
5th percentile rainfall	(mm/year)	609	779	685
10th percentile rainfall	(mm/year)	658	834	738
Median rainfall	(mm/year)	1063	1160	1,167
90th percentile rainfall	(mm/year)	1658	1740	1,325
95th percentile rainfall	(mm/year)	1819	1916	1,357
Highest rainfall	(mm/year)	2640	2715	1,455

Notes: 1. Elevation estimated from LiDAR data.

Source: BoM website (climate data online).

The rainfall statistics presented in Table 3.1 from the Albion Park Post Office and Kiama Bowling Club gauges are shown to experience greater rainfall during wet years and lower rainfall during dry years compared to the quarry gauge. This is likely to be associated with the limited (22 years) record available at the quarry gauge. Average yearly rainfall at Albion Park Post Office correlates well with the quarry gauge while median yearly rainfall at Kiama Bowling Club correlates well with the quarry gauge.

Further comparison between the quarry gauge and BoM gauges was undertaken for the coinciding rainfall record from 2002 to 2011 (ten-year period). Over this ten-year period, Albion Park Post Office was shown to receive approximately 4% less average annual rainfall compared to the quarry gauge. Kiama Bowling Club receives approximately 9% more average annual rainfall than the quarry gauge.

Albion Park Post Office is considered to be most representative of the conditions at the quarry due to its proximity to the quarry, length of available record and similarities to quarry gauge over the ten-year period of coinciding rainfall data.

Daily rainfall data for the Albion Park Post Office gauge was obtained as a SILO (Scientific Information for Land Owners) Patched Point Data from the Queensland Climate Change Centre of Excellence. SILO Patched Point Data is based on historical data from the BoM rainfall stations, with missing data 'patched' in by interpolating data from nearby station records. The SILO data for Albion Park Post Office provided rainfall depths for periods in the BoM records where data is missing, resulting in a continuous rainfall record at the gauge from 1 January 1900 to 31 December 2021. The SILO data was used to inform the water balance described in Section 4.3.

3.2.2 Design rainfall data

Design rainfall information is used to calculate aspects of the water management system. The following design rainfall information has been established for the quarry:

- Table 3.2 provides design rainfall depths for a range of Annual Exceedance Probability (AEP) events of varying durations. This information was sourced from the ARR2016 data portal; and
- Table 3.3 presents rainfall depths for 2, 5, 10 and 20 day rainfall events. This information was sourced from Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom 2004).

Table 3.2 Design rainfall depths from Australian Rainfall and Runoff 2016

	Annual Exceedance Probability (AEP) – rainfall depths (mm)						
	63.2%	**50%**	**20%**	**10%**	**5%**	**2%**	**1%**
15 min	15.0	17.2	25.0	30.7	36.8	45.5	52.7
30 min	20.5	23.6	34.1	41.9	50.2	62.0	71.9
1 hour	27.5	31.6	45.3	55.4	65.9	81.0	93.5
2 hour	37.4	42.9	60.8	73.8	87.1	106.0	121.0
3 hour	45.4	51.9	73.3	88.6	104.0	125.0	142.0
6 hour	64.2	73.7	104.0	124.0	145.0	173.0	194.0
12 hour	91.1	105.0	149.0	178.0	208.0	245.0	274.0
24 hour	125.0	144.0	208.0	252.0	295.0	350.0	391.0
48 hour	158.0	185.0	271.0	333.0	396.0	476.0	536.0
72 hour	174.0	204.0	303.0	375.0	450.0	545.0	618.0

Source: Data sourced from Australian Rainfall Runoff Data Portal.

Table 3.3 Design rainfall depths for frequent events

	Rainfall duration			
	2 day	5 day	10 day	20 day
80th percentile event	21.1 mm	31.8 mm	51.7 mm	95.6 mm
85th percentile event	27.9 mm	41.9 mm	66.1 mm	120.6 mm
90th percentile event	39.1 mm	59.8 mm	93.3 mm	158.0 mm
95th percentile event	67.4 mm	101.2 mm	147.8 mm	226.2 mm

Source: (Landcom 2004) Table 6.3 – values for Albion Park.

3.2.3 Evaporation data

Average monthly evaporation and potential evapotranspiration (PET) rates at the quarry were extracted from BoM monthly climate data maps (BoM 2016). Table 3.4 presents the average monthly pan evaporation and areal potential evapotranspiration rates at the quarry. The pan evaporation rate is approximately 50% greater than the average annual rainfall depth.

Table 3.4 Average monthly evaporation and PET data

Month	Pan evaporation (mm/month)	Areal potential evapotranspiration (mm/month)
January	196	168
February	160	127
March	143	116
April	111	76
May	82	50
June	72	37
July	78	38
August	110	55
September	133	76
October	167	118
November	177	144
December	207	154
Annual	1,638	1,159

Source: Bureau of Meteorology (BoM 2016).

3.3 Geology

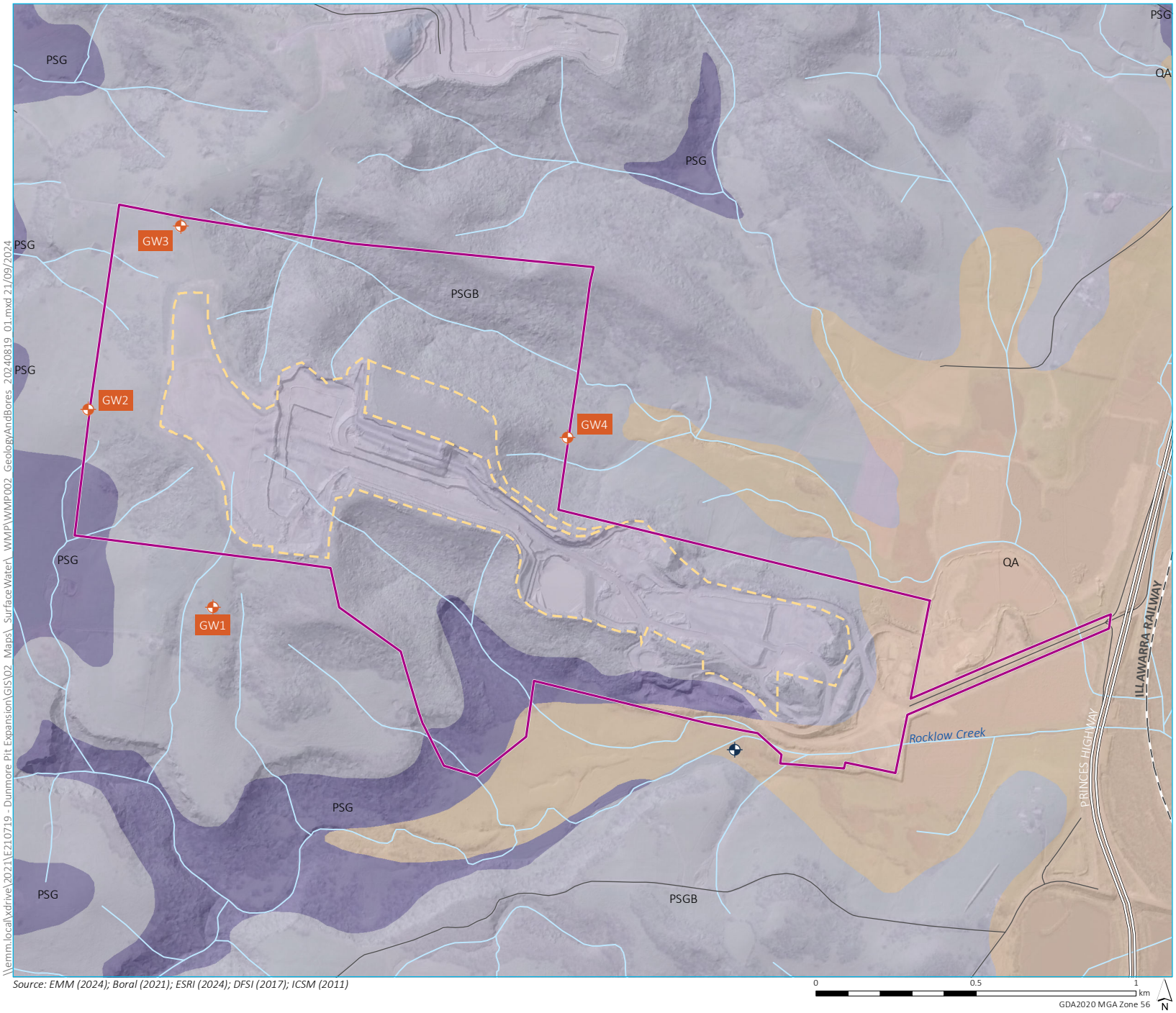
Volcanic activity in the area has produced a series of flat lying lava flows interspersed with volcaniclastic sandstone and breccias. The thickness of each successive flow decreases with distance from the volcanic origin, assumed to be off the current coastline to the south (Cohen 2006). At the quarry, all geological units exhibit a gentle dip in an easterly direction at approximately 2-3 degrees (Evans and Peck 2006).

Geology within the quarry (refer to Figure 3.1) predominantly consists of Bumbo Latite (an igneous hard rock), which is divided into three lava flow layers: upper, middle and lower. The latite is the resource that is extracted by the quarry operation. Operations to date have only extracted the upper and middle lava flow. Kiama Sandstone lies beneath the Bumbo Latite at the site of the quarry.

A breccia layer (a permeable sedimentary rock) is located between the middle and lower lava flow layers. The breccia layer, also comprising of volcanic material, ranges in thickness between 5 and 22 m (Cohen 2006). Accordingly, most of the historic extraction area has been quarried down to the top of the breccia layer.

The breccia layer outcrops at numerous locations around the periphery of the historic extraction area and is understood to have significant connectivity with the quarry's surface water management system due to a high permeability and positioning. The interaction between the breccia layer and the quarry's surface water management system is further described in Section 4.1.6.

Quaternary Alluvium is present in floodplain areas of the Minnamurra River and its tributaries, including Rocklow Creek. This alluvium comprises of unconsolidated to loosely consolidated gravels, sands, silts and clays (EMM 2016).



KEY

- Project area
- Approved extraction area
- Rocklow Creek monitoring bore
- Croome West monitoring bore

Lithology

- Quaternary Alluvium (Qa)
- Shoalhaven Group, Bumbo Latite (Psgb)
- Shoalhaven Group, undifferentiated siltstone (Psg)

Existing environment

- Rail line
- Major road
- Local road
- Watercourse/drainage line

Source: EMM (2024); Boral (2021); ESRI (2024); DFSI (2017); ICSM (2011)

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Geology and monitoring bores

Dunmore Hard RockQuarry
Annual Groundwater Monitoring Report
Figure 3.1

EMM
creating opportunities

3.4 Hydrogeology

3.4.1 Overview

The regional groundwater system flows south-east, governed by the dip in the strata and topography. Recharge to the regional groundwater system (Kiama Sandstone) is via infiltration from the overlying sedimentary units to the west of the quarry. Regional groundwater discharges to the Pacific Ocean (Cohen 2006).

Local groundwater flows are present within the Bumbo Latite in isolated areas and have limited connectivity to the regional groundwater system. The Bumbo Latite has low porosity that restricts groundwater flow (EMM 2022).

The breccia layer is understood to be partially saturated and more permeable than the surrounding latite. Breccia generally exhibits a variable porosity, with areas of high permeability common, but generally limited in extent. Most groundwater seepage that enters the pit evaporates from the rockface before it can enter the quarry water management system (EMM 2022).

Local groundwater systems are recharged by rainfall with infiltration higher in areas where the Bumbo Latite outcrops on ridgelines and hilltops. Discharge from the local groundwater system occurs in the valleys and includes ephemeral springs (EMM 2022).

The Quaternary Alluvial sediments associated with watercourses (such as Rocklow Creek) form unconfined groundwater systems of varying storage. These systems are recharged by leakage from surface watercourses during wet periods. The alluvial systems are depleted during dry periods and are not recharged by underlying porous and fractured rocks (Cohen 2006).

3.4.2 Groundwater flows

Groundwater within the Bumbo Latite flows from areas of high relief towards the valleys and low-lying plains where it discharges to the alluvium and surface watercourses. The bulk rock mass has a low primary permeability with groundwater flow primarily occurring through fractures and across the contacts between the latite and breccia (EMM 2022).

Near the quarry, groundwater flow is generally towards the south-east, discharging to Rocklow Creek and the Minnamurra River estuary system. To the north of the quarry, the landscape gives way to steep valleys that shed surface water and provide limited potential for groundwater recharge (EMM 2022).

The deep groundwater systems within the Kiama Sandstone formation typically flow sub-horizontally towards the east and coincide with the dip of the strata.

3.4.3 Groundwater levels

Baseline data for the regional (GW1) and local (GW2, GW3 and GW4) groundwater systems has been collected since 2014 as part of ongoing groundwater monitoring undertaken by EMM. The monitoring network is shown in Figure 3.1. Dataloggers were installed in the bores and record groundwater levels at six-hourly intervals. Datalogger readings are verified with manual dips at six-monthly intervals. Monitored groundwater levels are shown in Figure 3.2.

Groundwater levels within GW1 (partially screened in the Kiama Sandstone) and GW2 (screened within the Bumbo Latite) show a slow post installation recovery in groundwater level following drawdown due to bore construction, which is reflective of the low permeability of the Bumbo Latite at these locations. The groundwater level at GW3 (partially screened within the breccia) shows a rapid recovery following drawdown which is consistent with the higher permeability of the breccia layer (EMM 2018).

GW1, screened in the latite and sandstone shows more response to rainfall conditions, which suggests the rainfall conditions have greater influence on regional groundwater flows in the Kiama Sandstone than the local flows in the Bumbo Latite. GW2 and GW3 in the latite and breccia layers show little to no response to rainfall conditions (EMM 2018).

Groundwater elevations at GW4, screened at the base of the latite, are lower and ranged between 50 and 55 m AHD (ignoring the sampling spikes). GW4 is also located further down hydraulic gradient compared to GW1, GW2 and GW3. Groundwater levels across the monitoring network range from 50 to 130 m AHD and generally reflect changes in topography.

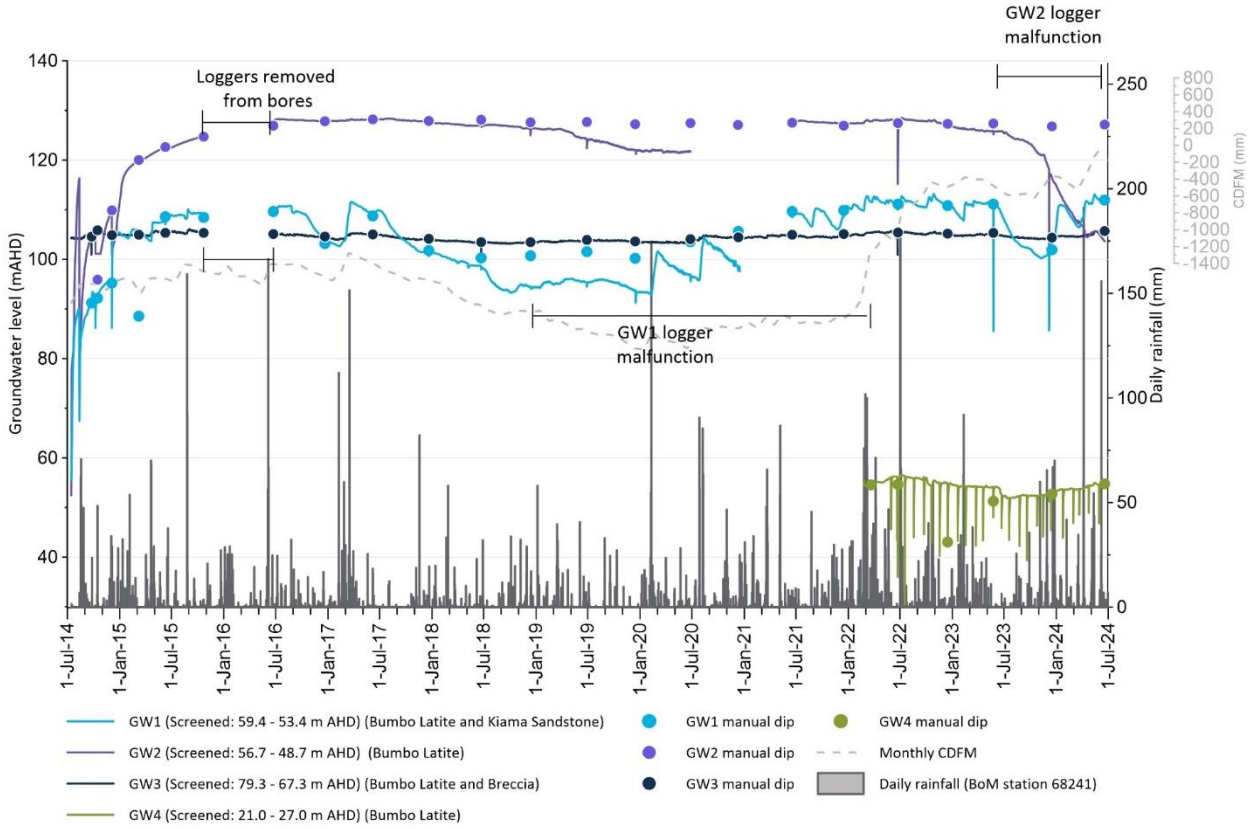


Figure 3.2 Groundwater elevation

3.4.4 Groundwater quality

Baseline data at the Croome West Pit monitoring locations has been collected at six-monthly intervals since installation in 2014. Groundwater at the quarry is fresh (GW3) to brackish (GW1) and has a neutral to slightly alkaline pH. Groundwater in the latite is dominated by sodium and bicarbonate and is high in magnesium. The chemical composition of the groundwater shows:

- pH within the groundwater system is generally within the WQO range
- salinity (as indicated by electrical conductivity) ranges between 649 and 3,970 µS/cm and is elevated relative to the WQO range in all groundwater monitoring bores
- nitrogen and phosphorus results are elevated compared to the WQOs
- generally low concentrations of dissolved metals with the exception of arsenic, copper (GW3 only), chromium, iron, nickel and zinc which were elevated relative to the WQO values.

A summary of groundwater quality monitoring data is provided in Appendix E.

3.4.5 Groundwater users

The groundwater database maintained by DPI Water contains information on the regional groundwater monitoring network in proximity to the quarry. Works include private landholder bores, private monitoring bores and DPI Water monitoring bores.

Three registered bores (GW029241, GW026848 and GW027498) are located within 2 km of the quarry. The bores access groundwater from the groundwater system in the Kiama Sandstone. Cohen (2006) reports many landholders find it difficult to find sufficient yield to construct bores into the hard rock. This is evidenced by a lack of registered groundwater works in the Bumbo Latite.

3.5 Local watercourses

3.5.1 Overview

The quarry is located centrally within the Rocklow Creek catchment. Rocklow Creek has an estimated 21 km^2 catchment area and generally flows in an easterly direction towards the Pacific Ocean (EMM 2017).

Downstream of the quarry, Rocklow Creek flows into an ephemeral waterbody prior to flowing beneath the Princes Highway and joining the Minnamurra River estuary, 1,500 m upstream of its outlet to the Pacific Ocean.

The western portion of the Croome West Pit is located within the upper extent of the Frasers Creek catchment, which drains west towards the township of Albion Park, before discharging to Macquarie Rivulet and Lake Illawarra.

3.5.2 Rocklow Creek water level

A continuous water level logger was installed in Rocklow Creek on 17 November 2016. The logger was installed in a groundwater monitoring bore and measures both Rocklow Creek groundwater and surface water levels (RHDHV 2017). The location of Rocklow Creek monitoring bore is shown in Figure 3.1 while Figure 3.3 displays the recorded water level in Rocklow Creek from 2016 to 2018.

Figure 3.3 shows the water level in Rocklow Creek experiences a rapid response to material rainfall events. A gradual decline in water level is experienced during periods of dry weather.

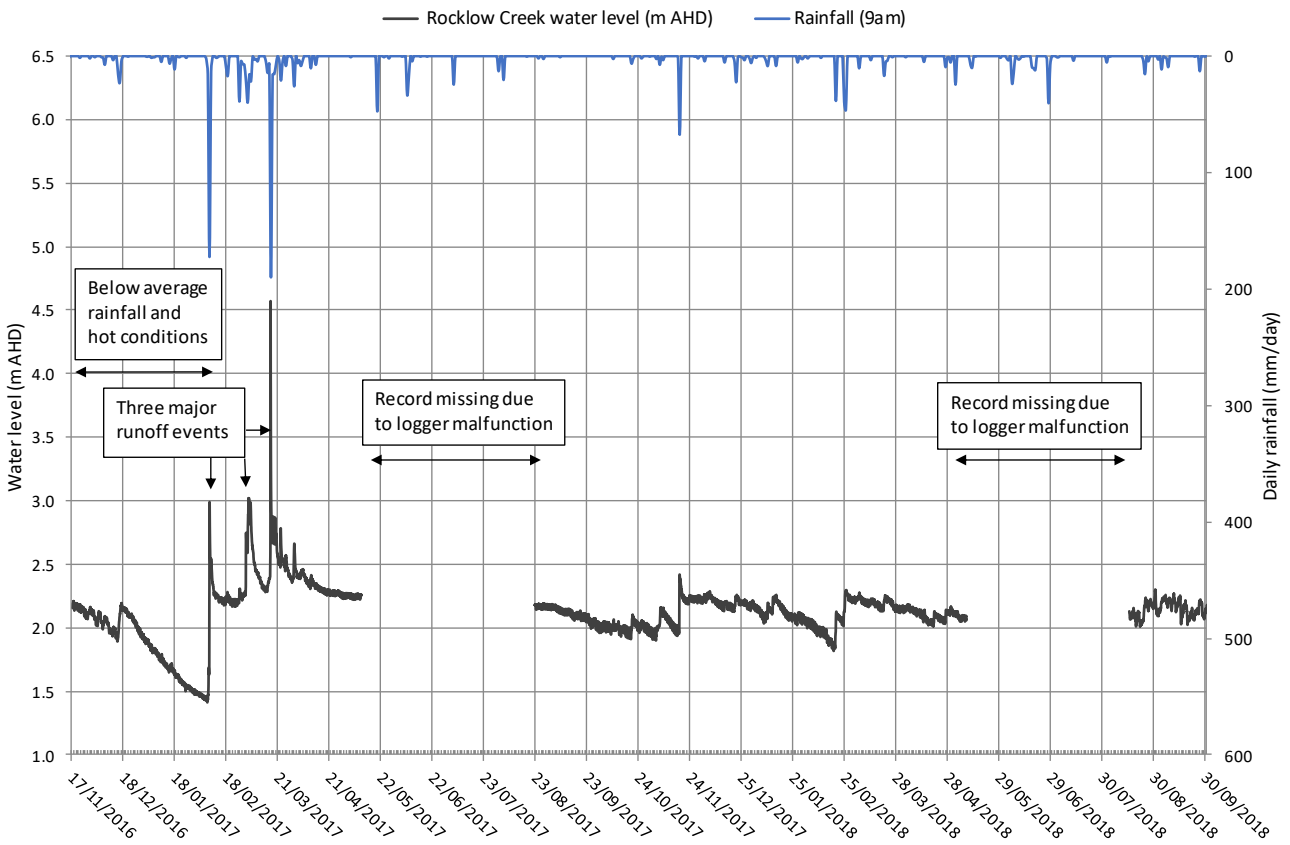


Figure 3.3 Water level data – Rocklow Creek

3.5.3 Receiving water quality

Receiving water (Rocklow Creek) quality is described in Section 5.2.2.

3.6 Surface water-groundwater connectivity

Watercourses in the elevated portions of the landscape are interpreted to be hydraulically disconnected from the underlying fractured rock groundwater systems. These watercourses are ephemeral, meaning streamflow only occurs during and shortly after rainfall. This ephemeral nature indicates that the surface watercourses are not connected to the groundwater systems (EMM 2022).

The surface water systems to the north, east and south of the quarry in the lower parts of the landscape (Illawarra River, Minnamurra River and Rocklow Creek) are connected to shallow, marginal groundwater systems within surficial alluvial systems. Direct rainfall and surface runoff recharge these shallow alluvial systems during wet periods. Although groundwater within the shallow latite flows through to the alluvium, the volume of this flux is likely to be insignificant compared to the recharge into the alluvium from the overlying watercourses (EMM 2018).

Surface water from Rocklow Creek is connected to the quarry's Lower Dam via groundwater flows within the Rocklow Creek alluvium (RHDHV 2017).

4 Water management system

This section describes the existing water management system and should be read in conjunction with Figure 4.1, which diagrammatically describes the system functionality. The following sections provide further information of the catchment areas, water management dams, process water uses, water transfers and site discharge locations and presents water balance model results.

Proposed changes to the water management system are discussed in Section 5.3.

4.1 Existing water management system

4.1.1 Water management area

There are four defined catchments within the site water management area. Figure 4.2 shows the extent of each catchment and the location of key surface drains. Table 4.1 provides a summary of each catchment area and estimated land-use characteristics.

Table 4.1 Existing catchment characteristics

Catchment	Area (ha)	Land-use	Catchment land-use				Annual runoff coefficient[2]
			Exposed rock	Vegetation	Stockpile	Quarry void	
Lower Dam	25.1	Haul roads, stockpiles, processing plant and some vegetated areas.	51%	30%	19%	0%	0.44
Middle Dam	13.9	Remnant quarry workings, haul roads and water management dam.	59%	27%	14%	0%	0.56
Croome Pits[1]	36.7	Rock extraction and in-pit processing areas, haul roads and stockpiles.	75%	0%	0%	25%	0.50
Eastern Catchment	20.1	Haul roads, site administration and work shop areas, stockpiles and vegetated areas.	37%	18%	45%	0%	0.36

Notes: 1. Croome Pits have historically been referred to as 'Upper Dam' in previous quarry documentation.

2. Annual runoff coefficients based on water balance results for a typical median rainfall year (refer to Section 4.3.1).

An additional 7.8 ha will drain to the Middle Dam as a result of Modification 13, increasing the total Middle Dam catchment to 21.7 ha. As extraction from the RIC Pit area has not commenced yet, the increased catchment area associated with Modification 13 has not been included in the existing conditions site water balance described in Section 4.3. Regardless, water management infrastructure associated with the RIC Pit area is shown in Figure 4.2 for context. The impacts of Modification 13 on the site water balance are described for the proposed water management system in Section 5.3.3.

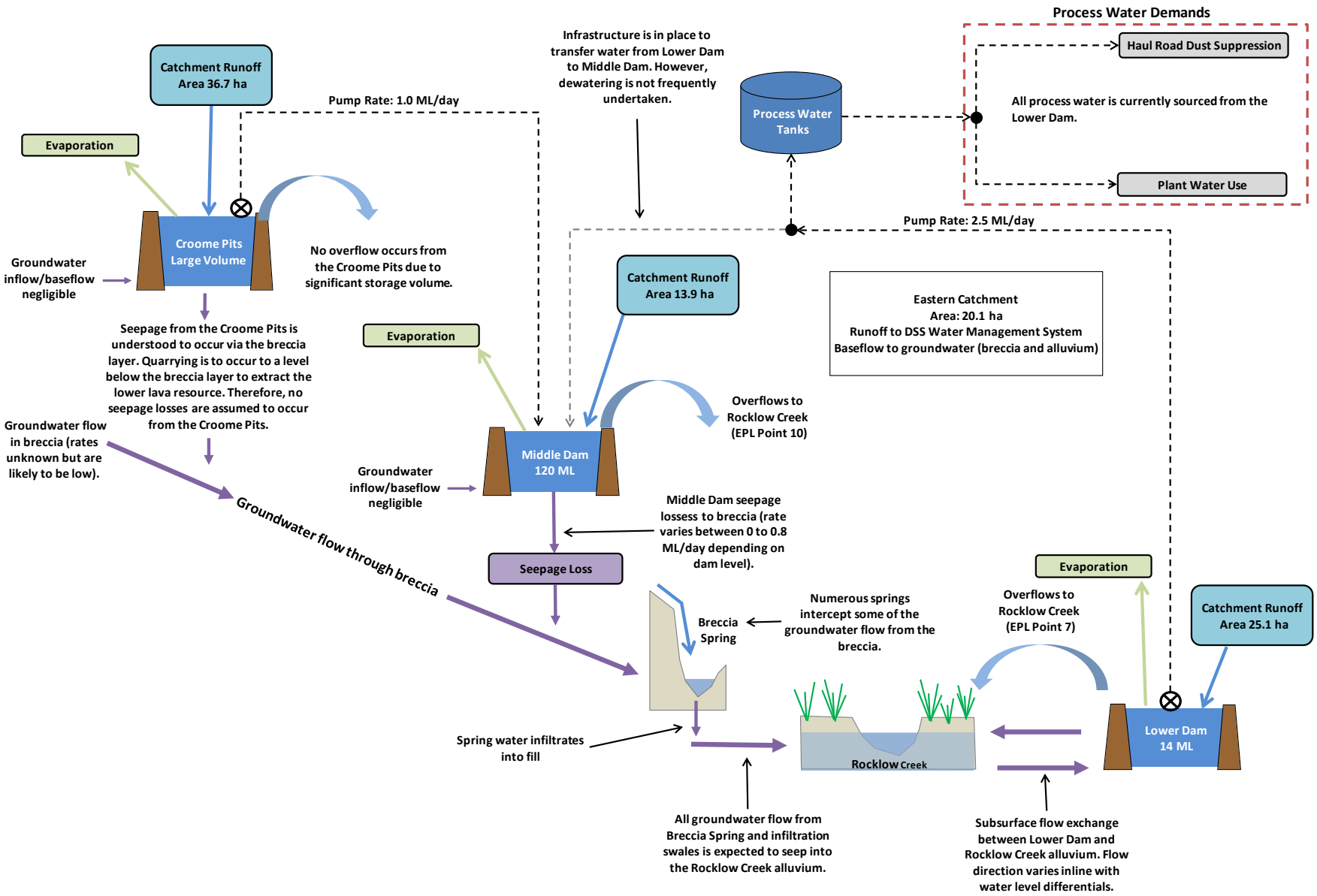
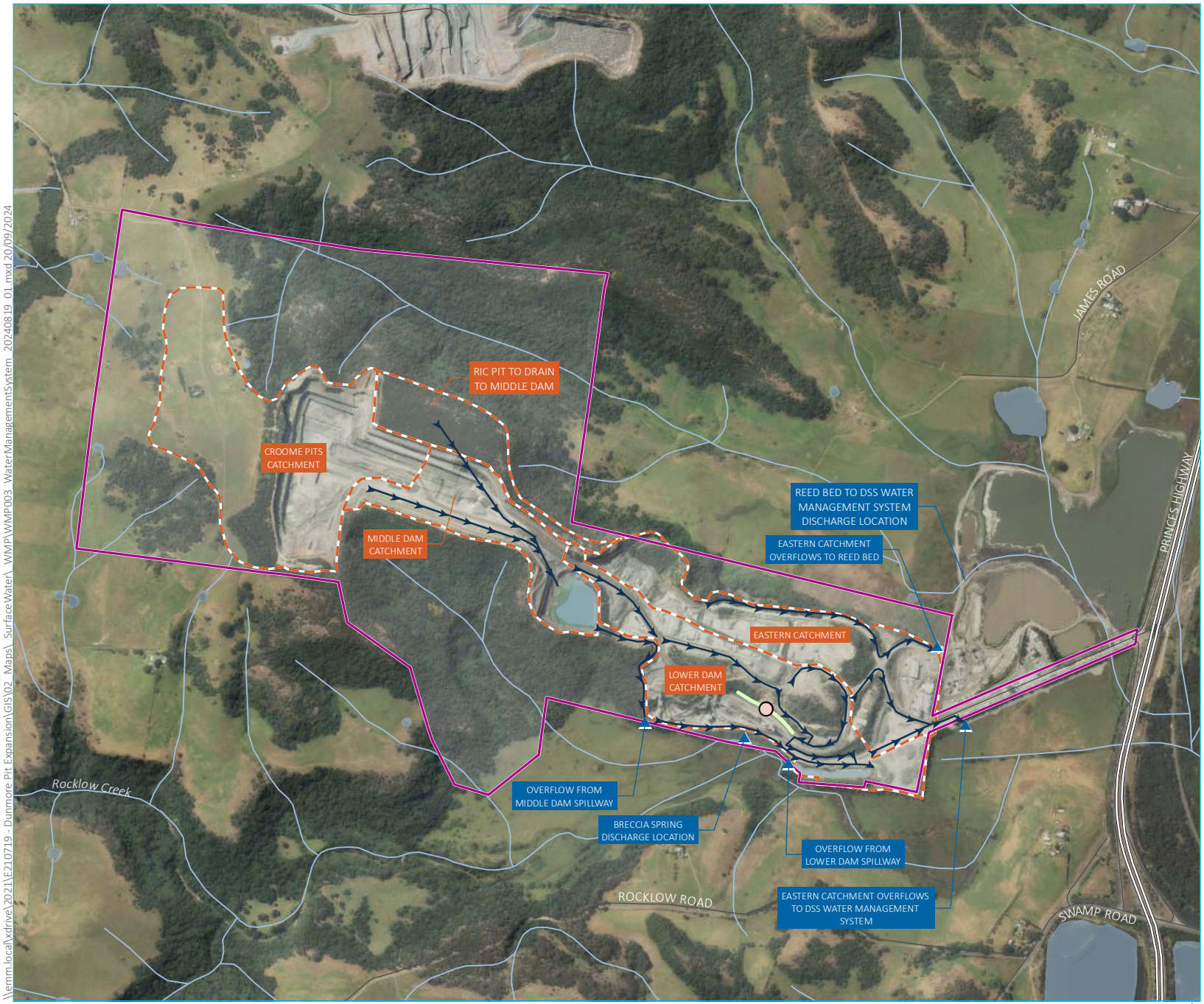


Figure 4.1 Water management system schematic



KEY

- Project area
- Breccia spring
- Surface water discharge location
- Indicative surface drain
- Infiltration swale
- Catchment boundary

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Waterbody

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Source: EMM (2024); DFSI (2017); SixMaps (2024); Boral (2019); ICSM (2011)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

Water management system overview

Dunmore Hard Rock Quarry
Water Management Plan
Figure 4.2

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4.1.2 Water management dams

The water management system includes two water management dams, quarry pit voids (referred to as the Croome Pits) and a biofiltration swale. The Croome Pits represent the storage volume available within the quarry's excavated pits. The available storage in the Croome Pits is expected to change in-line with the quarry stage. The Croome Pits are expected to have a large storage volume regardless of the quarry stage. The location of the two water management dams and the Croome Pits are shown in Figure 4.2. The biofiltration swale is located to the south of Lower Dam. Table 4.2 describes the key characteristics of each control.

Table 4.2 Existing water storage structures

Storage	Function	Volume[1]	Overflow
Lower Dam	• Stores and treats runoff from Lower Dam catchment. • Supplies water for process water use.	14 megalitres (ML)	Rocklow Creek
Middle Dam	• Stores and treats runoff from Middle Dam catchment. • Receives pumped water from the Croome Pits. • Leaks into the underling breccia layer at rates of up to 0.8 ML/day.	120 ML plus 30 ML for sediment storage	Rocklow Creek
Croome Pits	• Pit sumps that are located within the excavated quarry pits and receive runoff from the Croome Farm Pit and Croome West Pit catchments.	Greater than 500 ML	Dewatered to Middle Dam (overflow unlikely due to large storage volume)
Biofiltration swale	• Intended to be a controlled discharge arrangement that would treat water pumped from Lower Dam. • Controlled discharges have not been undertaken in recent years.	Designed to treat up to 7 ML/day	Rocklow Creek

Notes: 1. Storage volumes obtained from *Dunmore Hard Rock Quarry Modification 9 Surface Water Assessment* (RHDHV 2017). Storage volumes were estimated from LiDAR survey and site observations.

4.1.3 Water supply

A detailed investigation into a range of water supply sources for the quarry was undertaken as part of the 2005 quarry WMP (Matrix Consulting 2005) and supplemented with updates from subsequent WMPs (Evans and Peck 2008; Arcadis 2016). In addition to stormwater runoff that is captured within the existing water management dams, the following alternative water supply sources were investigated:

- Mains water supply.
- Treated sewage effluent.
- Extraction from Rocklow Creek.
- Extraction from the tidal zone of Rocklow Creek (downstream of the quarry).
- Extraction from groundwater sources.

Extraction from Rocklow Creek was identified as the preferred alternative water source option, with the extraction of groundwater from DSS second and treated effluent third (Matrix Consulting 2005). Evans and Peck (2008) reassessed the preferred alternative water supply options and noted that the relatively small volume of water required would likely exclude groundwater extraction and effluent treatment from being feasible due to the complexity involved, infrastructure required and associated cost. Furthermore, the water quality of treated effluent and tidal water was found to be unsuitable for use in the process plant and for dust suppression of product stockpiles. Evans and Peck (2008) concluded that extraction from Rocklow Creek via the existing water access licence (refer to Section 8.3) is still considered to be the preferred option as an alternative water supply.

In line with the outcomes of the alternative water supply investigations described above, process water supply at the quarry is preferentially sourced from the Lower Dam which receives and stores stormwater runoff from the Lower Dam catchment. When there is insufficient stored stormwater to supply process water demands, water is extracted from Rocklow Creek (Illawarra Rivers Water Source) via the mechanisms described in Section 4.2.1. Water access licencing for the extraction of water from Illawarra Rivers Water Source is described in Section 8.

4.1.4 Process water use

The quarry uses process water for haul road dust suppression and for dust suppression within the processing plant. Table 4.3 further describes the use of process water for quarry operations.

Table 4.3 Process water use description

Process water use	Description	Annual water use
Haul road dust suppression	The site operates a 50 kilolitre (kL) water cart 5.5 days per week. Typical rates measured during February 2019 are 0.625 ML/day (average of 12.5 carts per day).	Between 154 ML/year and 167 ML/year for wet and dry years respectively.
Dust suppression within processing plant	Water is used for conveyor and stockpile dust suppression within the plant at an average daily use rate of 75 kL/day.	Constant at 22 ML/year.

4.1.5 Operating principals

The water management system is operated using the following principals:

- Process water is preferentially sourced from Lower Dam via pumping. Historically, the Lower Dam has been replenished by groundwater ingress from the Rocklow Creek alluvium (refer to Section 3.6).
- Lower Dam, Middle Dam and the Croome Pits capture runoff from their respective catchment areas. The Croome Pits are dewatered to Middle Dam on an as needs basis. Infrastructure is in place to dewater Lower Dam to Middle Dam, however transfers have historically occurred infrequently.
- Accumulated water in Middle Dam seeps into the underlying breccia. Minimal volumes have historically been pumped out of or spilled from Middle Dam, demonstrating that this has been an effective method for managing runoff volumes from the Middle Dam and Croome Pits catchments.

4.1.6 Site discharge mechanisms

i Breccia Spring

As described in Section 3.4, groundwater is interpreted to flow through the breccia on top of the low permeability lower Bumbo Latite rock layer. Substantial seepage from the breccia layer occurs to the north of the material processing plant area where the breccia outcrops. The seepage currently concentrates into a small waterfall that spills into an infiltration swale that is located to the north-east of the plant (refer to Photograph 4.1). Water from the swale is interpreted to infiltrate under the adjoining haul road (which is constructed on fill) into the Rocklow Creek alluvium. No direct connection to the Lower Dam is expected. The waterfall (which is also referred to as the Breccia Spring) and swale locations are indicated in Figure 4.2.

Photograph 4.1 Breccia Spring waterfall (left) and infiltration swale looking east (right)

ii Summary of discharge locations

Discharge locations from the water management system are identified in Figure 4.2. Table 4.4 describes the key characteristics of each discharge location.

Table 4.4 Site discharge locations

Location	Description	EPL point
Overflow from Lower Dam spillway	Overflows occur to Rocklow Creek when the dam water level exceeds the spillway crest level.	EPL Point 7
Overflow from Middle Dam spillway	Overflow occurs to Rocklow Creek when the dam water level exceeds the spillway crest level.	EPL Point 10
Discharge from biofiltration swale	The biofiltration swale was intended to proactively discharge stored water from Lower Dam if water levels were too high in Middle Dam to transfer water. The biofiltration system has not been used in recent years.	EPL Point 6
Breccia Spring	Groundwater flows from the breccia layer infiltrate into the Rocklow Creek alluvium via an infiltration swale that is located to the east of the processing plant.	No EPL point. The current EPL does not recognise this discharge.
Lower Dam seepage	Some seepage from Lower Dam into the adjoining Rocklow Creek alluvium is expected to occur when the dam level is higher than the adjoining aquifer level.	No EPL point. The current EPL does not recognise this discharge.
Eastern Catchment to reed beds	Runoff from the northern portion of the Eastern Catchment drains into an established reed bed/wetland area prior to discharging into the northern section of the DSS water management system. The DSS water management system and existing reed beds/wetland area are expected to provide water quality treatment benefits.	No EPL point. The current EPL does not recognise this discharge.
Eastern Catchment directly to DSS water management system	Runoff from the Eastern Catchment drains into the DSS water management system.	No EPL point. The current EPL does not recognise this discharge.

4.1.7 Bunding and spill management

Fuel and chemicals are stored in self-bunded above ground storage tanks which are installed and operated with the requirements of AS 1940, AS 2507 AS 3780 and AS 4452 and internal Boral requirements. Self-bunded tanks can store a volume equal to 110% of the volume held in the largest container. Drainage has been redirected away from fuel and chemical storage areas. Treatment of any spills is managed by the quarry's *Pollution and Incident Response Management Plan* and internal Boral spill management standards and procedures.

4.2 Water level data

Water level loggers are installed in the Middle and Lower dams, and in Rocklow Creek upstream of the Lower Dam spillway (refer to Figure 4.2). The loggers record water pressure on an hourly basis, which can then be converted to a corresponding water level. Data from the water level loggers has been used to improve understanding of the functionality of the water management system and to provide specific information on:

- the extent and nature of connectivity between Lower Dam and the Rocklow Creek alluvium
- the extent of flood water ingress from Rocklow Creek to Lower Dam
- seepage rates from Middle Dam into the underlying breccia layer.

4.2.1 Lower Dam water levels

A comparison of water levels in Lower Dam and Rocklow Creek is provided in Figure 4.3. Figure 4.4 compares water levels in Lower Dam and Rocklow Creek during the March 2017 high flow event.

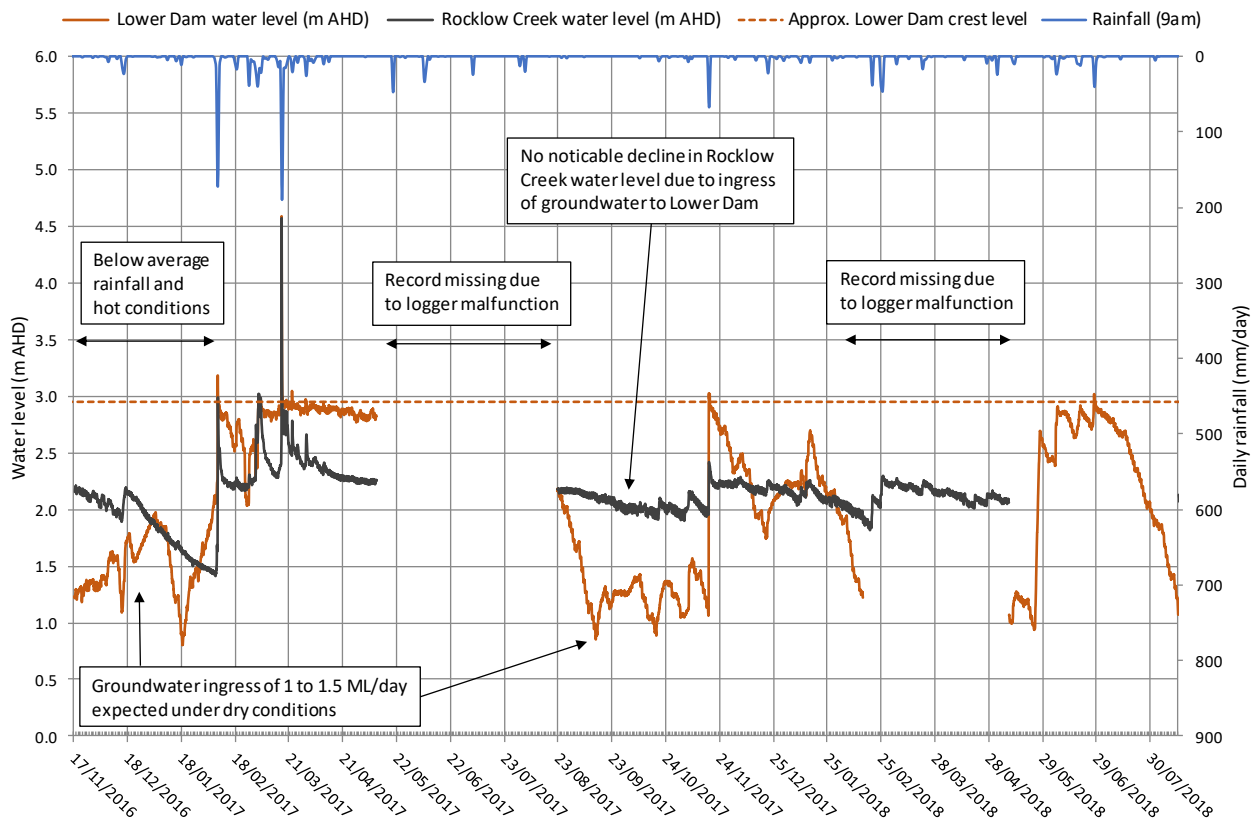


Figure 4.3 **Water level data – Lower Dam and Rocklow Creek**

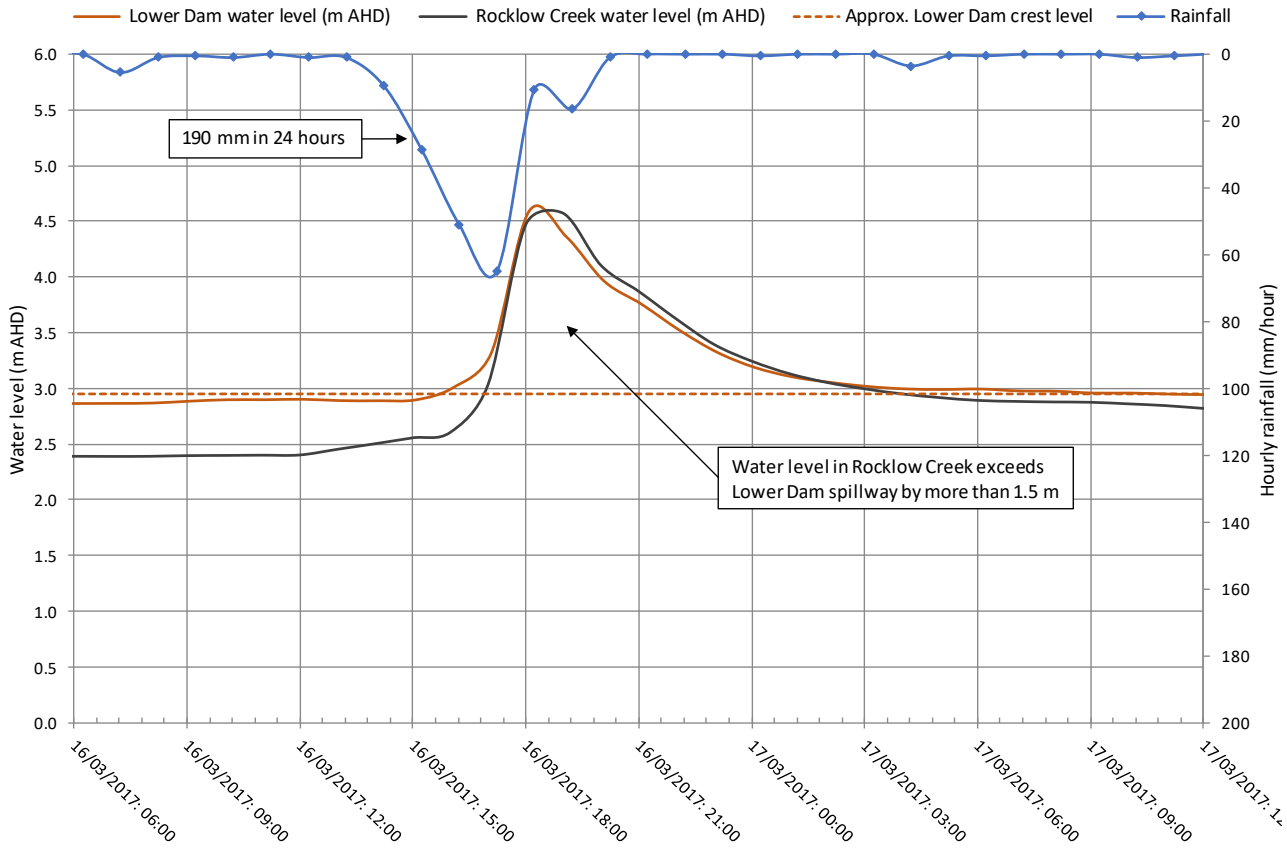


Figure 4.4 **Water level data – Lower Dam and Rocklow Creek (16 March 2017 event)**

The following trends can be established from the water level data provided in Figure 4.3 and Figure 4.4:

- Decreasing water levels in Rocklow Creek are generally related to extended dry periods that result in less runoff and reduced recharge to the Rocklow Creek alluvium. The drawdown of water in Lower Dam does not have a notable impact on the water level in Rocklow Creek. However, the location of the Rocklow Creek water logger is approximately 100 m upstream of the Lower Dam and may not be indicative of water level fluctuations immediately adjacent to the Lower Dam.

- Lower Dam can experience rising water levels despite dry conditions and a declining water level in Rocklow Creek. This suggests that groundwater ingress from the Rocklow Creek alluvium is resupplying the Lower Dam. This water is then extracted from Lower Dam for process water use at rates of up to 1.5 ML/day during dry conditions (RHDHV 2017).

- Dewatering the Lower Dam to Middle Dam to improve the Lower Dam's sediment treatment is limited due to the connectivity to the Rocklow Creek alluvium. It is expected that the potential for dewatering would be limited to a Lower Dam water level of approximately 2.0 m AHD, or the adjoining Rocklow Creek water level, whichever is higher. Any additional dewatering would result in further ingress from the Rocklow Creek alluvium to replenish the dewatered volume. This would effectively add volume to the quarry's water management system and be counterproductive.

- Rocklow Creek levels exceeded the Lower Dam spillway crest level for a short period on three occasions over the recorded period.

- It is expected that the elevated Rocklow Creek water levels would have resulted in some mixing of the Rocklow Creek and Lower Dam waters, within Lower Dam. Some of this mixed water would have then flow back into Rocklow Creek as water levels recede.

- Lower Dam overflowed six times over the recorded period (approximately four times per year).

4.2.2 Middle Dam water levels

Figure 4.5 presents Middle Dam water levels between 17 November 2016 and 10 May 2017. Due to limitations regarding access to the base of the dam, the water level logger in Middle Dam has since been discontinued.

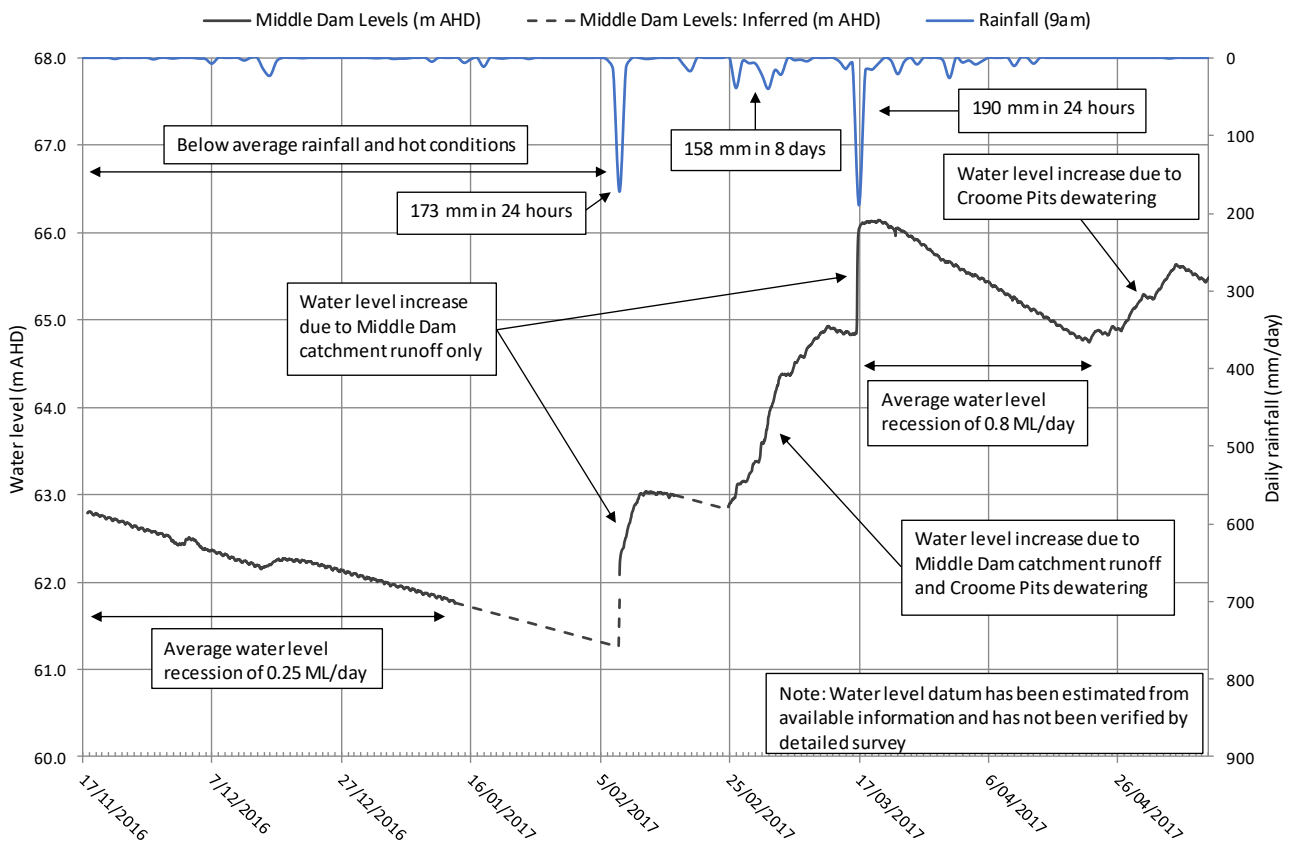


Figure 4.5 Water level data – Middle Dam

The following trends can be established from the water level data provided in Figure 4.5:

- There are two clear periods of water level recession: mid-November 2016 to mid-January 2017, and April 2017 following substantial rainfall in March. The *Modification 9 Surface Water Assessment* (RHDHV 2017) determined that the seepage rate from Middle Dam was 0.25 ML/day and 0.8 ML/day for the first and second water level recession periods respectively. This demonstrates that the dam seepage rate into the underlying breccia rock increases with water level.

- Substantial runoff events result in a well-defined water level response in Middle Dam. Both the February and March 2017 runoff events lead to a more than 1 m increase in the Middle Dam water level. Following these wet periods, the dewatering of the Croome Pits to Middle Dam can lead to further increases in water levels in Middle Dam despite dry conditions.

4.3 Site water balance

4.3.1 Water balance results

A site water balance model of the quarry water management system was developed in GoldSim version 12.0 (GoldSim Technology 2017). The water balance model applies a continuous simulation methodology that simulates the response of the water management system under a range of climatic conditions (i.e. rainfall and evaporation).

The water balance model is created by representing each process of the water management system with pre-determined responses that reflect how the proposed water management system will operate. The model simulated the water management system over a 118-year period using the climate data discussed in Section 3.2, and a daily time step. The methodology and assumptions used in developing the site water balance model are further described in Appendix F.

Water balance results for typical dry (10th percentile), median (50th percentile) and wet (90th percentile) rainfall years are presented in Figure 4.6, Figure 4.7, Figure 4.8 respectively. The water balance results display the total water movements over the year.

The site water balance is used to assess proposed improvements to the water management system discussed in Section 5.3.

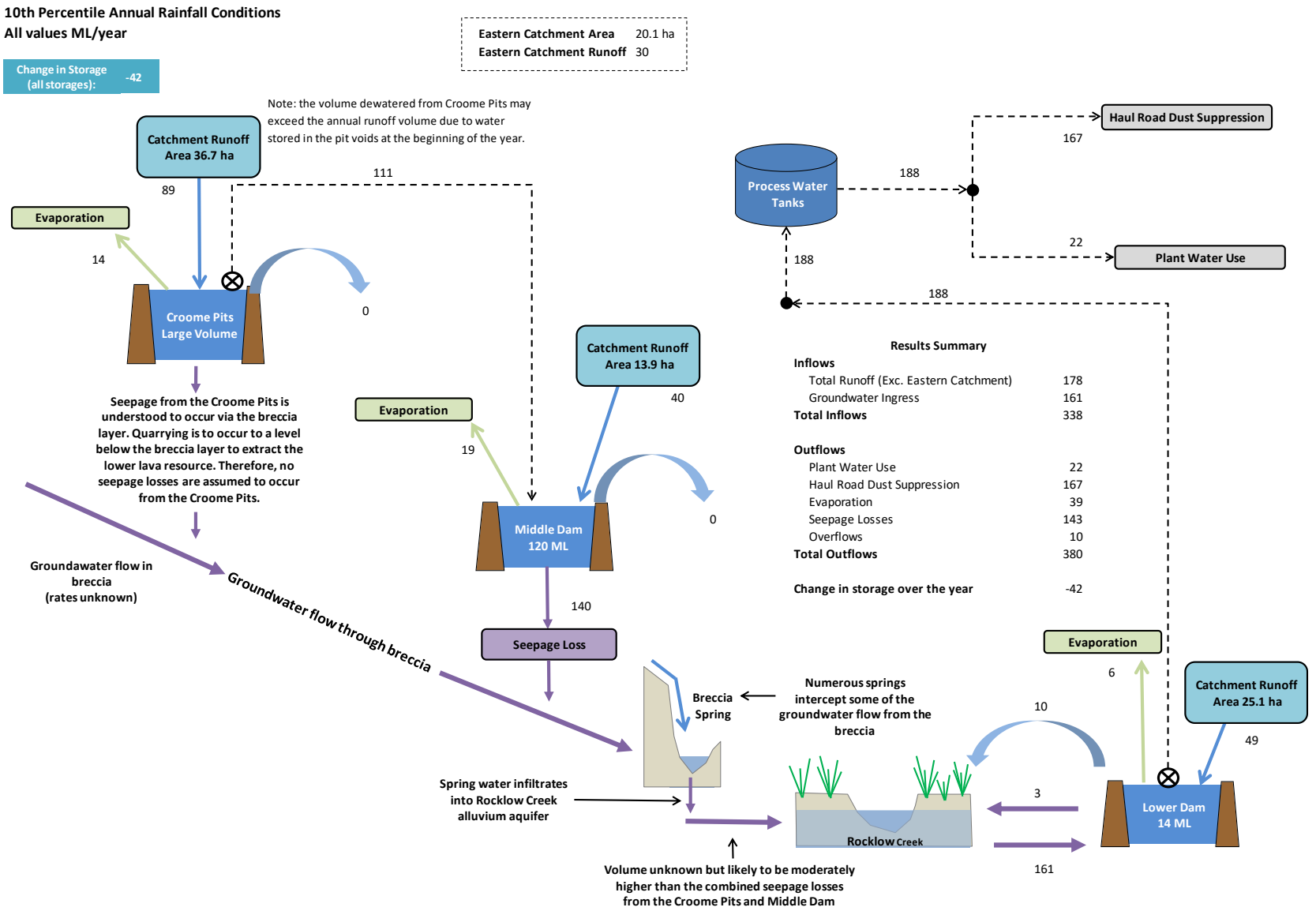


Figure 4.6 **Existing water management system: typical dry year results**

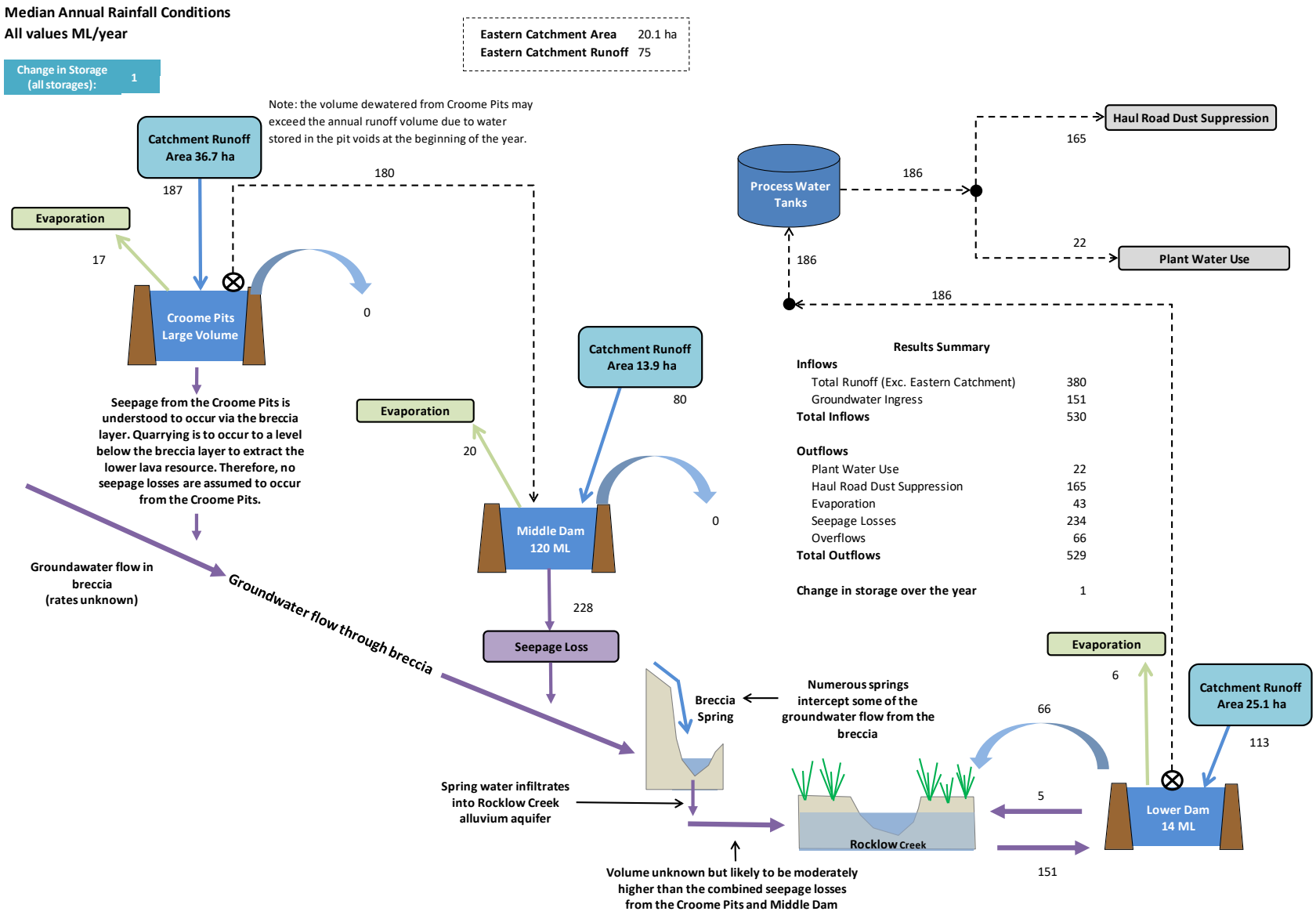


Figure 4.7 **Existing water management system: typical median year results**

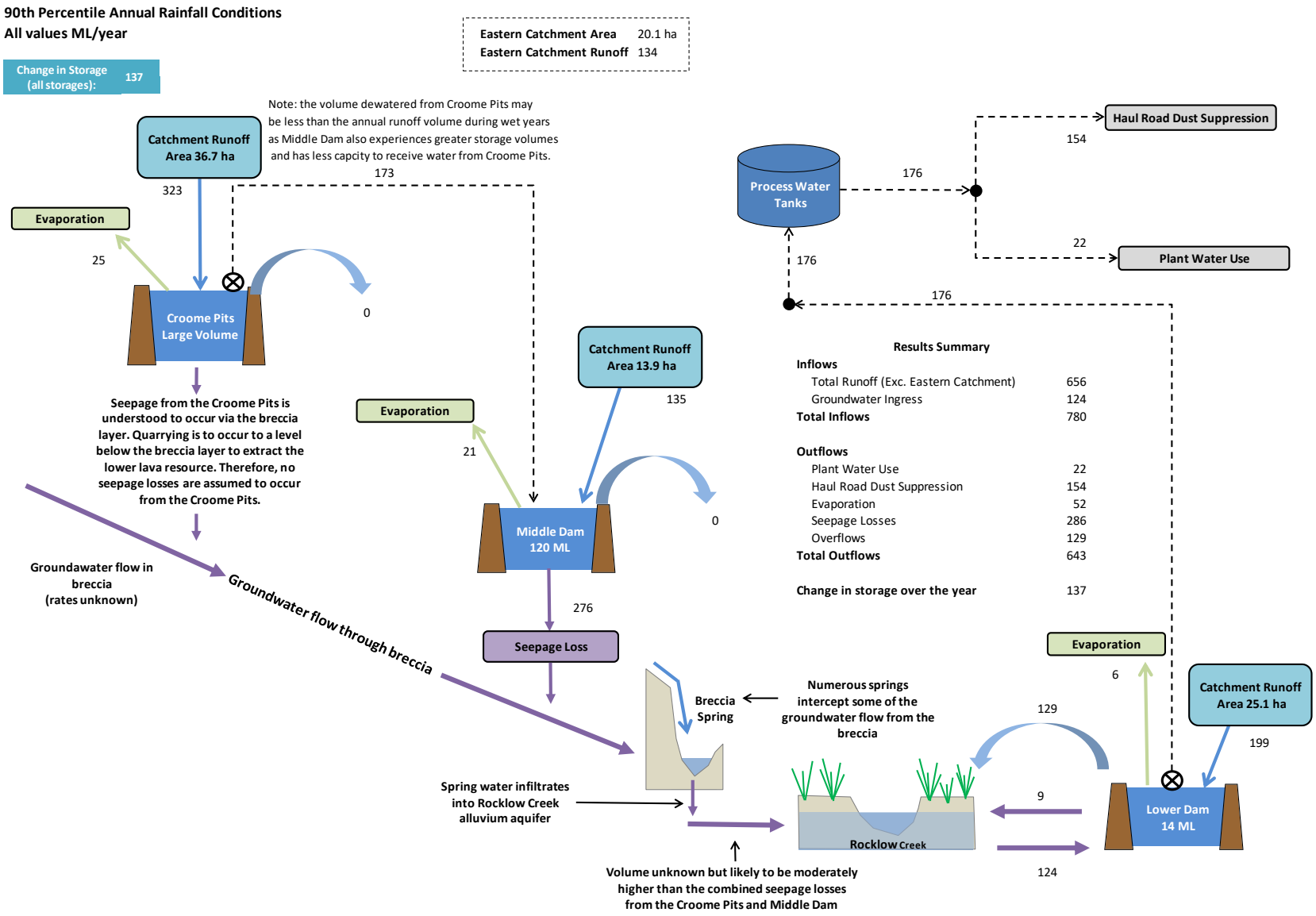


Figure 4.8 **Existing water management system: typical wet year results**

Water balance model outputs have been used to calculate annual exceedance probabilities for key site discharge and inflow mechanisms. Figure 4.9 presents exceedance probabilities for overflows from the Lower Dam and Middle Dam spillways, Lower Dam groundwater ingress and Middle Dam seepage and the annual maximum Croome Pits storage volume.

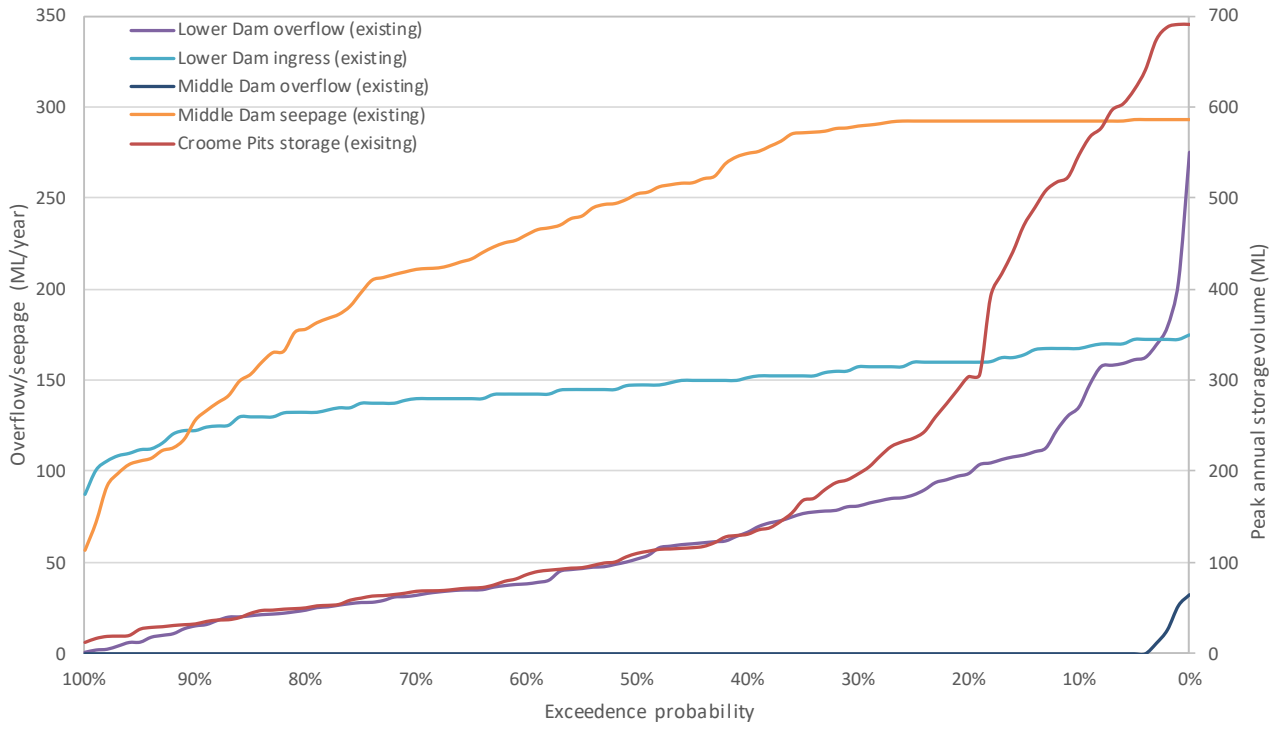


Figure 4.9 Water balance outputs summary

Water balance model results indicate that groundwater ingress from the Rocklow Creek alluvium is a key source of water. Under dry conditions, less site runoff is captured by the water management dams and a greater reliance on groundwater ingress is experienced. Historically, the quarry has not experienced water shortages due to the Lower Dam's connectivity with the Rocklow Creek alluvium. The Lower Dam is predicted to experience an average of four overflow events per year, which is in-line with the observed water level data presented in Section 4.2.1.

Figure 4.9 shows the maximum volume of stored water in the Croome Pits is expected to exceed 50% of the maximum peak annual storage volume (690 ML) in approximately 1 in 5 years. This represents a significant volume of stored water that must be removed from the water management system over time to reduce risks of pit flooding.

4.3.2 Potential influences of climate change on site water balance

Climate change projections for the quarry location available on the Adapt NSW website indicate temperature is predicted to increase, annual rainfall totals are generally predicted to decrease (although predictions are highly uncertain) while rainfall totals associated with extreme storm events are predicted to increase. Potential changes to the local climate conditions are expected to have the following impact on the site water balance:

- Increased temperature and more frequent hot days are anticipated to increase evaporation losses from the water storages and hence reduce the volume of water that may be extracted for reuse.
- Periods of decreased rainfall are expected to decrease the volume of runoff that reports to the water management system, reducing the amount of water that is available for reuse. A reduction in the volume of water held in Lower Dam water may result in additional ingress from Rocklow Creek.

- Periods of increased rainfall, particularly those associated with extreme storm events, are expected to increase runoff volumes to the water management system which may increase the volume and frequency of discharges and the volume of water which may be stored in the Croome Pits.

The additional evaporation losses associated with increased temperatures and reduced annual rainfall may not necessarily lead to a reduction in discharges where more frequent and intense storm events are observed. Water management improvement options that could be implemented at the quarry to mitigate discharge impacts are described in Section 5.3.

5 Discharge impact assessment

5.1 Overview

This section describes the discharge regimes and water quality characteristics of the existing water management system in relation to the WQOs established in Table 2.6. Residual impacts are identified, and a number of water management improvement options are assessed. Boral proposes to implement some of these improvements. The performance of the proposed water management system in mitigating residual impacts is assessed against the WQOs.

5.2 Existing discharges

5.2.1 Discharge regimes

Discharge from the quarry's water management system will occur via the Breccia Spring, Lower Dam overflows, seepage from Lower Dam, runoff from the Eastern Catchment, and infrequently via overflows from Middle Dam (approximately once every 20 years).

Water balance model results presented in Section 4.3 estimated that seepage losses from the Middle Dam (which is a key contributor to the Breccia Spring flows) will be approximately 50%, 60% and 75% of total site discharge during wet, median and dry rainfall years respectively. Hence, the Breccia Spring flows are the quarry's primary discharge mechanism.

The circumstances under which discharge from the water management system are expected to occur are described in Table 5.1.

Table 5.1 Summary of discharge conditions

Discharge condition	Description	Associated discharge mechanism(s)[1]
Runoff during a rainfall event	During and shortly following rainfall events that are large enough to produce runoff (rainfall depths of approximately 20 mm or more).	• Eastern Catchment to reed beds (and subsequently DSS water management system) • Eastern Catchment directly to DSS water management system
Overflows during a significant rainfall event	Overflow will occur during and shortly following rainfall events that result in more runoff than the relevant water management dam capacity. Once water management dams are full, overflows will occur at the same rate as inflows into the dam.	• Overflow from Lower Dam spillway (approximately 3-4 times per year) • Overflow from Middle Dam spillway (approximately once every 20 years)
Overflows during extended wet periods[2]	During extended wet periods when runoff volumes exceed water extraction for dust suppression and processing plant use.	• None[2]
Seepage losses	The rate of seepage is dependent on the water level in the associated water management dam and may occur independent of wet weather conditions (i.e. for several months following a rainfall period).	• Lower Dam seepage • Breccia Spring (Middle Dam seepage)

Notes: 1. Quarry discharge mechanisms are identified and described in Section 4.1.6.

2. Lower Dam is not expected to overflow as a result of extended wet periods due to water levels within the dam naturally equilibrating with the Rocklow Creek alluvium.

5.2.2 Water quality characterisation

Water quality data is available from the quarry's ongoing monitoring program. Additional water quality data was obtained to inform the Surface Water Characterisation Assessment (SWCA) undertaken as part of the *Modification 9 Surface Water Assessment* (RHDHV 2017). A further round of water quality sampling (2018) was obtained to inform the water quality characterisation described below.

i WMP sampling events

Boral have been monitoring water quality for a number of years in accordance with the quarry's WMP and EPL conditions. Table 5.2 provides a summary of the sampling locations, monitoring records and sampling frequencies. Sampling locations are shown in Figure 5.1.

Table 5.2 WMP sampling events

Location	EPL point	Sampling record	Sampling frequency
Lower Dam	EPL Point 8	2009-2022	Monthly and daily during discharge
Lower Dam overflows (RC2)	EPL Point 7	2010-2022	Daily during discharge from Lower Dam
Upstream of Lower Dam (RC1, GS1)	Not applicable	2010-2022	Monthly
Rocklow Creek downstream of Lower Dam (near field) (GS2, GS3)	EPL Point 9	2007-2022	Monthly and daily during discharge
Rocklow Creek downstream of Lower Dam (far field) (RC4, RC5)[1]	Not applicable	2017-2022	Monthly

Notes: 1. The Downstream of Lower Dam (far field) location does not form part of the quarry's monitoring program. The location forms part of the DSS monitoring program and has been provided in this WMP for comparative purposes only.

ii SWCA sampling events

Water quality data was collected by Boral to inform the SWCA undertaken as part of the *Modification 9 Surface Water Assessment* (RHDHV 2017). SWCA supplemented the sampling undertaken by Boral by:

- expanding the analytical suite (Table 5.5)
- establishing additional surface water monitoring locations at Middle Dam, Croome Pits, Breccia Spring and receiving waters.

Surface water samples were collected on six separate occasions. Table 5.3 provides a summary of the date and weather context for each sampling event.

Table 5.3 Sampling events

ID	Date	Sample locations[1]	Weather context[2]
Event 1[3]	7 June 2017	Lower Dam, Middle Dam, Croome Pits, receiving waters (GS2)	Wet weather – 34 mm of rainfall occurred within 24 hours prior to sampling
Event 2[3]	14/15 June 2017	Lower Dam, Middle Dam, Croome Pits, Breccia Spring, receiving waters (GS2)	After wet weather – sample collected 5 days after a wet weather period
Event 3	28 June 2017	Lower Dam, Middle Dam, Croome Pits, Breccia Spring, receiving waters (GS1 and GS2)	Dry weather
Event 4	17 July 2017	Lower Dam, Middle Dam, Croome Pits, Breccia Spring, receiving waters (GS1, GS2, RC1, RC2, RC4 and RC5)	Dry weather
Event 5	4 August 2017	Lower Dam, Middle Dam, Croome Pits, Breccia Spring, receiving waters (GS1, GS2, RC1, RC2, RC4 and RC5)	Wet weather – 21 mm of rainfall occurred within 24 hours prior to sampling
Event 6[4]	12 December 2018	Lower Dam, Middle Dam, Croome Pits, Breccia Spring, receiving waters (GS2 and RC1)	Dry weather

Notes: 1. Sample locations described in Table 5.4 and shown in Figure 5.1.

2. Rainfall recorded at the quarry's weather gauge.

3. Dissolved metals not analysed.

4. Event 6 was collected to inform this water quality characterisation and did not form part of the 2017 SWCA (RHDHV 2017).

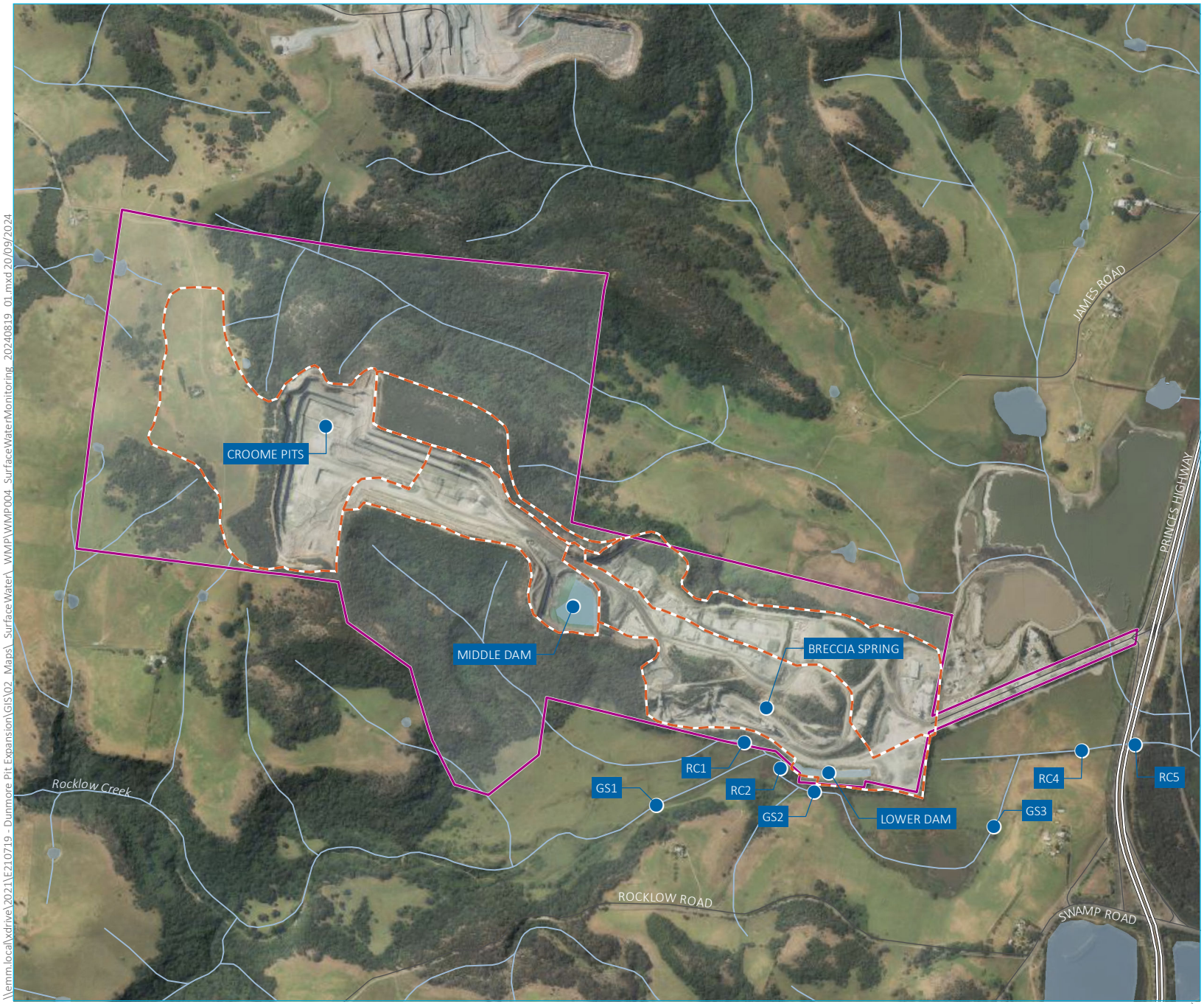
iii Sampling locations

Sampling locations and objectives are described in Table 5.4 and are shown in Figure 5.1.

Table 5.4 Sample locations and objectives

ID	Location	Sampling objective
Croome Pits	Pit sump	To characterise water quality in the excavated quarry pits
Middle Dam	Water management dam	To characterise water quality in the water management dam
Lower Dam	Water management dam	To characterise water quality in the water management dam
Breccia Spring	Breccia Spring discharge location	To characterise water quality discharging from the Breccia Spring
GS1	Rocklow Creek, upstream of the quarry discharge locations	To characterise water quality in Rocklow Creek upstream of the discharge location
RC1	Rocklow Creek, adjacent to the Breccia Spring	To characterise water quality in Rocklow Creek adjacent to the Breccia Spring discharge location
RC2	Rocklow Creek, adjacent to the Lower Dam Spillway	To characterise water quality in Rocklow Creek adjacent to the Lower Dam discharge location
GS2, GS3	Rocklow Creek, downstream of the quarry discharge locations	To characterise water quality in Rocklow Creek downstream of the discharge location[1]
RC4, RC5	Rocklow Creek, downstream of the quarry at Princes Highway	To characterise water quality in Rocklow Creek downstream of the discharge location[1]

Notes: 1. GS3 and RC4 are located adjacent to DSS while RC5 is located downstream of DSS. Hence, water quality at these locations may experience some influence from the DSS operation.



KEY

- Project area
- Catchment boundary
- Surface water monitoring site

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Waterbody

Source: EMM (2022); DFSI (2017); Metromap (2022); Boral (2019); ICSM (2011)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

\\emm.local\xdrive\2021\E210719 - Dunmore Pit Expansion\GIS\02_Maps_SurfaceWater_WMP\WMP004_SurfaceWaterMonitoring_20240819_01.mxd 20/09/2024

Surface water monitoring locations

Dunmore Hard Rock Quarry
Water Management Plan
Figure 5.1

EMM
creating opportunities

iv Analysis methods

Table 5.5 describes monitoring analytes and analysis methods.

Table 5.5 Analysis methods and parameters

Category	Sampling analytes	Analysis method
Physico-chemical properties	pH, dissolved oxygen, electrical conductivity, turbidity, oil and grease, total suspended solids, total hardness	Analysis undertaken by a NATA certified laboratory
Nutrients	total nitrogen, ammonia, oxidised nitrogen and total kjeldahl nitrogen	
	total phosphorus and filterable reactive phosphorous	
Metals (dissolved)	Al, As, Ag, B, Co, Cu, Cr (total), Cd, Pb, Mn, Ni, Zn, Fe, Hg, Se	

v Results

Table 5.6 and Table 5.7 present the water characterisation results (from both WMP and SWCA sampling events) for the quarry receiving waters (Rocklow Creek) and the quarry water management system respectively. Results are compared to WQO values (where relevant) and are discussed below the tables.

Table 5.6 Water characterisation results – receiving water quality

	Units	WQO value[1]	GS1			RC1			RC2			GS2, GS3			RC4, RC5		
			# Samples/exceed	Min value[4]	Max value[4]	# Samples/exceed	Min value[4]	Max value[4]	# Samples/exceed	Min value[4]	Max value[4]	# Samples/exceed	Min value[4]	Max value[5]	# Samples/exceed	Min value[4]	Max value[4]
Analytical results - general																	
Electrical conductivity	µS/cm	200-300	81/64	229	**483**	3/3	**599**	**818**	2/2	**434**	**452**	287/251	245	**1098**	23/23	**968**	**49,780**
Dissolved oxygen	%	85-110	67/41	**44**	**110**	-	-	-	-	-	-	178/149	**24**	94	12/10	**40**	110
pH	-	6.5-8.5	82/5	6.51	7.69	3/0	7.2	8.3	2/0	7.2	7.5	287/20	6.50	7.69	23/0	7.2	7.9
Turbidity	NTU	6-50	80/8	2	47	3/2	15	**80**	2/0	8	17	261/32	6	**60**	21/1	3	27
Oil and grease	mg/L	-	66/0	<1	5	-	-	-	-	-	-	66/0	<1	5	-	-	-
Total suspended solids (TSS)	mg/L	-	83/0	<5	66	3/0	<5	235	2/0	9	18	280/0	5	55	23/0	<5	38
Total hardness (as $CaCO_3$)	mg/L	-	3/0	64	75	3/0	129	192	2/0	90	95	8/0	88	151	4/0	555	2620
Analytical results - nutrients																	
Ammonia	mg N/L	0.020	3/0	<0.01	<0.01	3/0	<0.01	0.02	2/0	<0.01	0.02	6/3	<0.01	**0.21**	4/2	<0.01	**0.09**
Oxidised nitrogen	mg N/L	0.040	3/1	0.02	**0.05**	3/1	<0.01	**3.73**	2/1	<0.01	**0.32**	6/3	<0.01	**0.5**	4/4	**0.06**	**0.1**
Total kjeldahl nitrogen	mg N/L	-	3/0	0.2	0.3	3/0	1	3.4	2/0	0.6	0.6	6/0	0.6	2.7	4/0	0.6	1.4
Total nitrogen	mg N/L	0.35	3/1	0.2	**0.4**	3/3	**1.3**	**4.7**	2/2	**0.6**	**0.9**	6/6	**0.6**	**2.8**	4/4	**0.7**	**1.5**
Filterable reactive phosphate	mg P/L	0.020	3/0	<0.01	<0.01	3/0	<0.01	0.01	2/1	<0.01	**0.03**	6/1	<0.01	**0.3**	4/0	<0.01	<0.01
Total phosphorus	mg P/L	0.025	3/3	**0.03**	**0.04**	3/3	**0.13**	**0.53**	2/2	**0.17**	**0.17**	8/7	0.02	**0.31**	4/4	**0.07**	**0.14**
Analytical results - metals (dissolved)																	
Aluminium (Al)	mg/L	0.055	3/0	<0.01	<0.01	3/0	<0.01	0.04	2/0	<0.01	<0.01	6/0	<0.01	<0.01	4/0	<0.01	<0.01
Arsenic (As)	mg/L	0.013[3]	3/0	<0.001	<0.001	3/0	<0.001	0.002	2/0	<0.001	<0.001	6/0	<0.001	<0.001	4/0	<0.001	<0.001
Boron (B)	mg/L	0.370	2/0	<0.05	0.05	2/0	0.09	0.1	1/0	0.06	0.06	4/0	<0.05	0.12	2/2	**0.52**	**1.81**
Cadmium (Cd)	mg/L	0.0002	2/0	<0.0001	<0.0001	2/0	<0.0001	<0.0001	1/0	<0.0001	<0.0001	4/0	<0.0001	<0.0001	2/0	<0.0001	<0.0001
Cobalt (Co)	mg/L	0.0014[2]	3/0	<0.001	<0.001	3/0	<0.001	<0.001	2/0	<0.001	<0.001	6/1	<0.001	**0.003**	4/0	<0.001	0.001
Copper (Cu)	mg/L	0.0014	3/0	<0.001	0.001	3/3	**0.004**	**0.009**	2/2	**0.002**	**0.002**	6/4	<0.001	**0.004**	4/2	<0.001	**0.002**
Chromium (Cr)	mg/L	0.001[3]	3/0	<0.001	<0.001	3/0	<0.001	<0.001	2/0	<0.001	<0.001	6/0	<0.001	<0.001	4/0	<0.001	<0.001
Manganese (Mn)	mg/L	1.9	3/0	0.05	0.093	3/0	0.021	0.106	2/0	0.182	0.224	6/0	0.053	0.624	4/0	0.152	0.281
Mercury (Hg)	mg/L	0.00006	3/0	<0.0001	<0.0001	3/0	<0.0001	<0.0001	2/0	<0.0001	<0.0001	6/0	<0.0001	<0.0001	4/0	<0.0001	<0.0001
Nickel (Ni)	mg/L	0.0011	3/0	<0.001	<0.001	3/0	<0.001	<0.001	2/0	<0.001	<0.001	6/0	<0.001	<0.001	4/0	<0.001	<0.001
Lead (Pb)	mg/L	0.0034	3/0	<0.001	<0.01	3/0	<0.001	<0.001	2/0	<0.001	<0.001	6/0	<0.001	<0.001	4/0	<0.001	<0.001
Selenium (Se)	mg/L	0.005	3/0	<0.01	<0.01	3/0	<0.01	<0.01	2/0	<0.01	<0.01	6/0	<0.01	<0.01	4/0	<0.01	<0.01
Silver (Ag)	mg/L	0.00005	3/0	<0.001	<0.001	3/0	<0.001	<0.001	2/0	<0.001	<0.001	6/0	<0.001	<0.001	4/0	<0.001	<0.001

	Units	WQO value[1]	GS1			RC1			RC2			GS2, GS3			RC4, RC5		
			# Samples/exceed	Min value[4]	Max value[4]	# Samples/exceed	Min value[4]	Max value[4]	# Samples/exceed	Min value[4]	Max value[4]	# Samples/exceed	Min value[4]	Max value[5]	# Samples/exceed	Min value[4]	Max value[4]
Zinc (Zn)	mg/L	0.008	3/0	<0.005	<0.005	3/0	<0.005	<0.005	2/0	<0.005	<0.005	6/0	<0.005	0.005	4/0	<0.005	<0.005
Iron (Fe)	mg/L	0.3[2]	3/0	0.08	0.1	3/0	<0.05	0.26	2/1	0.14	**0.34**	6/3	<0.05	**0.45**	4/0	<0.05	0.25

Notes: 1. WQO values are established in Table 2.6.

2. Trigger value refers to a low reliability trigger value that has been established using the methods recommended in Section 8.3.4.5 of ANZECC/ARMCANZ (2000).

3. For As, WQO values for As (V) were applied. For Cr (total), WQO values for Cr (VI) were applied.

4. If water quality data is available for ten or more samples then 10th and 90th percentiles are used in lieu of minimum and maximum values.

Bold denotes WQO value is exceeded.

Table 5.7 Water characterisation results – site water quality

	Units	WQO value[1]	Croome Pits			Middle Dam			Breccia Spring			Lower Dam			Lower Dam overflows		
			# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]
Analytical results - general																	
Electrical conductivity	µS/cm	200-300	6/6	**308**	**981**	6/6	**315**	**668**	4/4	**511**	**845**	189/184	**368**	**1048**	34/25	265	**716**
Dissolved oxygen	%	85-110	-	-	-	-	-	-	-	-	-	174/105	**58**	103	27/25	**57**	**90**
pH	-	6.5-8.5	6/2	8.2	**8.8**	6/4	8.4	**8.8**	5/0	8.3	8.4	189/10	7.70	8.40	33/33	7.13	8.28
Turbidity	NTU	6-50	5/1	2	**289**	5/0	11	33	4/0	2	21	189/126	24	**310**	33/24	18	**630**
Oil and grease	mg/L	-	-	-	-	-	-	-	-	-	-	181/0	<1	1.49	22/0	<1	2
Total suspended solids (TSS)	mg/L	-	6/0	<5	119	6/0	<5	32	4/0	6	22	190/0	14	151	39/0	10	317
Total hardness (as $CaCO_3$)	mg/L	-	6/0	20	109	6/0	35	90	5/0	106	218	6/0	108	146	-	-	-
Analytical results - nutrients																	
Ammonia	mg N/L	0.020	4/0	<0.01	<0.01	4/0	<0.01	0.02	5/0	<0.01	0.02	4/0	<0.01	**0.02**	-	-	-
Oxidised nitrogen	mg N/L	0.040	4/4	**2.5**	**24.8**	4/4	**4.05**	**7.44**	5/5	**3.82**	**5.96**	4/4	**0.83**	**3.14**	-	-	-
Total kjeldahl nitrogen	mg N/L	-	4/0	0.5	0.9	4/0	0.5	0.8	5/0	0.3	0.7	4/0	0.3	1.1	-	-	-
Total nitrogen	mg N/L	0.35	4/4	**3**	**25.3**	4/4	**4.6**	**8.2**	5/5	**4.1**	**6.7**	4/4	**1.9**	**3.7**	-	-	-
Filterable reactive phosphate	mg P/L	0.020	4/0	<0.01	<0.01	4/0	<0.01	<0.01	5/0	<0.01	0.01	4/0	<0.01	0.01	-	-	-
Total phosphorus	mg P/L	0.025	6/5	<0.01	**1.14**	6/6	**0.03**	**0.1**	5/3	<0.01	**0.31**	6/6	**0.12**	**3.0**	-	-	-
Analytical results - metals (dissolved)																	
Aluminium (Al)	mg/L	0.055	4/2	0.03	**0.07**	4/2	0.04	**0.07**	5/0	<0.01	0.01	4/0	<0.01	0.02	-	-	-
Arsenic (As)	mg/L	0.013[3]	4/0	0.003	0.008	4/0	0.005	0.008	5/0	<0.001	0.001	4/0	<0.001	0.002	-	-	-
Boron (B)	mg/L	0.370	3/3	**0.46**	**0.76**	3/1	0.28	**0.56**	3/1	0.28	**0.45**	3/0	0.26	0.3	-	-	-
Cadmium (Cd)	mg/L	0.0002	3/0	<0.0001	<0.0001	3/0	<0.0001	<0.0001	4/0	<0.0001	<0.0001	3/0	<0.0001	<0.0001	-	-	-
Cobalt (Co)	mg/L	0.0014[2]	4/0	<0.001	<0.001	4/0	<0.001	<0.001	5/0	<0.001	<0.001	4/0	<0.001	<0.001	-	-	-
Copper (Cu)	mg/L	0.0014	4/4	**0.005**	**0.012**	4/4	**0.006**	**0.007**	5/5	**0.004**	**0.008**	4/4	**0.004**	**0.006**	-	-	-
Chromium (Cr)	mg/L	0.001[3]	4/0	<0.001	<0.001	4/0	<0.001	<0.001	5/0	<0.001	<0.001	4/0	<0.001	<0.001	-	-	-
Manganese (Mn)	mg/L	1.9	4/0	<0.001	0.003	4/0	<0.001	0.003	5/0	<0.001	0.003	4/0	<0.001	0.01	-	-	-
Mercury (Hg)	mg/L	0.00006	4/0	<0.0001	<0.0001	4/0	<0.0001	<0.0001	5/1	<0.0001	**0.0001**	4/0	<0.0001	<0.0001	-	-	-
Nickel (Ni)	mg/L	0.0011	4/0	<0.001	<0.001	4/0	<0.001	<0.001	5/0	<0.001	<0.001	4/0	<0.001	<0.001	-	-	-
Lead (Pb)	mg/L	0.0034	4/0	<0.001	<0.001	4/0	<0.001	<0.001	5/0	<0.001	<0.001	4/0	<0.001	<0.001	-	-	-
Selenium (Se)	mg/L	0.005	4/0	<0.01	<0.01	4/0	<0.01	<0.01	5/0	<0.01	<0.01	4/0	<0.01	<0.01	-	-	-
Silver (Ag)	mg/L	0.00005	4/0	<0.001	<0.001	4/0	<0.001	<0.001	5/0	<0.001	<0.001	4/0	<0.001	<0.001	-	-	-

	Units	WQO value[1]	Croome Pits			Middle Dam			Breccia Spring			Lower Dam			Lower Dam overflows		
			# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]	# Samples/ exceed	Min value[5]	Max value[5]
Zinc (Zn)	mg/L	0.008	4/0	<0.005	0.006	4/0	<0.005	0.006	4/0	<0.005	**0.012**	4/0	<0.005	<0.005	-	-	-
Iron (Fe)	mg/L	0.3[2]	4/0	<0.05	<0.05	4/0	<0.05	0.06	5/0	<0.05	<0.05	4/0	<0.05	<0.05	-	-	-

Notes: 1. WQO values are established in Table 2.6.

2. Trigger value refers to a low reliability trigger value that has been established using the methods recommended in Section 8.3.4.5 of ANZECC/ARMCANZ (2000).

3. For As, WQO values for As (V) were applied. For Cr (total), WQO values for Cr (VI) were applied.

4. If water quality data is available for more than ten samples then 10th and 90th percentiles are used in lieu of minimum and maximum values.

Bold denotes WQO value is exceeded.

vi Summary of receiving water quality

The water quality results presented in Table 5.6 are summarised as follows:

- pH within Rocklow Creek was generally within the WQO range. Elevated pH was occasionally observed both upstream and downstream of the quarry discharge locations.
- Salinity (as indicated by electrical conductivity) was slightly elevated above WQOs upstream and adjacent to the quarry (GS1, RC1, RC2 and GS2).
- Downstream of the quarry, Rocklow Creek experiences tidal influences resulting in increased salinity and total hardness (as $CaCO_3$) at RC4 and RC5, and occasionally at GS3.
- Oxidised nitrogen, total nitrogen and total phosphorus concentrations were elevated compared to the WQOs both upstream and downstream of the quarry discharge locations.
- Generally low concentrations of dissolved metals with the exception of boron (RC4 and RC5), cobalt (GS2 and GS3), copper (RC1, RC2, RC4, GS2 and GS3) and iron (RC2, GS2 and GS3) which were occasionally elevated compared to the WQOs.
- Water quality at RC1 was similar to discharges from the Breccia Spring.

vii Summary of site water quality

The water quality results presented in Table 5.7 are summarised as follows:

- pH within the water management dams was generally within the WQO range. Some samples in the Croome Pits and Middle Dam were elevated (basic) compared to the WQOs.
- Salinity (as indicated by electrical conductivity) was elevated relative to the WQO range for most Croome Pits, water management dam, Lower Dam overflows and Breccia Spring samples, but was similar to Rocklow Creek levels.
- Turbidity in the Lower Dam and Lower Dam overflows was generally elevated above the WQOs.
- Total suspended solids in the Lower Dam and Lower Dam overflows were typically elevated compared to the concentrations measured in the downstream receiving waters (RC2, GS2 and GS3).
- Oxidised nitrogen (and as a result total nitrogen) concentrations within the Croome Pits, water management dams, and Breccia Spring were elevated in all samples compared to the WQOs, with concentrations ranging from 0.83 to 24.8 mg/L.
- Total phosphorus within the Croome Pits, water management dams and Breccia Spring was elevated compared to the WQOs but was similar to Rocklow Creek levels.
- Copper concentrations within the Croome Pits, water management dams and Breccia Spring were elevated for all samples compared to the WQOs, with concentrations ranging from 0.004 to 0.012 mg/L.
- Aluminium and boron concentrations within the Croome Pits and Middle Dam were elevated compared to the WQOs. Boron was also occasionally elevated compared to the WQOs at the Breccia Spring.

5.2.3 Residual impacts

i Overview

The water quality results presented in Section 5.2.2 identified several analytes that were elevated compared to WQO and receiving water values. Suspended sediments (as indicated by turbidity and TSS), oxidised nitrogen, boron, copper and aluminium were all frequently detected at elevated levels.

ii Suspended sediments

Elevated concentrations of turbidity and TSS within the Lower Dam and discharges from the Lower Dam spillway indicate the Lower Dam is not providing effective sediment treatment during some overflow conditions. However, the low (10th percentile) TSS concentration within the Lower Dam suggests the sedimentation process within the dam effectively reduces TSS concentrations over time.

The *Modification 9 Surface Water Assessment* (RHDHV 2017) determined that the existing Lower Dam arrangement contained an undersized sediment treatment volume when compared to calculated guideline volumes. Table 5.8 compares the existing Lower Dam storage volumes with the required guideline volumes calculated by RHDHV (2017).

Table 5.8 Lower Dam storage volume

Storage characteristic	Existing Lower Dam[1]	Guideline volume[2,3]
Sedimentation treatment volume[4]	7.9 ML	12.5 ML
Sediment storage volume	6.1 ML	6.3 ML
Total storage volume	14 ML	18.8 ML

Notes: 1. Existing Lower Dam volumes obtained from Lower Dam modification preliminary civil design (refer to Section 5.3.2 and Appendix G, Figure 01).
2. Volume obtained from *Modification 9 Surface Water Assessment* (RHDHV 2017).
3. Guideline volume was calculated using the methods outlined in Managing Urban Stormwater: Soils and Construction Volume 2E: Mines and quarries for the 5-day 95th percentile rainfall depth as per Consent Condition 30.
4. Sedimentation treatment volume is taken as the dam volume above 1.5 m AHD.

iii Nutrients and dissolved metals

Elevated levels of oxidised nitrogen and copper are present in most Croome Pits, water management dam and Breccia Spring samples. The presence of oxidised nitrogen and copper are interpreted to be associated with the weathering of quarry rock that has naturally occurring levels of both analytes and potentially explosives residual (RHDHV 2017).

The highest concentrations of oxidised nitrogen, copper and boron are typically found in the Croome Pits with concentrations decreasing as water moves through the water management system. As water is transferred from Croome Pits to Middle Dam, the analyte concentrations are lower. The Breccia Spring had similar concentrations to Middle Dam. Concentrations of oxidised nitrogen and copper are generally lower in the Lower Dam than the Croome Pits, Middle Dam and the Breccia Spring, but were still elevated relative to WQOs. This may be due to runoff from remnant quarry areas and product stockpile areas within the Lower Dam catchment, or from groundwater inflows from a portion of the Rocklow Creek alluvium that receives Breccia Spring flows.

As discussed in Section 5.2.1, the Breccia Spring flows are considered to be one of the quarry's primary surface water discharge mechanisms. The Breccia Spring flows are interpreted to originate from Middle Dam seepage and infiltration into the breccia from the general quarry area.

As shown in Figure 4.5, seepage from Middle Dam into the underlying breccia will occur for several months following a rainfall period. For this reason, dry weather conditions provide the greatest potential for Breccia Spring flows to impact the water quality of Rocklow Creek. This is due to the constant flows from the Breccia Spring having less opportunity to mix or become diluted with Rocklow Creek and groundwater flows (through the Rocklow Creek alluvium).

The oxidised nitrogen concentrations in Breccia Spring range from 3.82 to 5.96 mg/L while copper concentrations ranged from 0.004 to 0.008 mg/L. Sampling at the location where Breccia Spring discharges to Rocklow Creek (RC1) recorded similar nitrate concentrations (4.7 mg/L) in one sample and similar copper concentrations in all samples (0.004 to 0.009 mg/L).

Water quality samples obtained at five locations of varying distance downstream of RC1 returned copper concentrations that were above the WQO value in 8 out of 12 samples but at reduced concentrations to RC1 (refer to Table 2.6). Oxidised nitrogen levels at RC2 (downstream of RC1 and adjacent to the Lower Dam) returned similar results to a site (GS1) upstream of the Breccia Spring inflow location, indicating that the Breccia Spring flows are only impacting water quality in the immediate mixing zone (around RC1). Possible explanations for this include:

- Nitrogen and copper concentrations are being readily removed by biochemical processes in the Rocklow Creek riparian zone. This is consistent with expectations given that Rocklow Creek is a wetland and wetlands are typically used to treat nutrients and metals (RHDHV 2017).
- Some surface and groundwater from the RC1 sampling location may flow into the Lower Dam via subsurface flow to replenish water extracted from Lower Dam for process water uses. This would reduce the potential for water from the RC1 sampling location to flow to downstream sampling locations (RHDHV 2017).

iv Assessment against WQOs

Section 2.6 established Water Quality and River Flow Objectives for the quarry receiving waters. T**able 5.9** describes potential impacts to the objectives due to discharges from the quarry under existing conditions.

T**able 5.9** **Potential impacts to Water Quality and River Flow Objectives**

Environmental value	Objective	Potential impacts
Water Quality Objectives		
Aquatic ecosystems	Maintaining or improving the ecological condition of water bodies and their riparian zones over the long term.	The water quality of quarry discharge is expected to meet WQO and receiving water conditions for most water quality parameters. Several water quality parameters (electrical conductivity, oxidised nitrogen, aluminium, boron, copper and mercury) are either frequently or occasionally elevated compared to the WQOs. However, monitoring results indicate that impacts are limited to a near discharge mixing zone, with minimal to no impacts further downstream.
Visual amenity	Aesthetic qualities of waters.	No impacts to the visual amenity of the receiving waters are expected as site discharges are not expected to have elevated concentrations of oils, petrochemicals and floating debris (that could form surface films and debris) and nuisance organisms such as algae.
Secondary contact recreation	Maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed.	No impacts to secondary or primary contact recreation activities are expected as site discharges are not expected to have elevated concentrations of faecal coliforms, enterococci or protozoans as there is no

Environmental value	Objective	Potential impacts
Primary contact recreation	Maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed.	source of these pollutants within the water management system.
Livestock water supply	Protecting water quality to maximise the production of healthy livestock.	No impacts to downstream livestock are expected as any impacts will be within the mixing zone area.
Irrigation water supply	Protecting the quality of waters applied to crops and pasture.	No impacts to downstream irrigators are expected as any impacts will be within the mixing zone area.
River Flow Objectives		
Protect pools in dry times	Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows.	Potential impacts due to the extraction of water from Rocklow Creek are approximately offset by the infiltration of Breccia Spring flows into the Rocklow Creek alluvium. Water balance results (refer to Section 4.3.1) show that during a typical dry year (10th percentile) 161 ML of water is extracted from Rocklow Creek, while 140 ML is returned to Rocklow Creek via infiltration from the Breccia Spring. Furthermore, the quarry has WAL entitlements to extract up to 227 ML/year from the relevant surface water sources and 250 ML/year from the relevant groundwater sources (refer to Section 8).
Protect natural low flows	Share low flows between the environment and water users and fully protect very low flows.	
Maintain natural flow variability	Maintain or mimic natural flow variability in all streams.	
Manage groundwater for ecosystems	Maintain groundwater within natural levels and variability, critical to surface flows and ecosystems.	

5.3 Option assessment

As per consent condition 35A, a Lower Dam Transition Plan has been established by:

- undertaking a broad assessment of the quarry's water management system
- investigating mitigation measures to improve water quality outcomes for the quarry.

This section presents the mitigation measures considered, proposed options to be adopted as part of the water management system and expected impacts.

5.3.1 Water management improvement options

Table 5.10 describes water management improvement options that could be implemented at the quarry to mitigate discharge impacts. The improvement options are considered in the context of the existing water management system and WQOs, and several water management improvement options are proposed. Proposed options are further described in Section 5.3.2.

Table 5.10 Water management improvement options

ID	Option	Expected outcome	Limitations	Option proposed	Justification
1	Preferentially source process water from the Croome Pits when safe to do so.	Preferential use of lower-quality water reduces oxidised nitrogen and copper loads in discharge to receiving waters via Middle Dam seepage and the Breccia Spring.	• Additional infrastructure may be required to pump water to process water storage tanks.	Yes	Expected to improve discharge water quality and reduce pit flooding risks.
2	Preferentially source process water from Middle Dam when safe to do so.	Preferential use of lower-quality water reduces oxidised nitrogen and copper loads in discharge to receiving waters via Middle Dam seepage and the Breccia Spring.	• Additional infrastructure may be required to pump water to process water storage tanks. • Increased discharge from the Lower Dam.	Yes	Improves overall discharge water quality by reducing the discharge of lower-quality water from the Breccia Spring. Discharge from Lower Dam overflow is expected to be of higher water quality. Also, reduces pit flooding risks.
3	Dewater Lower Dam to Middle Dam when water levels in Lower Dam are greater than 2.0 m AHD.	Reduce Lower Dam overflow volume and frequency.	• Increased Breccia Spring discharges. • Transfer constraints when Middle Dam storage levels are elevated.	No[1]	Reduction in overflows from Lower Dam offset by increased discharge from Breccia Spring, which is typically of lower water quality.
4	Construct sedimentation dam at the Eastern Catchment to reed bed discharge.	Provide additional treatment of runoff from the Eastern Catchment to the existing reed bed/wetland area.	• Due to existing constraints a sedimentation basin would need to be constructed within the existing reed bed/wetland area. This will disturb the existing wetland area, which is currently providing a water quality function.	No	Additional treatment benefits are not considered to outweigh the impact of disturbing existing water quality function.
5	Modify the storage volume and layout of the Lower Dam.	Improved sediment treatment functionality, reduce overflows from the Lower Dam and reduce Rocklow Creek flood inundation.	• Limited area available to extend existing dam footprint due to requirements to retain access roads, existing stockpiles and Rocklow Creek. • Deeping the existing dam is not expected to provide any benefit due to connectivity with Rocklow Creek alluvium.	Yes	Significant benefits are still expected despite limitations to increasing surface area and volume.

ID	Option	Expected outcome	Limitations	Option proposed	Justification
6	Reinstate usage of the biofiltration swale that discharges to EPL Point 6.	Provide beneficial treatment of controlled discharges from the Lower Dam.	• Discharges that infiltrate into the Rocklow Creek alluvium via the biofiltration swale may seep back into the Lower Dam. • Requirement to maintain and operate a pump system to transfer water from the Lower Dam into the biofiltration swale. *Biofiltration media is likely to clog due to high sediment loads.*	No	Risk of reduced treatment function due to ongoing operation and maintenance requirements.
7	Construct a channel to convey runoff from the Eastern Catchment directly into the DSS water management system.	Containment of runoff from the Eastern Catchment within either the quarry or DSS water management systems.	• The DSS water management system may be subject to change (i.e. rehabilitation/decommissioning of infrastructure) over the life of the quarry. Changes to the DSS water management system may require the investigation of alternative water management improvement options.	Yes	Reduces discharge to areas outside of a controlled water management area. Reed bed water treatment function can be reproduced via establishment of reed bed within constructed channel.

Notes: 1. The infrastructure to transfer water from Lower Dam to Middle Dam is to be dismantled as it is no longer in use and does not form part of the proposed water management system.

5.3.2 Proposed options

An assessment of water management improvement options is presented in Table 5.10. Boral proposes to adopt four (1, 2, 5 and 7) of the identified options to be implemented as part of the quarry's water management system. The proposed options were identified by comparing expected outcomes against identified limitations and the WQOs. The proposed water management improvement options are described further below.

i Containment of Eastern Catchment discharge

Runoff from the majority of the Eastern Catchment currently drains to an established reed bed area (refer to Section 4.1.6). Water in the red bed area then drains to an existing stormwater pipe that discharges to the DSS water management system (refer to Figure 4.2). Drainage works are proposed to contain discharges from the Eastern Catchment within either the quarry or DSS controlled water management systems. No material impacts to the DSS water management system are expected as:

- discharges from the Eastern Catchment currently flow into the DSS water management system (i.e. there will be minimal changes to inflow regimes)
- the establishment of reed beds along the base of constructed channel is proposed to provide similar water treatment benefits as the existing reed bed/wetland area (i.e. minimal change to inflow water quality).

The following modifications are proposed:

- Construct a channel along the existing haul road alignment to capture runoff from the Eastern Catchment before it enters the reed bed area.
- The channel will be constructed to an existing stormwater pipe that traverses a haul road and discharges to the DSS water management system.
- Construct bunding on the western side of the channel as required.
- Establish reed beds along the base of constructed channel.

Figure 5.2 provides a schematic of the proposed works.

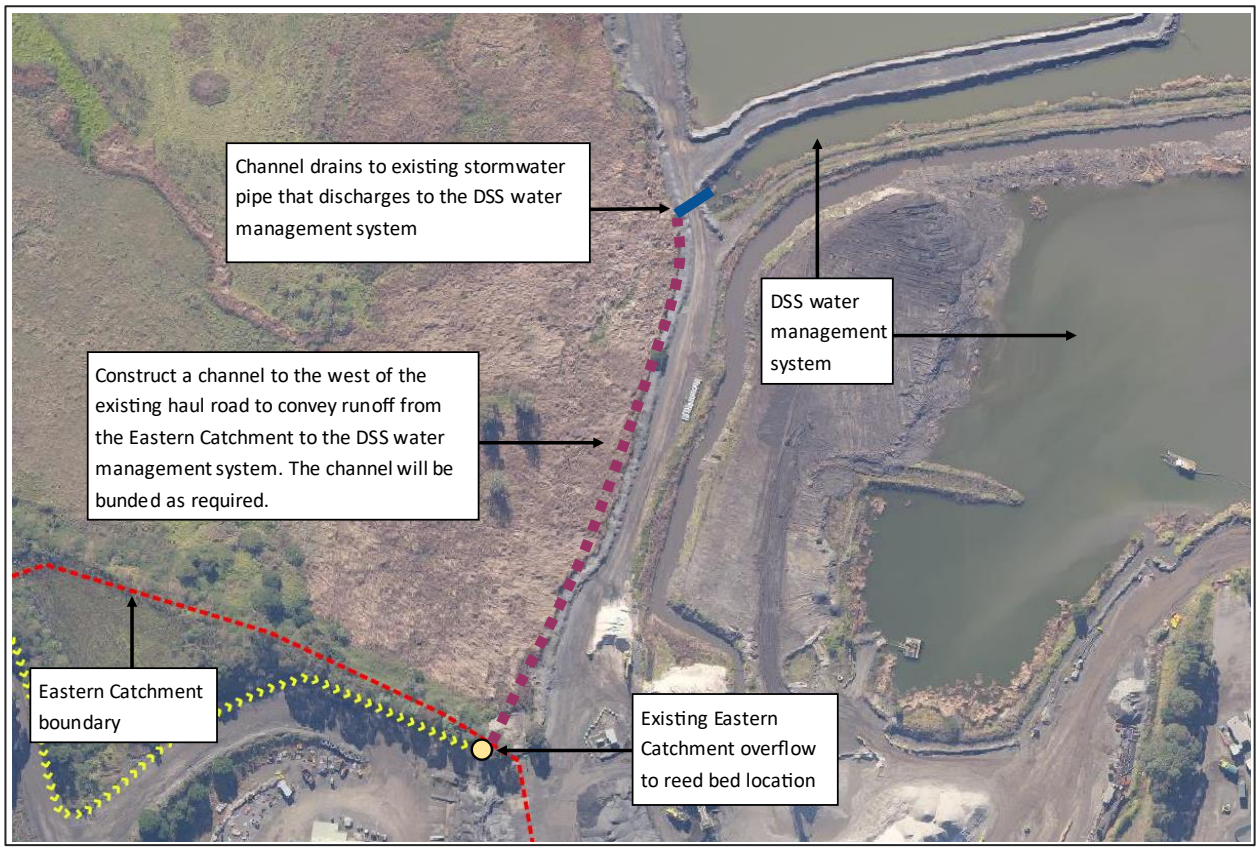


Figure 5.2 Proposed Eastern Catchment drainage works

ii Proposed Lower Dam modifications

Modifying the Lower Dam is proposed to improve sediment treatment functionality and reduce uncontrolled inflows from Rocklow Creek. Review of the existing dam identified the following constraints:

- Increasing the existing surface area of the Lower Dam is restricted by:
  - the need to maintain the access road to the north
  - the need to maintain the stockpile area to the east
  - minimising vegetation clearing and disturbance of the existing batter to the south
  - Rocklow Creek to the west.
- Significantly raising the spillway level and embankment height will increase geotechnical risks as a result of greater stored water levels.
- Excavating deeper than 2.0 m AHD will provide no benefit due to connectivity with the Rocklow Creek alluvium.

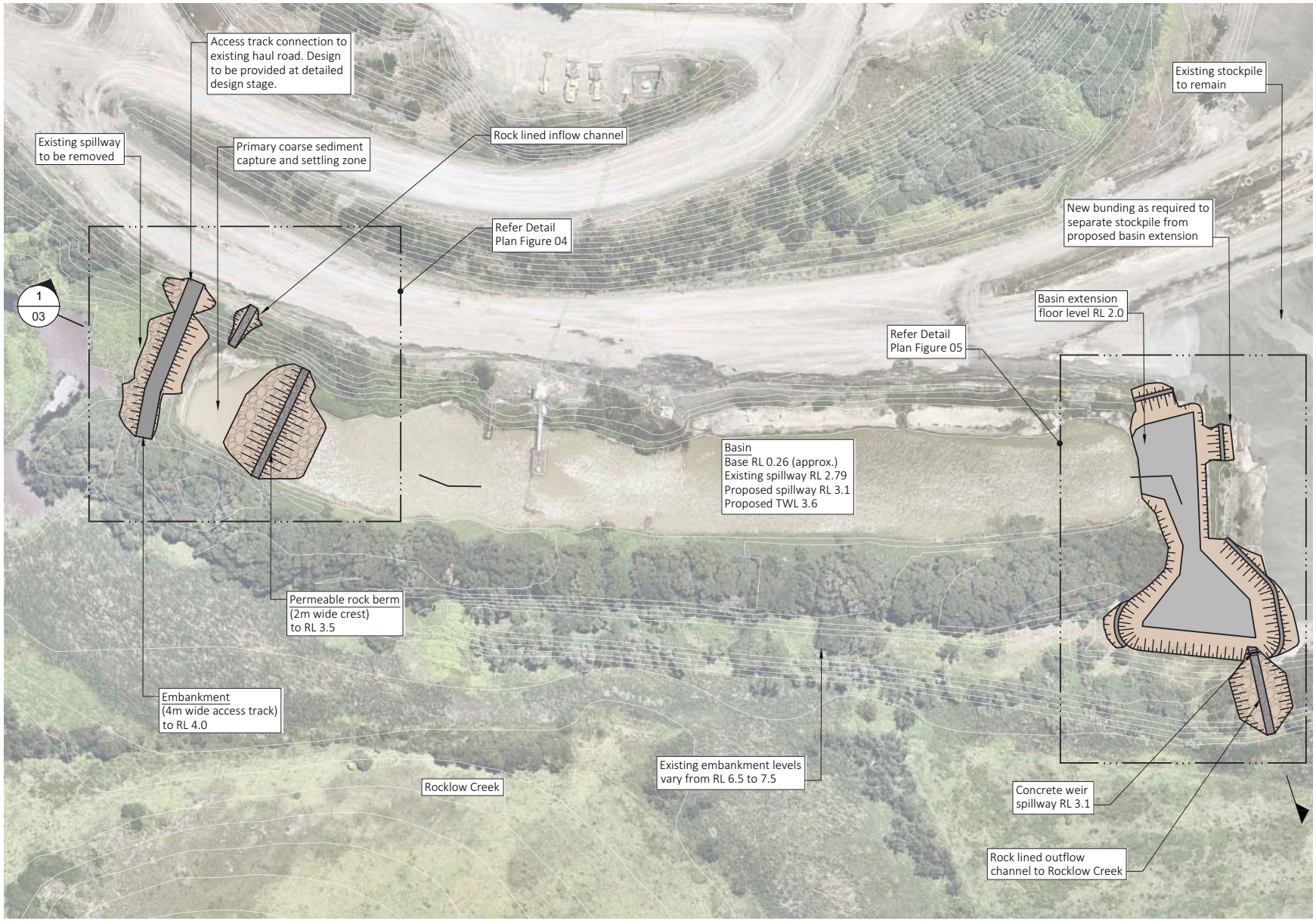
Several Lower Dam modification concepts were developed in conjunction with Boral and a preferred option was identified. A preliminary civil design was prepared for the preferred concept (refer to Appendix G). The proposed modifications are described in Table 5.11 and displayed in Figure 5.3.

Table 5.11 Lower Dam modifications

Proposed modification	Outcome
Relocate spillway to south-east side of the dam where Rocklow Creek levels are expected to be lower during large runoff events. Relocate primary sedimentation chamber to western end of dam. Raise embankment at existing spillway location from 2.8 to 4.0 m AHD.	• Significantly reduce the frequency of uncontrolled inflows from Rocklow Creek inundating the Lower Dam. • Improve water treatment function of Lower Dam during Rocklow Creek flood events. • Inflows will occur at the opposite end of the dam to outflows, resulting in longer residence time and improved sediment treatment function. • Provide vehicle access to primary sedimentation chamber to allow for sediment removal as required.
Extend the dam footprint to the east by approximately 1,600 m^2 and excavate to 2.0 m AHD.	• Provide an additional 1.1 ML of storage above 2.0 m AHD. • Establish a macrophyte zone near the dam outlet.
The relocated spillway will have an invert level of 3.1 m AHD[1], which will be 300 mm higher than the existing level (2.8 m AHD).	• Reduce the frequency of Rocklow Creek floodwaters inundating the Lower Dam. • Provide an additional 2.0 ML of storage above 2.0 m AHD.
Establish macrophyte zone within extended dam footprint area.	• Provide beneficial water quality treatment during significant rainfall (discharge) events.

Notes: 1. The spillway level of 3.1 m AHD represents the highest permanent water level proposed for the Lower Dam.

The proposed modifications to the Lower Dam will increase the sediment treatment volume from 7.9 ML to 11.0 ML (above 1.5 m AHD). The target sedimentation treatment volume (12.5 ML) outlined in Table 5.8 has not be attained due to the constraints outlined above. However, the proposed Lower Dam modifications are still expected to provide significant benefits compared to the existing arrangement as described in Table 5.11.



Site Plan

SCALE 1: 1000

KEY

- Earthwork batters
- Basin extension floor
- Earthworks crest or spillway
- Rock lining or permeable berm
- Existing surface contour — 3 —
- Earthworks windrow or berm

Proposed work overview plan

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 5.3
Preliminary Design

J180462 - DUNMORE \ Figure 02 Version 1 date 2019 03 13

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

0 10 20 50 m
1: 1000 @ A3 MGA Zone 56 AHD

N

EMM

iii Proposed changes to process water source

As discussed in Section 4.3, it is estimated that the quarry operation uses between 176 to 188 ML of process water a year. Historically, all process water has been extracted from Lower Dam with most of the water expected to have been drawn from the Rocklow Creek alluvium via groundwater ingress into the Dam.

It is proposed to preferentially source process water from the Croome Pits, followed by Middle Dam when there is insufficient stored water in the Croome Pits. This is expected to result in the following water management benefits:

- The lower-quality water stored in the Croome Pits (refer to Section 5.2.2) will be sourced for process water rather than transferred to Middle Dam where it seeps into the underlying breccia before discharging via the Breccia Spring. This will reduce the oxidised nitrogen and copper loads discharged via the Breccia Spring.
- A reduction in seepage volumes from the Middle Dam and associated Breccia Spring flows due to lower water levels in Middle Dam resulting from:
  - reduced dewatering rates from the Croome Pits due to stored water being preferentially sourced for process water use
  - increased dewatering rates from Middle dam for process water use.
- A reduction in the volume of water that is extracted from Lower Dam will reduce associated groundwater ingress into the Lower Dam from the adjoining Rocklow Creek alluvium.

Operating protocols for the extraction of process water are described in Table 5.12.

iv Operating protocols

Operating protocols define when and where water transfers are to occur within the water management system. The proposed operating protocols to be implemented at the quarry are described in Table 5.12.

Table 5.12 Proposed operating protocols

Operation	Operating rules
Extraction of process water from the Croome Pits	• When the volume of available water in the Croome Pits meets process water requirements and it is safe to extract water
Extraction of process water from Middle Dam	• When the volume of available water in the Croome Pits does not meet process water requirements • Middle Dam storage greater than 30% full
Extraction of process water from Lower Dam	• When the volume of available water in Middle Dam and the Croome Pits does not meet process water requirements
Dewatering of the Croome Pits to Middle Dam	• More than 10 ML stored in the Croome Pits[1] • Middle Dam storage less than 60% full

Notes: 1. The Croome Pits may occasionally require full dewatering to allow for the extraction of quarry materials.

5.3.3 Discharge regimes

The proposed water management system water balance model results were obtained from the *Modification 13 Surface Water Assessment* (EMM 2023). The Modification 13 water balance model included the proposed water management system modifications described above as well as the additional catchment area associated with the RIC Pit extraction area. Water balance results for typical dry (10th percentile), median (50th percentile) and wet (90th percentile) rainfall years are presented in Figure 5.4, Figure 5.5 and Figure 5.6 respectively. The water balance results display the total water movements over the year.

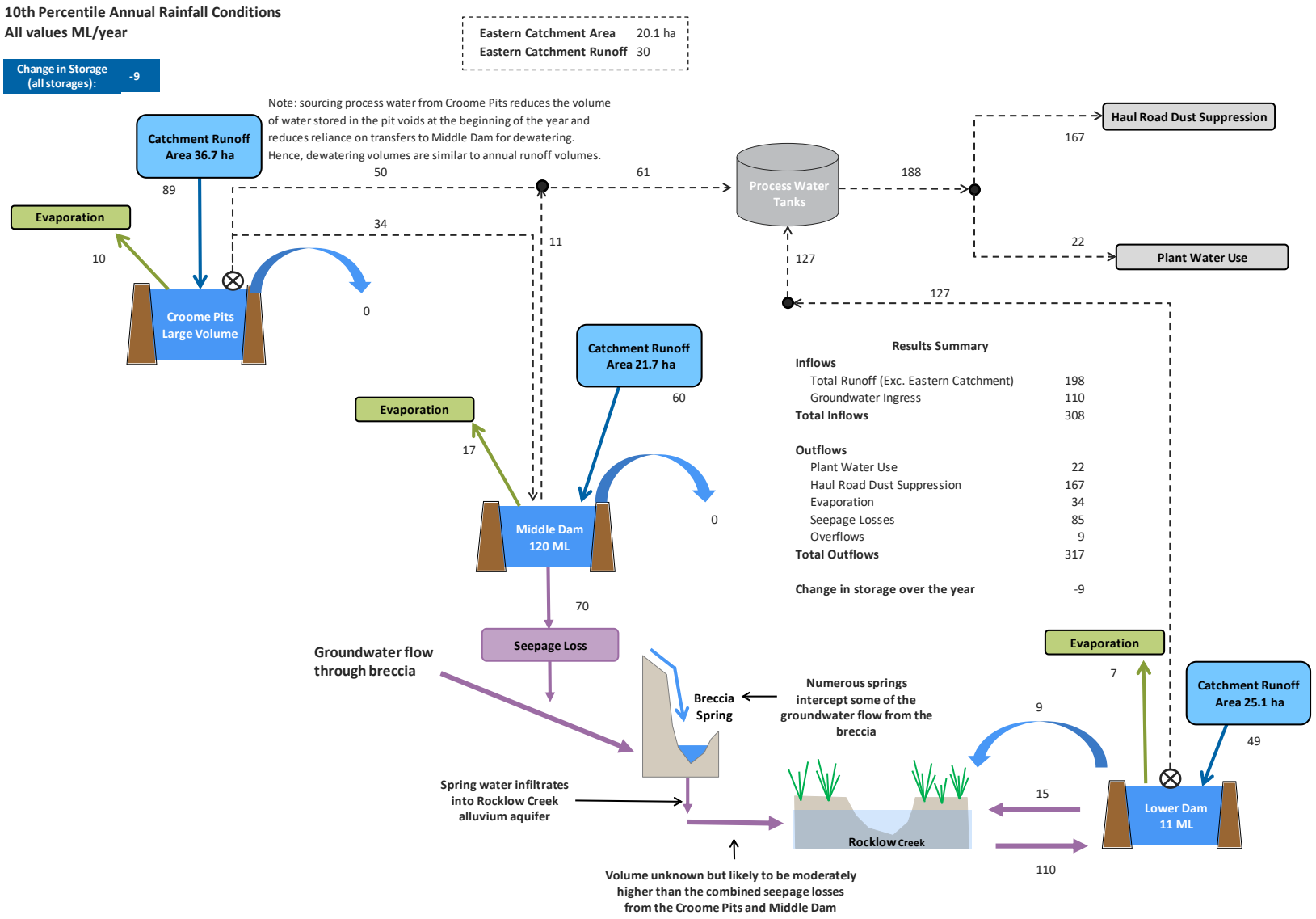


Figure 5.4 **Proposed water management system: typical dry year results (EMM 2023)**

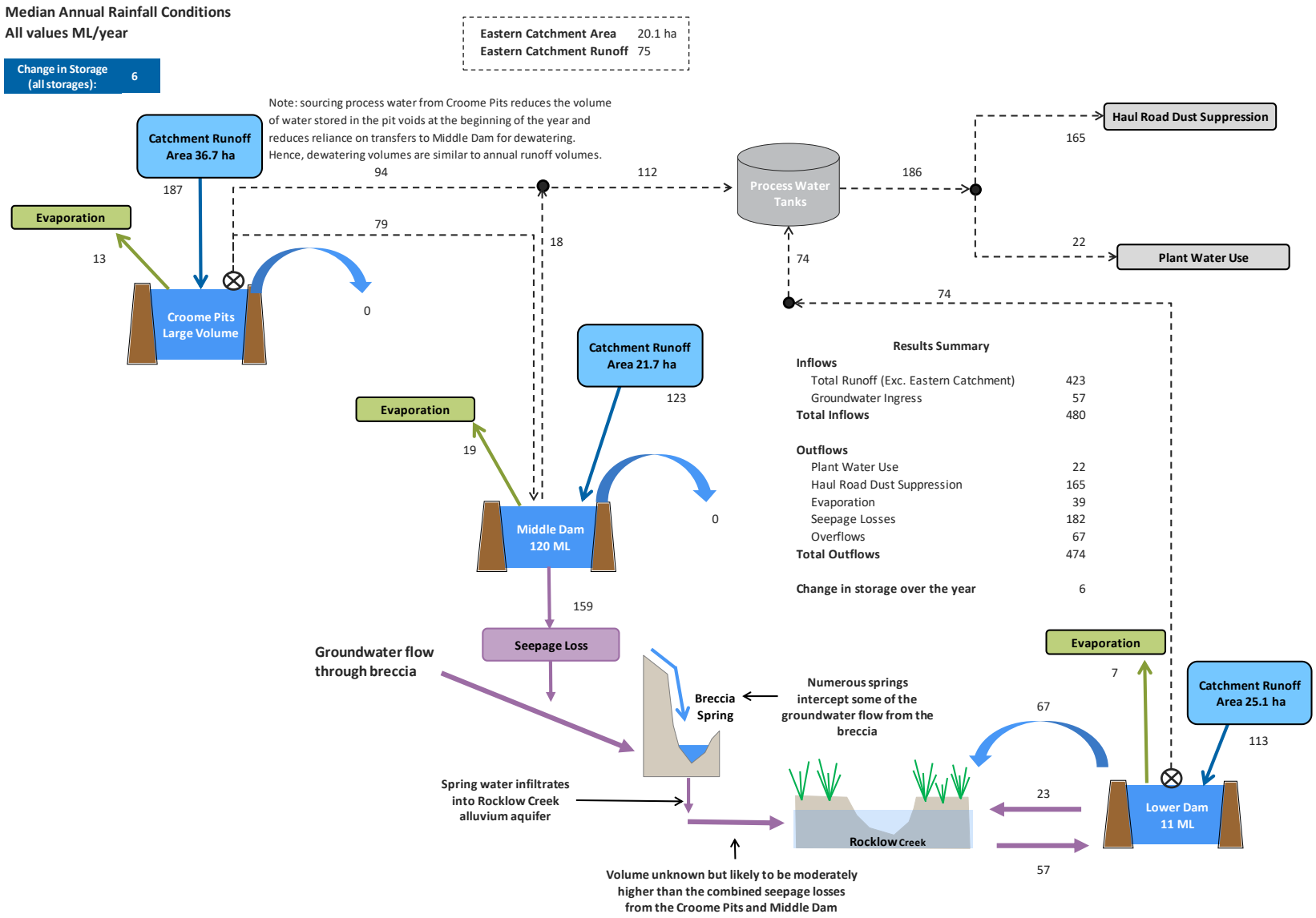


Figure 5.5 Proposed water management system: typical median year results (EMM 2023)

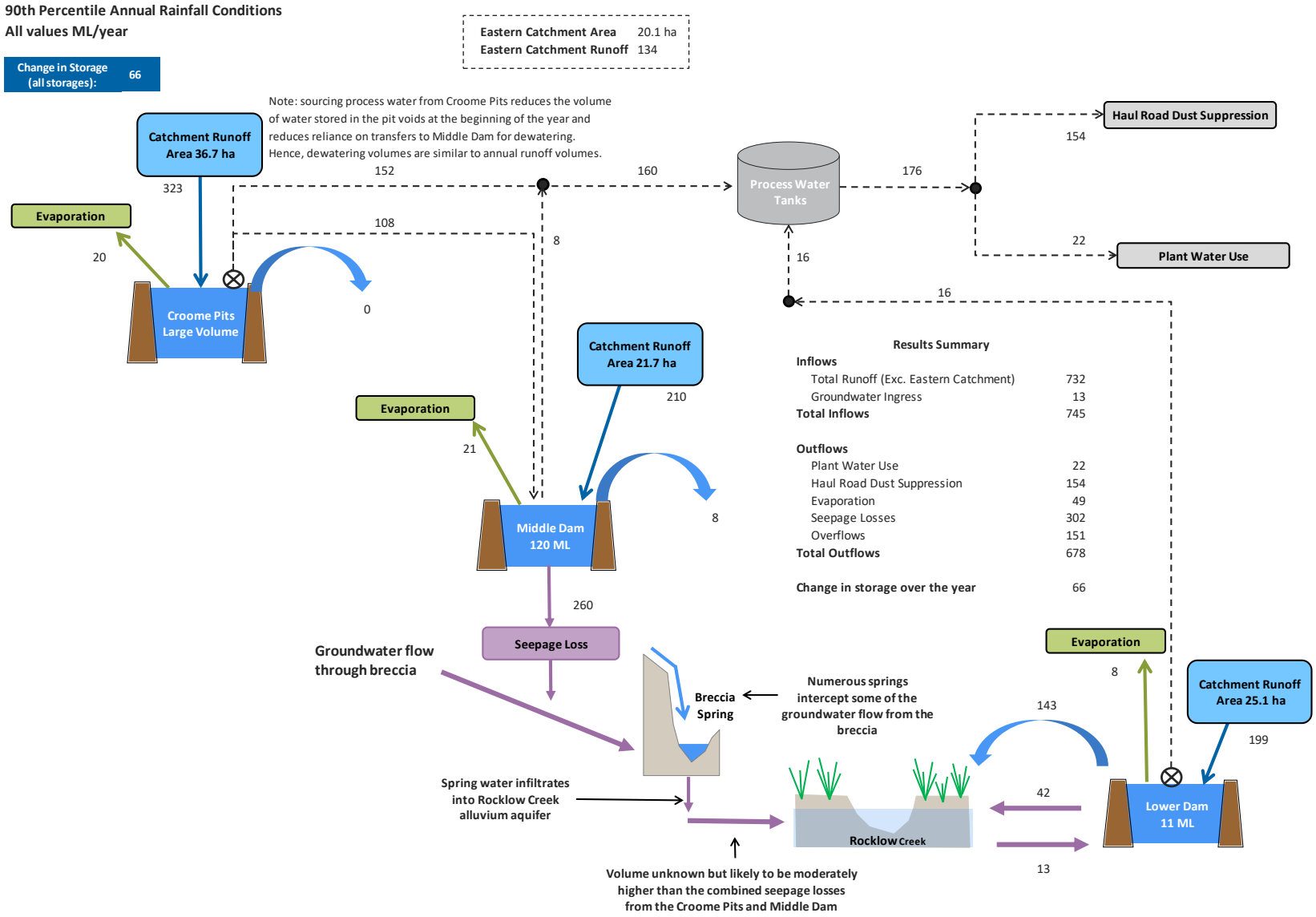


Figure 5.6 Proposed water management system: typical wet year results (EMM 2023)

Figure 5.7 compares annual exceedance probabilities for key site discharge and inflow mechanisms for the existing and proposed water management system.

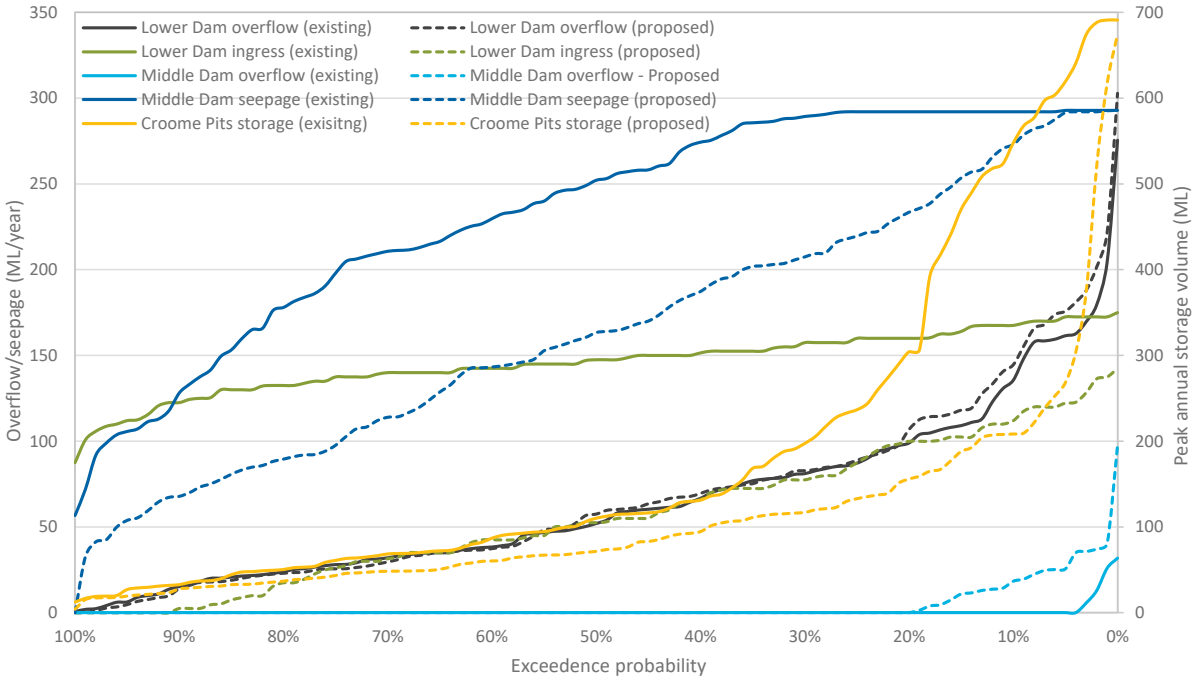


Figure 5.7 Comparison of water balance outputs for existing and proposed water management system

Figure 5.7 shows a reduced reliance on groundwater ingress from the Rocklow Creek alluvium under proposed conditions. Middle Dam seepage is reduced while overflows increase due to the additional extraction area associated with the RIC Pit. The frequency of Lower Dam overflows is predicted to remain similar to existing conditions with an average of four overflow events per year.

The frequency at which the Croome Pits storage volume exceeds 50% of the maximum peak annual storage volume (690 ML) is reduced from approximately 1 in 5 years to 1 in 25 years. Hence, preferentially sourcing process water from the Croome Pits and Middle Dam provides a significant reduction in potential pit flood risks.

The relative change in discharge volumes under varying climatic conditions for the Breccia Spring, Lower Dam overflows and Lower Dam seepage for the proposed water management system are presented in Table 5.13. No changes are expected to occur to the Eastern Catchment discharge regimes.

Table 5.13 Relative change in groundwater ingress and discharge volumes

	Units	Existing conditions			Proposed conditions			Relative change		
		Dry	Median	Wet	Dry	Median	Wet	Dry	Median	Wet
Lower Dam ingress	ML/year	161	151	124	110	57	13	-32%	-62%	-90%
Lower Dam seepage	ML/year	3	5	9	15	23	42	400%	360%	367%
Lower Dam overflow	ML/year	10	66	129	9	67	143	-10%	2%	11%
Breccia Spring	ML/year	140	228	276	70	159	260	-50%	-30%	-6%
Middle dam overflow	ML/year	0	0	0	0	0	8	-	-	-
Total discharge	**ML/year**	**153**	**299**	**414**	**71**	**223**	**415**	**-54%**	**-25%**	**0%**

Notes: 1. Annualised average based on 118-year model simulation.

Table 5.13 shows the proposed changes to the water management system will result in a median 25% reduction in overall discharge volumes and a 62% reduction in the median groundwater ingress volumes into Lower Dam. The key contributing factor to these changes is the proposal to preferentially source process water from the Croome Pits and Middle Dam over the Lower Dam.

Overflows and seepage losses from the Lower Dam are expected to increase due to higher average water levels. The overflow frequency is expected to remain unchanged at 3 to 4 overflow events per year. A minor increase in the discharge volumes from middle dam are predicted for wet conditions as a result of the increased catchment area associated with the RIC Pit extraction area.

5.3.4 Discharge characteristics

Residual impacts for the existing water management system were discussed in Section 5.2.3. The expected water quality characteristics for discharges from the proposed water management system are provided in Table 5.14. It is noted that the discharge water quality characteristics may change overtime and need to be progressively reviewed.

5.3.5 Residual impacts

As discussed in Section 5.3.3, the proposed changes to the water management system will result in a median 25% reduction in overall discharge volumes to Rocklow Creek. Most of this reduction will occur due to lower seepage losses from the Middle Dam, which discharges to Rocklow Creek via the Breccia Spring. This will result in a commensurate reduction in the loads of oxidised nitrogen and copper that are discharged to Rocklow Creek via the Breccia Spring. When discharge is occurring, it is expected that residual impacts will be similar to or less than the impacts described in Section 5.2.3.

The proposed modifications to Lower Dam include increasing the treatment volume and establishing a macrophyte zone. These modifications are expected to enhance the water quality treatment function of the dam during overflow and non-overflow conditions.

Table 5.14 Expected discharge water quality (proposed water management system)

Analyte	Units	WQO[1]	Breccia Spring		Lower Dam overflows and Eastern Catchment[4]		Rocklow Creek water quality[5]		Comments
			Typical[2]	Maximum[3]	Typical[2]	Maximum[3]	Typical[2]	Maximum[3]	
Electrical conductivity	µS/cm	200-300	520	845	370	500	430	570	pH is generally within the WQO range while typical electrical conductivity of discharge is elevated compared to WQOs for quarry discharge and receiving water quality.
pH	-	6.5-8.5	Within WQO range		Within WQO range		Within WQO range		
Turbidity	NTU	6-50	Within WQO range		310	750	65		Coarse and some fine suspended solids are removed in the water management dams and existing reed beds (Eastern Catchment).
Suspended sediment	mg/L	-	8	22	120	350	15	130	The proposed modifications to Lower Dam are expected to provide further beneficial treatment of suspended solids and associated turbidity.
Oxidised nitrogen	mg N/L	0.040	4.2	6.0	2.8	3.1	0.02	0.3	Preferentially sourcing process water from the Croome Pits and Middle Dam will reduce the nutrient and metal loads in discharge. Concentrations are not expected to materially change.
Total nitrogen	mg N/L	0.35	4.9	6.7	3.3	3.7	0.6	1.8	
Total phosphorus	mg P/L	0.025	0.05	0.3	0.3	3.0	0.1	0.3	The introduction of a macrophyte zone within the Lower Dam is expected to provide beneficial removal of some metals and toxicants.
Boron	mg/L	0.370	0.3	0.45	Within WQO range		Concentrations generally below WQOs		
Copper	mg/L	0.0014	0.006	0.008	0.005	0.006			
Mercury	mg/L	0.00006	<0.0001	0.0001	Within WQO range				
Other toxicants (dissolved metals, inorganics)	mg/L	Note 6	Concentrations of some metals may occasionally exceed WQOs. Concentrations are only expected to remain elevated near discharge mixing zones.						

Notes
1. WQO values are established in Table 2.6.
2. Typical concentrations based on median values resulting from the water characterisation program that is described in Section 5.2.2.
3. Maximum concentrations based on the maximum values presented in Table 5.6 and Table 5.7. Where more than ten samples available, 90th percentile is used in lieu of maximum value.
4. For analytes that are not available for Lower Dam overflows, typical and maximum values for the Lower Dam have been used. Runoff quality in the Eastern Catchment is assumed to be similar to the Lower Dam water quality.
5. Rocklow Creek Water quality characteristics were based on samples collected at GS1, GS2 and RC2 during the water characterisation program that is described in Section 5.2.2.
6. Values for slightly-moderately disturbed ecosystems apply.

6 Erosion and sediment control plan

An adaptive approach to erosion and sediment control is implemented at the quarry to account for frequent changes in quarry layout as quarrying activities progress across the site. Erosion and sediment control measures will also be applied when constructing the proposed water management improvement options.

This section provides an erosion and sediment control plan that is generally in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Volume 2E – Mines and Quarries* (DECC 2008).

6.1 Activities that may cause erosion and generate sediment

Land disturbance from quarrying activities, operating haul roads and stockpiling of product and overburden material are the primary activities that may cause erosion and generate sediment during operation of the quarry. Sediment that is generated by these processes is transported to the quarry pit or water management dams via surface water runoff.

Construction activities (such as the proposed Lower Dam modifications) may also cause erosion and generate sediment during the construction period.

6.2 Erosion and sediment control measures

The existing water management dams (refer to Section 4.1.2) are the primary mechanism for erosion and sediment control at the quarry. However, the following management measures are also in place to minimise soil erosion and the transport of sediment:

- Minimisation of disturbed areas to reduce the potential of erosion.
- Diversion of clean water from upstream catchments to reduce the risk of run-on and the mixing of clean and sediment laden water. Clean water diversions also reduce the volume of water required to be managed in the quarry water management system.
- Fines stockpiles are kept to a minimum practical size. Fines are transported to DSS wherever possible for utilisation as a sales product.
- Sheeting material is used on high traffic haul roads to minimise erosion.
- Wheel-wash facilities are provided for trucks exiting the site.
- Erosion and sediment control plans are prepared for any construction activities (such as the proposed Lower Dam modifications) that occur outside of the quarry's water management system.

6.3 Erosion and sediment control structures

The existing water management dams are the primary mechanism for erosion and sediment control at the quarry. The location, function and capacity of the existing water management dams are provided in Section 4.1.2. Additional erosion and sediment control benefits provided by the proposed Lower Dam modifications are described in Section 5.3.1.

6.4 Management of erosion and sediment controls

An erosion and sediment control checklist (as part of the environmental inspection checklist) is completed monthly or after 50 mm of rainfall in 48 hours. The erosion and sediment control checklist provides a means for assessing the effectiveness of controls and identify opportunities for progressive improvement. All corrective, improvement and maintenance actions are documented in the Site Incident Management Systems.

A copy of the current (2020) checklist is included in Appendix I. The provided checklist is for demonstrative purposes only and may change over time due to changes in quarry operations.

7 Monitoring and response plan

This section outlines a surface water and groundwater monitoring and response program. This program has been developed with consideration of the recommendations made in the *Modification 9 Surface Water Assessment* (RHDHV 2017), *Modification 13 Surface Water Assessment* (EMM 2023) and *Modification 13 Groundwater Assessment* (EMM 2022), and provides:

- surface and groundwater impact assessment criteria
- surface and groundwater monitoring programs
- surface and groundwater response plans
- incident response plans.

7.1 Surface water monitoring

7.1.1 Impact assessment criteria

Section 2.6 established Water Quality and River Flow Objectives for the quarry receiving waters. Table 5.14 compares expected discharge water quality to the WQOs. Impacts to receiving water monitoring locations (GS2 and GS3) are to be assessed against the WQO values established in Table 2.6 (and reproduced in Table 5.14). Quarry discharge (Breccia Spring and Lower Dam overflows) monitoring results are to be assessed against the expected 'maximum concentration' levels provided in Table 5.14, for the relevant location.

7.1.2 Monitoring plan

The objective of the surface water monitoring program is to collect data to enable:

- the occurrence, duration and volume of site discharges to be estimated
- the quality of surface water within the quarry's water management system and receiving waters to be progressively characterised
- the site water balance to be progressively updated (as required)
- compliance with consent and license conditions to be assessed.

Table 7.1 provides an overview of the surface water monitoring program. Table 7.2 lists the analytes to be monitored. It is not proposed to monitor analytes that were consistently below detection limits in sampling to date (as described in Section 5.1). No monitoring from the DSS water management system is proposed as monitoring at DSS is undertaken as part of the DSS WMP.

Table 7.1 Surface water monitoring program overview

Monitoring aspect	Objective	Monitoring locations	Monitoring description
Weather	Accurately record site weather conditions. This information will be used to validate and calibrate the site water balance model and demonstrate compliance with weather related consent conditions and EPL requirements.	• Current weather station location	Boral will continue to operate the site weather station which is capable of measuring rainfall, wind speed and temperature.

Monitoring aspect	Objective	Monitoring locations	Monitoring description
Process water	Boral will record process water volumes on a monthly basis. This information can be used to progressively improve the reliability of the water balance model.	• Water cart use • All other process water uses	Monthly process water volumes are to be recorded either by a cumulative flow meter or daily tanker load count. Process water usage is to be maintained in a spreadsheet.
Lower Dam process water use	Boral will measure and record the volumes of water extracted from the Lower Dam for process water use. This data will be used to estimate groundwater ingress volumes into the Lower Dam.	• Lower Dam	A cumulative flow meter will be installed to record the volumes of water extracted from the Lower Dam for process water use. The flow meter will be read on a monthly basis.
Water level	To continuously record the water levels in Lower Dam and Middle Dam. This data will be used to demonstrate the functionality of the water management system and estimate discharge, seepage losses and runoff characteristics.	• Rocklow Creek • Lower Dam • Middle Dam	Boral will continue to operate the water level loggers in Rocklow Creek, Lower Dam. The water level logger in Middle Dam will be reinstated. Data will be downloaded and reviewed annually.
Water quality (dry weather)	To monitor the quality of water at various discharge points around the site. This data will be used to infer water quality risks associated with overflows and performance of water quality improvement provided by water management dams.	• Rocklow Creek (RC1, GS1, GS2 and GS3) • Lower, Middle and Croome Pits • Breccia Spring	Monitoring is to be undertaken via grab samples at each location. Samples are to be collected during dry weather conditions on a quarterly basis.
Water quality (wet weather conditions[1])			Monitoring is to be undertaken via grab samples at each location. Samples are to be collected during wet weather conditions. Wet weather sampling will be undertaken up to two times annually pending wet weather conditions occurring.

Notes: 1. Wet weather conditions are defined as 50 mm or more rainfall occurring within the 48-hour period prior to sampling.

Table 7.2 Surface water quality analytical suite

Category	Analyte to be tested	Analysis method
General	• pH • Electrical conductivity • Turbidity	To be measured using a portable water quality meter in the field.
	• Total suspended solids (TSS) • Total hardness ($CaCO_3$)	Analysis to be undertaken by a NATA certified laboratory.
Nutrients	• Ammonia, nitrate, nitrite, oxidised nitrogen, organic nitrogen and total nitrogen • Reactive and total phosphorus	
Dissolved metals	• Aluminium, boron, copper, mercury	

7.1.3 Response plan

Monitoring will be undertaken from within the water management system, water management system discharge locations and at the nominated receiving water locations. Exceedances will be identified and addressed as described in Table 7.3.

Trigger Action Response Plans (TARPs) have been prepared to establish methods to identify the source of water quality exceedances and if necessary, establish actions to either improve water management or further investigate the exceedance. Separate TARPs have been prepared for receiving water and point of discharge exceedances. TARPs are provided in Appendix H.

Table 7.3 Overview of surface water operating protocols and Trigger Action Response Plans

Monitoring type	Trigger	Action	Objective
Water quality	If a WQO is exceeded in receiving water downstream of Lower Dam and Breccia Spring discharge locations (GS2 and GS3).	TARP 1 – Receiving water exceedance	• To identify (where possible) if the exceedance is naturally occurring or due to the quarry operations.
	If the 'maximum concentration' outlined in Table 5.14 is exceeded at a point of discharge (Breccia Spring and Lower Dam overflow).	TARP 2 – Point of discharge exceedance	• To identify the source (where possible) of each exceedance. • To establish actions to either improve water management or further investigate the exceedance mechanism.
Process water	Process water sources discussed in this WMP are unable to meet operational demand.	• Use mains water for plant dust suppression • Use chemical dust suppressants for haul road and stockpile dust suppression • Investigate alternative water sources	• To allow quarry operations to continue without exceeding WAL volumes.
Extraction of water from Lower Dam	Annual process water extraction from Lower Dam exceeds WAL volume (250 ML/year)	• Investigate whether water extracted from Lower Dam is solely sourced from the ingress of water from Rocklow Creek • Investigate alternative process water sources • Consult with government to establish licencing arrangements	• To establish appropriate water licencing arrangements

7.2 Groundwater management

7.2.1 Impact assessment criteria

Section 2.4 established minimal impact considerations based on the categorisation of the quarry's local groundwater system as 'less productive' porous or fractured rock. The criteria to assess potential groundwater impacts comprise the minimal impact considerations defined in Table 2.3. Further details on the expected impacts are described below.

i Groundwater inflow

Minor pit seepage is likely to occur during quarrying for short periods following the initial interception of isolated water bearing zones. The seepage will likely evaporate on the rockface before it can contribute to flows within the site water management system. This is consistent with current observations in the pit, where there is very minor to no groundwater seepage at the pit walls and floor (EMM 2022).

The maximum predicted annual inflow volume is 7.4 ML/year (EMM 2022).

ii Groundwater levels

Groundwater modelling (EMM 2022) predicts that quarry excavation will result in a depressurisation zone comprising a 2 m drawdown radius of 1 km from the edge of the quarry pit shell. This maximum lateral propagation of influence is modelled to occur in 2043, during the last year of quarrying activities. Registered bore GW026848 is modelled to experience between 4 m and 6 m of drawdown due to the quarry (EMM 2022). The quarry monitoring bores (GW1 to GW4) are predicted to experience drawdown of up to 22 m by the end of the quarry life.

Two ephemeral springs were also identified within the drawdown extent. The ephemeral springs are not anticipated to be influenced by the project. The water quality evidence suggests these springs rely on from a 'young' groundwater system with a less residence time. The modelled drawdown represents the depressurisation of the underlying confined aquifer, hydraulically disconnected from the springs (EMM 2022).

The predicted groundwater drawdown does not extend to the Minnamurra River Estuary Wetland or vegetation potentially relying on groundwater (EMM 2022).

iii Groundwater quality

Groundwater modelling (EMM 2022) indicates that groundwater will flow into the Croome Farm Pit and Croome West Pit. Therefore, the extraction process is not expected to impact the local groundwater quality.

7.2.2 Monitoring plan

Baseline groundwater level, quality and flow data from the intercepted groundwater systems has been collected since 2014. The objectives of the groundwater monitoring program are to:

- validate groundwater level modelling predictions
- monitor groundwater quality.

Although no impact to groundwater quality is expected, groundwater quality monitoring is still proposed to inform the assessment of the quarry's surface water management system. Due to the minor groundwater inflow expected to enter quarry pit, no formal monitoring of groundwater inflow is proposed.

i Monitoring network design

The groundwater monitoring network comprises seven monitoring bores installed at different times since 2014. The groundwater monitoring network has been designed to satisfy the requirements of Condition 40, Schedule 4 of the approved Development Consent. Four groundwater monitoring bores are installed into the fractured rock outside the quarry area, with a further three bores are installed into the alluvium outside the DSS dredge pond (refer to Figure 3.1 and Table 7.4). In summary:

- Three deep monitoring bores (GW1, GW2 and GW3) targeting the Bumbo Latite (EMM 2014), were installed in July 2014. GW1 is screened across latite and the top of the underlying sandstone, GW2 is screened across latite, and GW3 is screened across latite and breccia. These bores are located up hydraulic gradient from current quarrying activities.

- GW4 was installed in February 2022 as part of the proposed northern extension into the RIC area. GW4 is screened across the base of the latite and up gradient of current quarrying activities.

In addition to the above monitoring network, there was a commitment included as part of Modification 13 to also monitor the private landholder bore GW026848 if access permission could be gained by Boral. The construction details of GW026848 are not included in Table 7.4. GW026848 has been included in the monitoring program described in the sections below.

Table 7.4 Groundwater monitoring bore construction details

Bore ID	Total depth (mbgl)[1]	Ground level (m AHD)	Total depth (m AHD)	Screened interval (mbgl)[1]	Screened interval (m AHD)	Screened formation	Monitoring duration
GW1	78.0	131.44	53.440	72.0–78.0	59.44–53.44	Bumbo Latite and Kiama Sandstone	July 2014 - present
GW2	86.0	135.69	49.690	79.0–85.0	56.69–48.69	Bumbo Latite	July 2014 - present
GW3	80.0	147.25	67.250	68.0–80.0	79.25–67.25	Bumbo Latite and Breccia	July 2014 - present
GW4	29.0	57	28	20–26	21–27	Bumbo Latite	February 2022 - present

Notes: 1. mbgl = metres below ground level.

ii Groundwater monitoring program

The ongoing groundwater monitoring is summarised in Table 7.5.

Table 7.5 Groundwater monitoring overview

Site ID	Objective	Water quality frequency	Water level frequency
GW1	Ongoing monitoring of regional groundwater quality and levels through Kiama Sandstone.	Six monthly	• Logger at 12-hour intervals. • Manual water level measurements and logger download to occur six monthly.
GW2	Ongoing monitoring of regional groundwater quality and level through Bumbo Latite.		
GW3	Ongoing monitoring of local groundwater quality and level through Bumbo Latite – breccia contact.		
GW4	Ongoing monitoring of regional groundwater quality and level through Bumbo Latite near RIC area.		
GW026848	Private landholder bore approved for stock use. Located approximately 1 km west of the quarry.	None	• Manual water level measurements to occur six monthly if permitted.

Note: 1. Monitoring bores form part of the DSS monitoring program.

iii Groundwater quality monitoring analysis suite

The analytical suite to be tested in each water quality monitoring round is provided in Table 7.6. It is not proposed to monitor analytes that were consistently below detection limits in the water quality results discussed in Section Groundwater quality and presented in Appendix E.

Table 7.6 Groundwater quality analytical suite

Category	Analyte to be tested	
General	• pH • Electrical conductivity	To be measured using a portable water quality meter in the field.
	• Total dissolved solids • Total hardness ($CaCO_3$)	Analysis to be undertaken by a NATA certified laboratory.
Nutrients	• Ammonia, oxidised nitrogen, organic nitrogen and total nitrogen • Reactive and total phosphorus	
Dissolved metals	• Arsenic, boron, chromium, copper, iron, nickel and zinc	

7.2.3 Response plan

i Groundwater levels

Site-specific trigger values (SSTVs) for the Croome West bores have been developed to capture any groundwater level changes that exceed those predicted in the *Modification 13 Groundwater Assessment* (EMM 2022).

The SSTVs presented in Table 7.7 were developed based on predicted drawdown impacts (EMM 2022) and a statistical analysis of baseline data (analysed after the drilling recovery period). A response will be triggered if groundwater levels decline more than the predicted drawdown impact with consideration of natural variability.

The natural variability of groundwater in the area is approximated using the following equation:

Natural variability = (standard deviation from mean x 2) x 120%

An arbitrary buffer of 20% is applied to the observed range to allow for more extreme season variability than that observed in the baseline period. Therefore, the SSTV is determined by the following calculation:

SSTV = mean groundwater level – (natural variability + predicted drawdown)

Baseline data is not yet available for GW026848 to establish mean groundwater levels or characterise natural variation. The baseline data and SSTVs for GW026848 will be updated as data becomes available (pending access permission). Table 7.8 describes how exceedances will be identified and addressed.

Table 7.7 Groundwater site-specific trigger values

Bore ID	Mean groundwater level (m AHD)	Standard deviation from mean (m)	Natural variability (m)	Predicted drawdown (m)[1]	SSTV (m AHD)
GW1	105.2[2]	3.5	8.4	22	74.8
GW2	128.3[2]	0.4	1.0	21	106.3
GW3	104.4[2]	0.4	1.0	14	89.4
GW4	53.8[3]	1.9	4.6	9	40.2
GW026848	-	-	-	5	More than 2 m drawdown observed

Note: 1. Predicted drawdown obtained from the *Modification 13 Groundwater Assessment* (EMM 2022).
2. Calculated using baseline data from 2015 to 2018.
3. Calculated using baseline data from 2022 to 2024.

Table 7.8 Groundwater level drawdown level exceedance Trigger Action Response Plan

Monitoring type	Trigger	Action	Objective
Continuous and manual groundwater level monitoring	Groundwater level at one of the monitoring bores is lower than the SSTVs defined in Table 7.7.	TARP 3 – Groundwater drawdown level exceedance	To identify (where possible) if the exceedance is naturally occurring or due to the quarry operations.

7.3 Incident response plan

7.3.1 Incident response procedures

In the event of an unforeseen incident that may impact the surface water or groundwater at the quarry, the following protocols will be implemented:

1. conduct a preliminary review of the nature of the incident and expected impact regarding the WQOs
2. minimise and control the impact of the incident by identifying key risks and prepare an action plan manage those risks
3. mitigate contributing factors were possible
4. implement additional monitoring as necessary to measure the effectiveness of the controls implemented.

The outcome of any unforeseen incident investigations and the controls/remediation actions implemented will be reported in the Annual Review described in Section 9.2.1.

8 Water access licence

This section discusses the surface water and groundwater licensing requirements for the quarry operation.

8.1 Approvals

8.1.1 Existing approvals

Water supply work approval 10WA103611 applies to the quarry. The approval covers the period from 1 July 2011 to 30 June 2024 and is for a 100 mm centrifugal pump and a bywash dam (Lower Dam) in the Illawarra Rivers Water Source, Minnamurra River Management Zone. This approval applies to the pumping of water from the Lower Dam.

8.1.2 Exemptions

Dams that are solely for the capture, containment or recirculation of drainage, consistent with best management practice to prevent the contamination of a water source, that are located on a minor stream are considered to be excluded works under Schedule 1, item 3 of the NSW Water Management (General) Regulation 2018. The Middle Dam and Croome Pits are excluded works under this definition as the primary use of the storages is for water quality control by capturing runoff to prevent pollution of the downstream receiving environment. Excluded works under this definition are exempt from requiring a WAL, water supply work approval or water use approval.

8.2 Water licensing

8.2.1 Water sharing plans

i Surface water

The *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011,* Illawarra Rivers Water Source and Minnamurra River Management Zone applies to surface water resources at the quarry.

ii Groundwater

The *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*, Sydney Basin South Groundwater Source applies to groundwater resources at the quarry. NRAR advised in correspondence dated 26 October 2020 that this water sharing plan applies to groundwater inflows into the Lower Dam that occur from the Rocklow Creek alluvium when the dam is pumped down.

8.2.2 Existing water access licence

i Surface water

Boral holds an unregulated river WAL (WAL25152) to extract 227 ML per annum of surface water from the Illawarra Rivers Water Source, Minnamurra River Management Zone.

ii Groundwater

Boral holds an aquifer WAL (WAL44509) to extract 250 ML per annum of groundwater from the Sydney Basin South Groundwater Source.

8.3 Water licence requirements

8.3.1 Surface water

The water management system for the proposed operation will source water for operational purposes by extraction from the Croome pits, Middle Dam and the Lower Dam. Water extracted from the Croome pits and Middle Dam will be sourced from either surface water runoff from the respective catchments or groundwater inflows into the pits. Water extracted from the Lower Dam will be sourced from surface water runoff from the dam's catchment and groundwater ingress from the Rocklow Creek alluvium that occurs only when the dam is pumped down.

Water stored within the water management system is used for dust suppression activities and to supply the processing plant. The take of water from the water management system for this purpose is exempt from requiring a licence under Schedule 4, item 12 of the NSW Water Management (General) Regulation 2018. Accordingly, no surface water entitlement is required to account for water used from the Middle Dam and Croome Pits and the portion of water used from the Lower Dam that originates from surface water runoff.

8.3.2 Groundwater

Entitlement in the Sydney Basin South Groundwater Source is required for the following groundwater take mechanisms:

- Groundwater inflows into the quarry pits estimated at 7.4 ML/year.
- Groundwater inflows into the Lower Dam that occur from the Rocklow Creek alluvium when the dam is pumped down. The water balance model for the existing and proposed operation calculated the groundwater ingress into the Lower Dam. Table 8.1 reproduces the results for a range of weather scenarios. A maximum inflow of 140 ML/year occurs during extreme dry years for both the proposed operations.

Table 8.1 Lower Dam groundwater take

	Lower Dam ingress (ML/year)			
	Extreme dry year[1]	Typical dry year[2]	Typical median year[2]	Typical wet year[2]
Existing conditions	175	161	151	124
Proposed conditions	140	110	57	13

Notes: 1. Annual flow based on maximum Lower Dam ingress over the entire 118-year water balance model simulation.
2. Annual flow volumes sourced from the water balance flow charts presented in Section 4.3.1 and Section 5.3.3.

8.4 Licensing approach

Table 8.2 provides a break-down of the WALs required and WALs held for each relevant water source and demonstrates that Boral hold sufficient entitlements for the predicted maximum surface and groundwater take.

It should be noted a portion of the water pumped from the Lower Dam would be surface water runoff from the quarry and as such is exempt from licensing requirements (refer to Section 8.1.2). Regardless, the 250 ML/year groundwater entitlement held by Boral is sufficient to cover the maximum predicted ingress volume and pumped volume for both existing and proposed scenarios.

Table 8.2 Water licencing approach

Water take mechanism	Relevant Water Sharing Plan and water source	WALs required (based on maximum take)	WALs held
Surface water	*Greater Metropolitan Region Unregulated River Water Sources 2011*, Illawarra Rivers Water Source	Nil, all water take is exempt (see Section 8.1.2)	227 ML
Groundwater	*Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*, Sydney Basin South Groundwater Source		
a) Quarry pit inflows		7.4 ML	
b) Lower Dam inflows (proposed scenario)		140 ML	
Groundwater total		**147.4 ML**	**250 ML**

9 Action plan

9.1 Water management summary of actions

Table 9.1 summarises the actions to be undertaken in accordance with this WMP.

Table 9.1 WMP action plan

WMP actions	Trigger/timing	Outcome
Modifications		
Proceed with modifications to the Lower Dam (Lower Dam Transition Plan)	Following approval of this WMP	Modification of Lower Dam as outlined in this WMP
Construct Eastern Catchment discharge containment channel	Following approval of this WMP	Improved water management system outcomes
Proceed with modifications to process water source	Following approval of this WMP	Improved water management system outcomes
Reinstate the Middle Dam water level logger	Following approval of this WMP	Record water levels in the Middle Dam to provide better understanding of water management system
Dismantle Lower Dam to Middle Dam transfer infrastructure	Following approval of this WMP	Removal of infrastructure that is no longer in use and does not form part of the proposed water management system
Compliance		
Acquire a WAL for the extraction of water from the Sydney Basin South Groundwater Source	Immediately	Boral has acquired 250 ML/year of groundwater entitlement for the Sydney Basin South Groundwater Source
Consult with EPA to revise EPL conditions	Following submission of this WMP to government	Revise EPL conditions to reflect discharge locations/mechanisms and water quality risks identified in this WMP
Submit an as-executed report of the modified Lower Dam	Following modification of the Lower Dam	Address consent condition 34
Monitoring		
Monitor surface water conditions at the quarry	Following approval of this WMP, and subsequently as described in Section 7.1	Establish quarry discharge and water quality characteristics to assess compliance with consent and licence conditions
Monitor groundwater conditions at the quarry	Following approval of this WMP, and subsequently as described in Section 7.2	Validation of groundwater modelling level predictions and establish groundwater quality to inform the water management system

9.2 Reporting and review

9.2.1 Reporting

In accordance with Condition 9 of Schedule 5 of the Modification 13 development consent, Boral will prepare an Annual Review report each year. The report will include:

- the results of all environmental monitoring
- a water balance for the period
- identification of any non-compliance, and a description of what actions were (or are being) undertaken to achieve compliance
- the outcome of any unforeseen incidents investigations and the controls/remediation actions implemented
- assessment of the adequacy of site-specific environmental safeguards and management measures
- a description of any changes to management or mitigation measures.

9.2.2 Review

Boral will review the appropriateness of this WMP annually. Each review will consider:

- monitoring results
- amendments to the WMP (if applicable)
- details of the measures undertaken to address any identified issues (If applicable).

The effectiveness of the groundwater monitoring network will be evaluated annually as part of the ongoing groundwater review and will continue as per the recommendations made in the *Modification 13 Groundwater Assessment* (EMM 2022).

10 Summary

10.1 Project context

Boral own and operate the Dunmore Hard Rock Quarry located at the end of Tabbita Road, in the Shellharbour LGA. The hard rock produced at the quarry is crushed on-site to supply construction materials to markets in the Illawarra, Southern Highlands and Sydney Regions.

Development consent (DA 470-11-2003) for the quarry was granted by the Minister for Planning on 19 November 2004. Since consent was issued in November 2004, there have been 13 approved modifications to the development consent.

Modification 9 sought consent to expand the quarry by approximately 14.4 ha. Modification 9 was granted development consent in September 2017. Modifications 10, 11 and 12 were subsequently granted development consent in June 2017, March 2019, and September 2021 respectively. These modifications were in relation to administrative changes, such as hours of operation and rail versus road tonnages rather than changes to operational footprint.

Modification 13 sought consent to expand the quarry by approximately 8 ha to the north into land previously owned by the Rail Infrastructure Corporation (RIC). Modification 13 also sought to increase the depth of operations across the quarry to maximise resource extraction. Modification 13 was granted development consent in June 2024.

The project consent is subject to numerous conditions, including a requirement that Boral prepare an updated WMP for the quarry. This document presents and updated WMP and supersedes previous WMPs prepared by Matrix Consulting in 2005, Evans and Peck in 2008, and Arcadis in 2016.

10.2 Water Quality Objectives

Water Quality Objectives for the quarry's receiving waters (Rocklow Creek) have been established using the NSW Water Quality and River Flow Objectives (DECCW 2006) and the ANZECC/ARMCANZ (2000) guidelines. The water quality objective values are referenced when describing water quality characteristics and residual impacts.

10.3 Water management summary

10.3.1 Existing water management system

The existing water management system at the quarry comprises:

- four defined catchment areas that drain to water management dams, quarry pits or discharge from the quarry as runoff
- two water management dams (Lower Dam and Middle Dam) and a number of quarry pits (Croome Pits) that store and treat runoff from the corresponding catchment areas
- several discharge mechanisms that include overflows from the Lower Dam and Middle Dam spillways and seepage from the Lower Dam and Middle Dam (via the Breccia Spring)
- process water that is preferentially sourced from the Lower Dam, which is replenished by groundwater ingress from the adjoining Rocklow Creek alluvium.

10.3.2 Discharge impact assessment

Water balance model results identified the Breccia Spring (contributed to by seepage from the Middle Dam) as the quarry's primary discharge mechanism, which can maintain a constant flow for several months following a rainfall period. Overflows from the Lower Dam are estimated to occur approximately four times per year.

A water monitoring program was undertaken to characterise discharge and receiving water quality. The following residual impacts were established:

- Turbidity and TSS in the Lower Dam and Lower Dam overflows were typically elevated compared to the WQOs and receiving water concentrations. Elevated concentrations of suspended solids were attributed to the existing Lower Dam containing an undersized sediment treatment volume.

- Oxidised nitrogen and copper within the Croome Pits, water management dams and Breccia Spring were elevated in all samples compared to the WQOs. The presence of oxidised nitrogen and copper are interpreted to be associated with the weathering of quarry rock that has naturally occurring levels of both analytes.

- Aluminium and boron concentrations within the Croome Pits and Middle Dam were elevated compared to the WQOs. Boron was also occasionally elevated compared to the WQOs at the Breccia Spring.

The highest concentrations of oxidised nitrogen, copper and boron were found in the Croome Pits with concentrations decreasing as water moves through the water management system. The potential impact associated with the Breccia Spring discharge was determined to be greatest during periods of low flow. However, flows from the Breccia Spring were found to only impact water quality in the immediate mixing zone (near the discharge location).

10.3.3 Proposed modifications

A number of water management improvement options to mitigate discharge impacts were assessed. The proposed water management system modifications include:

- drainage works are to contain discharges from the north-east section of the quarry within the quarry's water management system prior to discharge into the DSS water management system

- modification of the Lower Dam – including:

    - relocating the dam spillway, primary sediment chamber and raising the existing spillway embankment

    - increasing storage by extending the dam footprint and raising proposed spillway height by 300 mm

    - establishing a macrophyte zone within the extended dam footprint area

- preferentially sourcing process water from the Croome Pits, followed by Middle Dam when there is insufficient stored water in the Croome Pits.

10.3.4 Expected outcomes

The proposed water management system is expected to achieve:

- significant reduction of the frequency of uncontrolled inflows from Rocklow Creek inundating the Lower Dam
- improvement of water treatment functionality of the Lower Dam and reduce the volume of groundwater ingress into the Lower Dam by 62%
- reduction of Breccia Spring discharges by 30%, resulting in commensurate reduction in oxidised nitrogen and copper loads discharged to receiving water
- reduced flooding risks in the Croome Pits during extended periods of wet weather.

10.4 Water Management Plan actions

Key actions to be undertaken in accordance with this WMP include:

- modification of the Lower Dam and process water source
- liaising with the EPA to revise the EPL conditions to reflect discharge locations/mechanisms and water quality risks identified in this WMP
- ongoing monitoring of surface water and groundwater.

References

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Appendix A
Development consent

EMM
creating opportunities

CONSOLIDATED CONSENT

Development Consent

Section 80 of the *Environmental Planning & Assessment Act 1979*

I, the Minister Assisting the Minister for Infrastructure and Planning (Planning Administration), approve the Development Application referred to in Schedule 1, subject to the conditions in Schedules 3 to 5.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the on-going environmental management of the development.

Diane Beamer, MP
Minister Assisting the Minister for Infrastructure and Planning (Planning Administration)

Sydney 2004 File No. S03/01960

SCHEDULE 1

Development Application:	DA 470-11-2003.
Applicant:	Boral Resources (NSW) Pty Limited (ABN: 51 000 756 507).
Consent Authority:	Minister Assisting the Minister for Infrastructure and Planning (Planning Administration).
Land:	See Appendix 1.
Proposed Development:	Increase production at the Dunmore Quarry from 1.2 million tonnes per annum (Mtpa) to 2.5 Mtpa, by: • increasing operating hours; • making minor changes to equipment types and configuration, mainly within the crushing and conveying circuit; and • increasing rail and road transportation of product.
State Significant Development:	The proposal is classified as State significant development, under section 76A(7) of the *Environmental Planning and Assessment Act 1979*, because it is an extractive industry where the proposed rate of production exceeds the threshold limits specified in the Ministerial declaration, dated 3 August 1999.
Integrated Development:	The proposal is classified as integrated development, under section 91 of the *Environmental Planning and Assessment Act 1979*, because it requires additional approvals under the: • *Protection of the Environment Operations Act 1997;* • *National Parks & Wildlife Act 1974;* • *Rivers and Foreshores Improvement Act 1948.*
Designated Development:	The proposal is classified as designated development, under section 77A of the *Environmental Planning & Assessment Act 1979*, because it is for an extractive industry that would "obtain or process for sale, or reuse, more than 30,000 cubic metres of extractive material per year…". Consequently, it meets the criteria for designated development in schedule 3 of the *Environmental Planning & Assessment Regulation 2000*.

CONSOLIDATED CONSENT

Note:

- *To find out when this development consent becomes effective, see Section 83 of the Environmental Planning and Assessment Act 1979* (EP&A Act);
- *To find out when this development consent is liable to lapse, see Section 95 of the EP&A Act; and*
- *To find out about appeal rights, see Section 97 of the EP&A Act.*

This instrument includes changes made by Modification 1 in December 2005 (marked in blue)
This instrument includes changes made by Modification 2 in June 2006 (marked in red)
This instrument includes changes made by Modification 3 in May 2008 (marked in green)
This instrument includes changes made by Modifications 4 and 5 in November 2008 (marked in pink)
Modification 6 (January 2014) marked in purple
Modification 7 (October 2015) marked in maroon
Modification 8 (November 2016) marked in orange
Modification 10 (June 2017) marked in aqua
Modification 9 (September 2017) marked in light green
Modification 11 (March 2019) marked in yellow highlight
Modification 12 (September 2021) marked in cornflower blue
Modification 13 (June 2024) marked in brown

SCHEDULE 2
DEFINITIONS

Annual Review	Annual Review, as required under condition 9 of schedule 5
Applicant	Boral Resources (NSW) Pty Limited
BCA	Building Code of Australia
BCS	Biodiversity, Conservation and Science Group of DCCEEW
Calendar year	A period of 12 months from 1 January to 31 December
CCC	Community Consultative Committee
Council	Shellharbour City Council
Commonwealth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
Croome West Pit	Western extension of the extraction area approved in Modification 9
DA	Development Application
Day	Day is defined as the period from 7am to 6pm on Monday to Saturday, and 8am to 6pm on Sundays and Public Holidays
Department	NSW Department of Planning, Housing and Infrastructure
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	Environment Protection Authority
EPL	Environment Protection Licence issued under the POEO Act
Evening	Evening is defined as the period from 6pm to 10pm
Feasible	Feasible relates to engineering considerations and what is practical to build or carry out
GTA	General Term of Approval
Heritage Item	An Aboriginal object, an Aboriginal place, or a place, building, work, relic, moveable object, tree, or precinct of heritage significance, that is listed under any of the following: • the State Heritage Register under the *Heritage Act 1977*; • a state agency heritage and conservation register under section 170 of the *Heritage Act 1977*; • a Local Environmental Plan under the EP&A Act; • the World Heritage List; • the National Heritage List or Commonwealth Heritage List under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999; or • anything identified as a heritage item under the conditions of this consent
Incident	A set of circumstances that: • causes or threatens to cause material harm to the environment; and/or • breaches or exceeds the limits or performance measures/criteria in this consent
Land	As defined in the EP&A Act, except where the term is used in the noise and air quality conditions in Schedules 4, 4A and 5 of this consent, where it is defined as a whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this consent.
Laden trucks	Trucks transporting quarry products from the site
Material harm	Is harm to the environment that: • involves actual or potential harm to the health or safety involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial; or • results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000, (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)
MEG	Regional NSW – Mining, Exploration and Geosciences
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the development
Minister	Minister for Planning and Public Spaces, or delegate
Night	Night is defined as the period from 10pm to 6am on Monday to Saturday, and 10pm to 8am on Sundays and Public Holidays
NMO	Nature Markets and Offsets, within the BCS
Privately-owned land	Land not owned by the Applicant or its related companies or where a private agreement does not exist between the Applicant and the landowner
POEO Act	*Protection of the Environment Operations Act 1997*
Quarrying operations	Includes the removal of overburden and extraction, processing, handling,

	storage and transportation of extractive material on the site
Quarry products	Includes all saleable quarry products, but excludes tailings, other wastes and rehabilitation material
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
RIC Pit Extension	Extension of quarring area as part of Modification 13
Planning Secretary	Planning Secretary of the Department, or nominee
SEE	Statement of Environmental Effects
Shoulder	Time interval from 6am to 7am, Monday to Saturday
Site	Land to which the DA applies
TfNSW	Transport for NSW
Waste	Has the same meaning as the definition of the term in the Dictionary to the POEO Act
Water Group	DCCEEW – Water Group

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SCHEDULE 3
ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. In addition to meeting the specific performance measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the construction and operation of the development, and any rehabilitation required under this consent.

Terms of Approval

2. The Applicant must carry out the development generally in accordance with the:
   (a) DA 470-11-2003;
   (b) EIS titled *Environmental Impact Statement for the proposed Dunmore Quarry Production Increase*, Volumes 1 & 2, dated November 2003, and prepared by R. W. Corkery & Company Pty Limited;
   (c) The letter from Boral Quarries to the Department dated 20 October 2005 about the application to modify Dunmore Quarry development consent DA 470-11-2003, and accompanying plans 4034032_01 issue E, and 4034032_EL issue B;
   (d) modification application MOD 59-4-2006 and letter from Boral Quarries to the Department dated 13 April 2006;
   (e) Modification Application 470-11-2003 Mod 3, letter to the Department dated 28 March 2008, and accompanying plans GE-DU-2961-02 Rev D; GE-DU-2962-01 Rev B; GE-DU-2963-01 Rev 0; and GE-DU-2964-02 Rev 0;
   (f) Modification Application 470-11-2003 Mod 4 and accompanying SEE titled *Statement of Environmental Effects for the proposed Dunmore Hard Rock Quarry Extension,* dated May 2008, and letter from Boral Quarries & Recycling to the Department dated 22 September 2008;
   (g) Modification Application 470-11-2003 Mod 5 and accompanying letter from Boral Quarries & Recycling to the Department dated 16 September 2008 (and accompanying plan GE-DU-2966-01 Rev E);
   (h) Modification Application 470-11-2003 Mod 6 and accompanying document titled *Environmental Assessment Dunmore Hard Rock Quarry– Modification 6,* prepared by EMGA Mitchell McLennan and dated 19 November 2012;
   (i) Modification Application 470-11-2003 Mod 7 and accompanying document titled *Proposed Blending Plant Dunmore Hardrock Quarry DA 470-11-2003 – Modification 7, Environmental Assessment*, dated December 2014;
   (j) Modification 470-11-2003 Mod 8 and accompanying document titled *Dunmore Quarry – Modification 8 Environmental Assessment,* dated August 2016 and accompanying Response to Submissions, dated 22 September 2016;
   (k) Modification Application 470-11-2003 Mod 10 and accompanying documents titled *Environmental Assessment: Dunmore Quarry Modification 10*, dated 23 May 2017, and supplementary Environmental Assessment titled *Environmental Assessment: Dunmore Quarry Modification 10,* dated 16 June 2017;
   (l) Modification Application 470-11-2003 Mod 9 and accompanying documents titled *Dunmore Quarry – Modification 9 Environmental Assessment*, dated 17 February 2017, and Response to Submissions titled *Dunmore Quarry – Modification 9 Response to Submissions*, dated 17 August 2017;
   (m) Modification Application 470-11-2003 Mod 11 and accompanying document titled *Dunmore Quarry – Modification 11 Environmental Assessment*, dated 28 September 2018, Response to Submissions titled *Dunmore Quarry – Mod 11 Response to Submissions*, dated 7 November 2018, and additional information titled *Traffic Impact Assessment Addendum*, dated 24 January 2019;
   (n) Modification Application 470-11-2003 Mod 12 and accompanying document titled *Statement of Environmental Effects - Laden truck dispatch restriction amendments*, prepared by Boral Land and Property Group, dated June 2021, and letter from Boral Property Group dated 04 August 2021 with additional information; and
   (o) Modification Application 470-11-2003 Mod 13 and accompanying document titled *Modification Report – Dunmore Hard Rock Quarry Modification 13*, prepared by EMM, dated 20 January 2023, and *Submissions Report – Dunmore Quarry Mod 13*, dated January 2024, and additional information titled *Response to Further RFI from BCS – Dunmore Quarry Mod 13*, dated 18 April 2024 and *2nd Response to Further RFI from BCS – Dunmore Quarry Mod 13*, dated 14 June 2024.

2A The Applicant must carry out the development in accordance with the conditions of this consent.

3. The conditions of this consent and directions of the Planning Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and the document/s listed in condition 2. In the event of an inconsistency, ambiguity or conflict between any of the document/s listed in condition 2, the most recent document prevails to the extent of the inconsistency, ambiguity or conflict.

4. Consistent with the requirements in this consent, the Planning Secretary may make written directions to the Applicant in relation to:

(a) the content of any strategy, study, system, plan, program, review, audit, notification, report or correspondence submitted under or otherwise made in relation to this consent, including those that are required to be, and have been, approved by the Planning Secretary; and
(b) the implementation of any actions or measures contained in any such document referred to in condition 4(a).

Quarrying Operations

5. The Applicant may carry out quarrying operations on the site until 31 December 2043.

Note: Under this consent, the Applicant is required to rehabilitate the site and carry out additional undertakings to the satisfaction of the Planning Secretary. Consequently, this consent will continue to apply in all other respects other than the right to conduct quarrying operations until the rehabilitation of the site and those undertakings have been carried out to a satisfactory standard.

6. The Applicant must not produce or transport more than 2.5 million tonnes of quarry products a calendar year from the development.

Transportation

7. A maximum of 2.5 million tonnes of quarry products may be transported from the site in any calendar year.

7A. The Applicant must not dispatch more than:
(a) 50 laden trucks per hour from the site between 6 am and 6 pm, with only 33 laden trucks per hour between 6 am and 9 am permitted to head northwest into Albion Park Rail from the intersection of New Lake Entrance Road / Princes Highway;
(b) 23 laden trucks from the site in any hour between 6 pm and 6 am; and
(c) a total of 400 laden trucks from the site on per day.

Note: In this condition, "day" means any 24-hour period.

Surrender of Consents

8. Deleted

Structural Adequacy

9. The Applicant must ensure that any new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

Notes:
- *Under Part 4A of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for any building works.*
- *Part 8 of the EP&A Regulation sets out the detailed requirements for the certification of development*

Demolition

10. The Applicant must ensure that all demolition work is carried out in accordance with *AS 2601-2001: The Demolition of Structures,* or its latest version.

Protection of Public Infrastructure

11. The Applicant must:
(a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and
(b) relocate, or pay the full costs associated with relocating any public infrastructure that needs to be relocated as a result of the development.

Operation of Plant and Equipment

12. The Applicant must ensure that all plant and equipment at the site, or used in connection with the development, are:
(a) maintained in a proper and efficient condition; and
(b) operated in a proper and efficient manner.

Compliance

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

SCHEDULE 4
SPECIFIC ENVIRONMENTAL CONDITIONS

IDENTIFICATION OF BOUNDARIES

1. Within 6 months of the date of this consent and any subsequent modification involving a change to the approved limits of extraction, the Applicant must:
   (a) engage a registered surveyor to mark out the boundaries of the approved limits of extraction;
   (b) submit a survey plan of these boundaries to the Planning Secretary; and
   (c) ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits.

ACQUISITION UPON REQUEST

2. Upon receiving a written request for acquisition from the landowner of the land listed in Table 1, the Applicant must acquire the land in accordance with conditions 3 and 4 below.

Land Owner(s)	Land Identification
Creagan	Lot 5 DP1001931
Stocker	Lot 1 DP745632
McParland/ Fogarty	Lot 10 DP977931
Kimmorley Property	Lot 1 DP998321

Table 1: Land Subject to Acquisition on Request

Note: Land titled 'McParland/Fogarty' has been acquired and is now quarry-owned.

3. Within 6 months of receiving a written request from the landowner, the Applicant must pay the landowner:
   (a) the current market value of the landowner's interest in the land at the date of this written request, as if the land was unaffected by the development the subject of this DA, having regard to the:
      - existing and permissible use of the land, in accordance with the applicable environmental planning instruments at the date of the written request; and
      - presence of improvements on the land and/or any approved building or structure which has been physically commenced at the date of the landowner's written request, and is due to be completed subsequent to that date; and
   (b) the reasonable costs associated with:
      - relocating within the Shellharbour or Kiama local government areas, or to any other local government area determined by the Planning Secretary; and
      - obtaining legal and expert advice for determining the acquisition price of the land and the terms upon which it is to be acquired; and
   (c) reasonable compensation for any disturbance caused by the land acquisition process.

   However, if within 6 months of receiving this written request, the Applicant and landowner cannot agree on the acquisition price of the land and/or the terms upon which the land is to be acquired, then either party may refer the matter to the Planning Secretary for resolution.

   Upon receiving such a request, the Planning Secretary shall request the NSW President of the Australian Property Institute to appoint a qualified independent valuer to consider submissions from both parties, and determine a fair and reasonable acquisition price for the land, and/or the terms upon which the land is to be acquired.

   If either party disputes the independent valuer's determination, the independent valuer must refer the matter back to the Planning Secretary for resolution.

   If the landowner refuses to accept this offer within 6 months of the date of the Applicant's offer, the Applicant's obligations to acquire the land cease, unless otherwise agreed by the Planning Secretary.

4. The Applicant must bear the costs of any valuation or survey assessment requested by the independent valuer or the Planning Secretary, and the costs of determination referred to in Condition 3 above.

5. If the Applicant and landowner agree that only part of the land should be acquired, then the Applicant must pay all reasonable costs associated with obtaining Council approval for any plan of subdivision, and registration of the plan at the Office of the Registrar-General.

6. While the land listed in Table 1 is privately-owned land, the Applicant must comply with the requirements applying to this land in these conditions of consent.

ADDITIONAL MITIGATION UPON REQUEST

6A. Upon receiving a written request from the landowner of any residence on the land listed in Table 1 or Table 1A, the Applicant must implement additional mitigation measures at or in the vicinity of the residence, in consultation with the landowner. These measures must be consistent with the measures outlined in the *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Development* (NSW Government, 2014), as may be updated or replaced from time to time. They must also be reasonable and feasible and proportionate to the level of predicted impact.

If within 3 months of receiving this request from the landowner, the Applicant and the owner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Planning Secretary for resolution.

Receiver Locations	Mitigation Basis
Locations AA, D, F, G and Z	Noise

Table 1A: Land Subject to Mitigation on Request

NOISE

Noise Limits

7. [1]The Applicant must ensure that the noise generated by the development does not exceed the criteria specified in Table 2.

Receiver Locations	Noise Limits dB(A)					
	$L_{Aeq\ (15minute)}$				$L_{A1\ (1minute)}$	
	Day	Evening	Night	Shoulder	Night	Shoulder
Location K Stocker Residence	49	44	38	47	48	55
Location O Dunmore Lakes	49	44	38	47	48	55
Location J Creagan Residence	Negotiated Agreement in Place					
Location AA	38	38	38	38	45	45
Locations AB and T	36	36	36	36		
Locations D, F, G and Z	40	40	40	40		
Location S	37	37	37	37		
Other privately-owned residences	35	35	35	35		

Table 2: Noise Impact Assessment Criteria for the Development

Notes:

1. *Receiver locations are shown in Appendix 2.*
2. *The above table may be varied if the Applicant enters into a negotiated agreement with any of the affected residents, or if existing agreements become void.*
3. *Noise from the development is to be measured at the most affected point on or within the residential boundary or at the most affected point within 30m of the dwelling (rural situations) where the dwelling is more than 30m from the boundary, to determine compliance with the $L_{Aeq(15\ minute)}$ noise limits in the above table. Where it can be demonstrated that direct measurement of noise from the development is impractical, the EPA may accept alternative means of determining compliance (see Chapter 11 of the NSW Industrial Noise Policy). The modification factors presented in Section 4 of the NSW Industrial Noise Policy must also be applied to the measured noise levels where applicable.*
4. *Noise from the development is to be measured at 1m from the dwelling façade to determine compliance with the $L_{A1(1minute)}$ noise limits in above table.*
5. *The noise emission limits identified in Table 1 apply under meteorological conditions of:*

[1] Incorporates EPA GTA

- *Wind speed up to 3m/s at 10 metres above ground level; or*
- *Temperature inversion conditions of up to 3°C/100m and wind speed up to 2m/s at 10 metres above the ground.*

Noise Investigations

8. Deleted

Operating Hours

9. The Applicant must comply with the operating hours in Table 3:

Activity	Days of the Week	Time
Extraction and Processing	Monday – Saturday	6-00am to 10-00pm
Product Transfer to Stockpiles	Monday - Saturday	6-00am – Midnight
Maintenance	Monday – Sunday	24 hrs
Construction (including construction of the bund under Modification 8)	Monday – Saturday	7-00am to 6-00pm Monday to Friday 8-00am to 1-00pm Saturday

Table 3: Operating Hours for the Development

10. Deleted

Oversized Material

11. [2]The Applicant must not process any oversized raw feed material at the development during the shoulder period.

Note: For the purpose of this condition "oversized raw feed material" is defined as where more than 50% of the shot is over 900mm in diameter.

Noise Operating Conditions

11A. The Applicant must:

(a) take all reasonable steps to minimise the construction, operational and transport noise associated with the development;

(b) take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions; when the noise criteria in this consent do not apply; and

(c) regularly assess noise monitoring data, and modify or stop operations on the site to ensure compliance with the relevant conditions of this consent,

to the satisfaction of the Planning Secretary.

Noise Monitoring

12. Deleted

13. [3]Within 3 months of the date of this consent, and annually thereafter, unless directed otherwise by the Planning Secretary, the Applicant must:

(a) commission a suitably qualified person to assess whether the development is complying with the noise impact assessment criteria in Table 2, in general accordance with the NSW Industrial Noise Policy and Australian Standard (AS) 1055-1997: "Description and Measurement of Environmental Noise"; and

(b) provide the results of this assessment to the EPA and Planning Secretary within a month of commissioning the assessment.

Noise Management Plan

14. The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:

(a) be prepared in consultation with the EPA;

(b) be submitted to the Planning Secretary for approval prior to commencing quarrying operations in the Croome West Pit, unless the Planning Secretary agrees otherwise;

(c) describe the measures to be implemented to ensure:

[2] Incorporates EPA GTA
[3] Incorporates EPA GTA

- compliance with the noise criteria and operating conditions of this consent;
- best practice management is being employed;
- noise impacts of the development are minimised during stage 3 extraction of the Croome West Pit, particularly during the shoulder period; and
- noise impacts of the development are minimised during meteorological conditions under which the noise criteria in this consent do not apply;

(d) describe the proposed noise management system; and

(e) include a monitoring program to be implemented to measure noise from the development against the noise criteria in Table 2.

The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

Reporting

15. Deleted

BLASTING AND VIBRATION

Airblast Overpressure Criteria

16. The Applicant must ensure that the airblast overpressure level from blasting at the development does not exceed the criteria in Table 4 at any residence or sensitive receiver on privately-owned land.

Airblast overpressure level [dB(Lin Peak)]	Allowable exceedance
115	5% of the total number of blasts over a period of 12 months
120	0%

Table 4: Airblast Overpressure Limits

Ground Vibration Criteria

17. The Applicant must ensure that the peak particle velocity from blasting at the development does not exceed the criteria in Table 5 at any residence or sensitive receiver on privately - owned land.

Peak particle velocity (mm/s)	Allowable exceedance
5	5% of the total number of blasts over a period of 12 months
10	0%

Table 5: Ground Vibration Limits

Blasting Restrictions

18. [4]Blasting operations at the site may only take place:

a) between 9am and 5pm Monday to Saturday inclusive;

b) are limited to 2 blasts each day; and

c) at such other times as may be approved by EPA.

Blast Operating Conditions

19. During blasting operations, the Applicant must:

(a) take all reasonable steps to:

(i) protect the safety of people in the surrounding area;

(ii) protect public or private infrastructure/property in the surrounding area from any damage; and

(iii) minimise blast-related dust and fume emissions; and

(b) operate a suitable system to enable members of the public to get up-to-date information on the proposed blasting schedule on the site,

to the satisfaction of the Planning Secretary.

[4] Incorporates EPA GTA

Blast Management Plan

20. The Applicant must prepare a Blast Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
    a) be submitted to the Planning Secretary for approval within 6 months of Modification 8, or as otherwise agreed by the Planning Secretary;
    b) describe the measures that would be implemented to ensure compliance with the blast criteria and operating conditions of this consent;
    c) include measures to manage and monitor the avoidance of impacts on the heritage values on the buildings on Lot 10 DP977931;
    d) include measures to manage flyrock;
    e) include a monitoring program for evaluating and reporting on compliance with the blasting criteria in this consent;
    f) include community notification procedures for the blasting schedule, in particular to nearby residences; and
    g) include a protocol for investigating and responding to complaints.

    The Applicant must implement the approved Blast Management Plan as approved from time to time by the Planning Secretary.

    Note: Prior to the approval of the Blast Management Plan revised under Modification 8, the most recent approved version must continue to have full force and effect and must be implemented.

Blast Monitoring

21. [5]The Applicant must monitor the airblast overpressure and peak particle velocity impacts of the development at the permanent monitoring station as approved by the EPA, to the satisfaction of the EPA and Planning Secretary, using the specified units of measure, frequency, sampling method, and location in Table 6.

Parameter	Units of Measure	Frequency	Sampling Method	Measurement Location
Airblast overpressure	dB(Lin Peak)	During every blast	AS2187.2-1993[1]	Not less than 3.5m from a building or structure *(or as otherwise agreed by EPA)*
Peak particle velocity	mm/s	During every blast	AS2187.2-1993	Not more than 30m from a building or structure *(or as otherwise agreed by EPA)*

Table 6: Airblast overpressure and peak particle velocity monitoring

[1] Standards Australia, 1993, AS2187.2-1993: Explosives - Storage, Transport and Use of Explosives

AIR QUALITY

Impact Assessment Criteria

22. The Applicant must ensure that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 7 at any residence on privately-owned land.

Pollutant	Averaging period	Criterion	
Particulate matter < 10 µm (PM_{10})	Annual	[a,d] 25 µg/m^3	
Particulate matter < 10 µm (PM_{10})	24 hour	[b] 50 µg/m^3	
Particulate matter < 2.5 µm (PM_{10})	Annual	[a,d] 8 µg/m^3	
Total suspended particulates (TSP)	Annual	[a,d] 90 µg/m^3	
[c] Deposited dust	Annual	[b] 2 g/m^2/month	[a,d] 4 g/m^2/month

Table 7: Air Quality Impact Assessment Criteria

[5] Incorporates EPA GTA

Notes:
a Cumulative impact (ie increase in concentrations due to the development plus background concentrations due to all other sources).
b Incremental impact (ie increase in concentrations due to the development alone, with zero allowable exceedances of the criteria over the life of the development.
c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.
d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Planning Secretary.

Air Quality Operating Conditions

23. The Applicant must:
    (a) take all reasonable steps to minimise dust, fume and greenhouse gas emissions of the development;
    (b) regularly assess meteorological and air quality monitoring data and relocate, modify or stop operations on the site to ensure compliance with the relevant conditions of this consent;
    (c) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see Note d to Table 7 above); and
    (d) minimise any visible off-site air pollution,
    to the satisfaction of the Planning Secretary.

Air Quality Management Plan

24. The Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
    (a) be submitted to the Planning Secretary for approval within 6 months of the determination of Modification 9, unless otherwise agree by the Planning Secretary;
    (b) describe the measures to be implemented to ensure:
        - compliance with the air quality criteria and operating conditions of this consent;
        - best practice management is being employed; and
        - the air quality impacts of the development are minimised during adverse meteorological conditions and extraordinary events;
    (c) describe the proposed air quality management system;
    (d) include an air quality monitoring program that:
        - is capable of evaluating the performance of the development and informing day to day management decisions;
        - includes a protocol for determining any exceedances of the relevant conditions of consent; and
        - effectively supports the air quality management system.

    The Applicant must implement the approved Air Quality Management Plan as approved by the Planning Secretary.

METEOROLOGICAL MONITORING

25. For the duration of the development, the Applicant must ensure that there is a suitable meteorological station operating in close proximity to the site that:
    (a) complies with the requirements in the *Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales* (DEC, 2007) (as may be updated or replaced from time to time); and
    (b) is capable of continuous real-time measurement of atmospheric stability category determined by the sigma theta method in accordance with the NSW Industrial Noise Policy (EPA, 2000), (as may be updated or replaced from time to time) unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.

26. Deleted

SURFACE AND GROUND WATER

Pollution of Waters

27. Except as may be expressly provided by an Environment Protection Licence, the Applicant must comply with section 120 of the *Protection of the Environment Operations Act 1997* during the carrying out of the development.

Water Supply

28A. The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of quarrying operations to match its available water supply.

Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.

Water Discharge Limit

28. The Applicant must comply with the discharge limits in any EPL, or with section 120 of the POEO Act.

Site Water Balance

29. In each Annual Review, the Applicant must:
(a) recalculate the site water balance for the development; and
(b) provide information on evaporative losses, dust suppression, dam storage levels and implications of obtaining any water supplies from off-site; and
(c) evaluate water take against licensing requirements.

Storm Water Management System

30. The Applicant must ensure that the storm water management system for the development is designed, constructed and operated to capture and treat polluted waters from storm event(s) of up to and including the 5-day, 95th percentile rainfall event.

31. The Applicant must ensure that the basins in the storm water management system are managed in accordance with the operating principles within the revised Water Management Plan prepared by Evans and Peck, dated April 2008, or any subsequent Water Management Plan approved by the Planning Secretary, to maintain the required storm water storage volume.

Offline Dam

32. By 18 May 2008, or as otherwise agreed to by the Planning Secretary, the Applicant must:
(a) modify the existing dam at the site to create increased capacity offline from Rocklow Creek;
(b) construct dams within the site of sufficient capacity to ensure that the water quality criteria in condition 29 can be met for all rainfall events up to and including the 5-day duration 95th percentile rainfall event;
(c) ensure the discharge and overflow points of the dams do not cause erosion at the point of discharge/overflow;
(d) rehabilitate and stabilise the banks of the dams; and
(e) ensure the integrity of the dams would not be compromised by flooding;
to the satisfaction of the EPA and the Planning Secretary.

33. Prior to carrying out any of these works, the Applicant must prepare a Dam Upgrade Plan in consultation with the EPA, and to the satisfaction of the Planning Secretary. This plan must include:
(a) the detailed design and specifications of the proposed works, which have been certified by a practicing registered engineer;
(b) an erosion and sediment control plan for the proposed works, that is consistent with the requirements in the Department of Housing's *Managing Urban Stormwater: Soils and Construction* manual;
(c) a vegetation and rehabilitation plan, setting out how the banks of the dams and other relevant pollution control features would be rehabilitated and stabilized;
(d) an acid sulfate soil management plan that is consistent with the *NSW Acid Sulfate Soil* manual;
(e) a construction program for the proposed works; and
(f) a program setting out how the modified dam and associated revegetation works would be maintained during the life of the development.

The Applicant must implement the approved management plan as approved from time to time by the Planning Secretary.

34. Within 1 month of completing the construction works in the Dam Upgrade Plan, the Applicant must submit an as-executed report, certified by a practicing registered engineer, to the satisfaction of the EPA and Planning Secretary.

Lower Dam Transition Plan

35A. Within 3 months of the determination of Modification 9, or as otherwise agreed by the Planning Secretary, the Applicant must prepare a Lower Dam Transition Plan in consultation with the EPA and to the satisfaction of the Planning Secretary. The plan must include a program to:

(a) undertake a broader assessment of the site's water management system and potential water pollution impacts; and
(b) investigate reasonable and feasible mitigation measures to improve water quality outcomes for the site, including altering the design of the Lower Dam or else transitioning away from its use, within two years.

The Applicant must not alter the Lower Dam until this plan is approved by the Planning Secretary. The Applicant must implement the approved plan as approved by the Planning Secretary.

Flocculant Management

35. The Applicant must not use flocculants on the site.

36. Deleted

Other Water Management Works

37. [6]Within 18 months of the date of this consent, the Applicant must carry out the following works:
(a) Workshop and Fuel Storage Area
- desilt drains and culverts upstream of the workshop to limit flooding;
- construct a first flush collection basin to capture and store the first 13mm of run-off from the external service bays before it is treated by the oil/water separator; and
- bund and roof the drum storage area;

(b) Magazine Area
- reinstate drain through access road to magazines to direct stormwater flows to the main drain;

(c) deleted

to the satisfaction of EPA and the Planning Secretary.

Bunding

38. [7]Impervious bunds must be constructed around all fuel, oil and chemical storage areas and the bund volume must be large enough to contain 110 per cent of the volume held in the largest container. The bund must be designed and installed in accordance with the requirements of the EPA Environment Protection Manual Technical Bulletin *Bunding and Spill Management*.

Monitoring

39. The Applicant must:
(a) measure:
- the volume of water discharged from the site via licenced discharge points;
- water use on the site;
- water transfers across the site;
- dam and water structure storage levels;

(b) monitor the quality of the surface water:
- discharged from the licence discharge point/s of the development;
- upstream and downstream of the development;

(c) monitor flows in Rocklow Creek; and
(d) monitor regional groundwater levels and quality;
to the satisfaction of the EPA and the Planning Secretary.

Note: On the provision of two years of monitoring data that shows negligible impact on the regional groundwater network, the Planning Secretary may agree to suspend monitoring of regional groundwater levels and/or quality.

Site Water Management Plan

40. Within 12 months of the date of this consent, the Applicant must prepare a Site Water Management Plan for the development, in consultation with the Water Group, and to the satisfaction of the Planning Secretary. This plan must include:
(a) the predicted site water balance;
(b) an Erosion and Sediment Control Plan;
(c) a Surface Water Monitoring Program
(d) a Ground Water Monitoring Program; and
(e) an Integrated Water Management Strategy.

The Applicant must implement the approved management plan as approved from time to time by the Planning Secretary.

[6] Incorporates EPA GTA
[7] Incorporates EPA GTA

41. The Erosion and Sediment Control Plan must:
    (a) be consistent with the requirements of the Department of Housing's *Managing Urban Stormwater: Soils and Construction* manual;
    (b) identify activities that could cause soil erosion and generate sediment;
    (c) describe measures to minimize soil erosion and the potential for the transport of sediment to downstream waters;
    (d) describe the location, function, and capacity of erosion and sediment control structures; and
    (e) describe what measures would be implemented to maintain the structures over time.
42. The Surface Water Monitoring Program must include:
    (a) detailed baseline data on surface water flows and quality in Rocklow Creek;
    (b) surface water impact assessment criteria;
    (c) a program to monitor surface water flows and quality in Rocklow Creek;
    (c1) a program to monitor and minimise surface water and groundwater ingress into the Lower Dam and water egress into Rocklow Creek;
    (d) a program to monitor bank and bed stability in Rocklow Creek; and
    (e) a program to monitor the effectiveness of the Erosion and Sediment Control Plan.

43. The Ground Water Monitoring Program must include:
    (a) detailed baseline data on ground water levels and quality, based on statistical analysis;
    (b) ground water impact assessment criteria;
    (c) a program to monitor regional ground water levels and quality; and
    (d) a program to monitor groundwater inflows.

    Note: On the provision of two years of monitoring data that shows negligible impact on the regional groundwater network, the Planning Secretary may agree to suspend monitoring of regional groundwater levels and/or quality.

44. [8]The Integrated Water Management Strategy must:
    (a) explore a range of options for a sustainable resource alternative for water supply to the site;
    (b) identification of all possible and available sources of water;
    (c) consistency with Government Water Reform initiatives and policies;
    (d) quality of water to meet usage requirements including any possible effects on product;
    (e) costs of supply;
    (f) health and environmental impacts;
    (g) legislative requirements;
    (h) assessment of the feasibility, benefits and costs of options;
    (i) a process to identify and evaluate preferred options for implementation; and
    (j) the identification of a timetable for implementation of the selected options.

FLORA AND FAUNA

Vegetation Offset Strategy

45. The Applicant must:
    a. establish, conserve, and maintain at least:
        - 4.6 hectares of *Melaleuca armillaris* Tall Shrubland; and
        - 8.2 hectares of Blue Gum-White Box Woodland/Forest,

        on Boral-owned land adjacent to the development;
    b. conserve, maintain, and enhance the vegetation in the area to the south of the development marked on the map in Appendix 3 as Remnant Vegetation Conservation Area;
    c. conserve, maintain, enhance and establish the vegetation in the area to the south of the development marked on the map in Appendix 3 as Offset Area, in accordance with the letter from Boral to the Department dated 22 September 2008 titled *Dunmore Quarry – Revised Offset for Quarry Extension*;
    d. within 12 months of the date of Modification 8, the Applicant must provide a biodiversity offset strategy outlining the measures to offset 48 Illawarra Zieria individuals and 1.94 ha of native vegetation clearing (including 0.05 ha of Illawarra Subtropical Rainforest EEC), to the satisfaction of BCS and the Planning Secretary. The offset must demonstrate that the biodiversity values in the general vicinity of the site have been maintained or improved; and
    e. within 12 months of the date of approval of Modification 9, the Applicant must provide a biodiversity offset strategy outlining measures to offset 162 Illawarra Zieria individuals by no less than 2,268 Illawarra Zieria credits, to the satisfaction of BCS and the Planning Secretary. The offset must demonstrate that the biodiversity values in the general vicinity of the site have been maintained or improved.

    Note: The Compensatory Habit Area established to address paragraph (a) is marked on the map in Appendix 3.

[8] Incorporates EPA GTA

45A. Within 12 months of the date of Modification Application 470-11-2003 Mod 4, the Applicant must make suitable arrangements in consultation with the BCS to provide appropriate long term security for the biodiversity offset referred to in condition 45(c), to the satisfaction of the Planning Secretary.

45B. Within 12 months of the date of providing the biodiversity offset strategy required under condition 45(d), the Applicant must make suitable arrangements to provide long term security for this strategy, to the satisfaction of the Planning Secretary.

45C. Within 12 months of the date of providing the biodiversity offset strategy required under condition 45(e), the Applicant must make suitable arrangements to provide long term security for this strategy, to the satisfaction of the Planning Secretary.

Note: Mechanisms to provide appropriate long term security to the land within a biodiversity offset strategy in accordance with the NSW Biodiversity Offset Policy for Major Projects 2014, include a BioBanking Agreement, Voluntary Conservation Agreement or an alternative mechanism that provides for a similar conservation outcome.

Biodiversity Credits Required

45D. Prior to undertaking activities that would impact on biodiversity values within the RIC Pit extension area (Modification 13), the Applicant must retire the biodiversity credits specified in Table 8 and Table 9 in accordance with the Biodiversity Offsets Scheme of the *Biodiversity Conservation Act 2016*, including the application of any ancillary rules published under clause 6.5 of the *Biodiversity Conservation Regulation 2017*.

Table 8: *Biodiversity credit requirements – ecosystem credits*

Credit Type	*Area (ha)*	*Credits Required*
720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion	8.63	111
1300-Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	0.05	1

Table 9: *Biodiversity credit requirements – species credits*

Credit Type	*Credits Required*
Gang-gang Cockatoo	1
White-flowered Wax Plant	1
Little Eagle	68
Square-tailed Kite	68
Illawarra Irene	8
Barking Owl	1
Powerful Owl	1
Masked Owl	1
Illawarra Zieria	2,762
Total	**2,911**

45E. The Applicant must provide the Planning Secretary with evidence that confirms that the correct number and class of credits has been retired prior to impacting the biodiversity values within the RIC Pit extension area.

Biodiversity Stewardship Agreement

45F. Within two years of the commencement of quarrying operations within the RIC Pit extension area (Modification 13), the Applicant must establish a biodiversity stewardship agreement, which:

(a) includes a minimum area of 130 ha, including at least 41 ha of PCT 720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion as identified in Appendix 3; and

(b) incorporates the existing Offset Area (as required by condition 45c. and existing Compensatory Habitat Area (as required by condition 45a.),

in consultation with BCS, to the satisfaction of the Planning Secretary, unless otherwise agreed.

45G. Within three months of the biodiversity stewardship agreement being established in accordance with condition 45F, the Applicant must retire:
(a) all the credits generated by the biodiversity stewardship agreement required by condition 45D;
(b) an additional 111 credits of PCT 720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion; and
(c) commence management actions and pay the Total Fund Deposit in full,
to the satisfaction of the Planning Secretary, unless otherwise agreed.

Notes:
- *These credit requirements are set out in Table 8 and Table 9 and must be retired additionally to those required in Condition 45D.*
- *Conditions 45D, 45G(a) and 45(b) result in a total of 333 credits of PCT 720-Bracelet Honey-myrtle - Australian Indigo dry shrubland on volcanics, southern Sydney Basin Bioregion being retired.*

Flora and Fauna Management Plan

46. Within 12 months of the date of this consent, the Applicant must prepare a Flora and Fauna Management Plan for the development to the satisfaction of the Planning Secretary. This plan must include:
a. a Vegetation Clearing Protocol;
b. a Compensatory Habitat Management Plan;
c. a Remnant Vegetation Conservation Plan; and
d. a Biodiversity Offset Management Plan.

The Applicant must implement the approved management plan as approved from time to time by the Planning Secretary.

47. The Vegetation Clearing Protocol must:
a. delineate the areas of remnant vegetation to be cleared; and
b. describe the procedures that would be implemented for:
- pre-clearance surveys;
- progressive clearing;
- fauna management;
- conserving and reusing topsoil;
- collecting seed from the site;
- salvaging and reusing material from the site; and
- controlling weeds.

48. The Compensatory Habit Management Plan must:
a. describe the compensatory habitat proposal to satisfy condition 45a.;
b. justify why this area(s) is suitable for the compensatory habitat proposal;
c. establish baseline data for the existing habitat in the proposed compensatory habitat area(s);
d. describe how the compensatory habitat proposal would be implemented;
e. set completion criteria for the compensatory habitat proposal; and
f. describe how the performance of the compensatory habitat management proposal would be monitored over time.

49. The Remnant Vegetation Conservation Plan must:
a. describe what measures would be implemented to satisfy condition 45b.;
b. establish baseline data for the existing vegetation in the area;
c. set completion criteria for the Remnant Vegetation Conservation Area; and
d. describe how the performance of the Remnant Vegetation Conservation Area would be monitored over time.

50A. The Biodiversity Offset Management Plan must:
(a) describe what measures would be implemented to satisfy condition 45c.;
(b) describe the biodiversity offset strategies in conditions 45d.-e.;
(c) include a timetable for providing long term security of the offset areas;
(d) set performance and completion criteria for the offset areas; and
(e) include a program to monitor and report on the effectiveness of the implementation measures, and progress against the performance and completion criteria.

50B. Prior to undertaking activities that would impact on biodiversity values within the RIC Pit extension area (Modification 13), the Applicant must prepare and implement a Vegetation Translocation Plan, in consultation with the Commonwealth DCCEEW and BCS.

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Reporting

50. The Applicant must include a progress report on the implementation of the Flora and Fauna Management Plan in the Annual Review.

Independent Audit

51. Within 3 years of the date of this consent, and every 5 years thereafter unless the Planning Secretary directs otherwise, the Applicant must commission, and pay the full cost of an Independent Audit of the Flora and Fauna Management Plan. This audit must:
    a. be conducted by a suitably qualified, experienced, and independent person whose appointment has been endorsed by the Planning Secretary;
    b. assess the performance of the Flora and Fauna Management Plan;
    c. review the adequacy of the Flora and Fauna Management Plan; and, if necessary,
    d. recommend actions or measures to improve the performance and/ or adequacy of the Flora and Fauna Management Plan.

REHABILITATION

Rehabilitation Objectives

52. The Applicant must rehabilitate the site to the satisfaction of the Planning Secretary. Rehabilitation of the site must comply with the objectives in Table 10.

Table 10: *Rehabilitation objectives*

Feature	Objective
All areas of the site affected by the development	• Safe and non-polluting • Hydraulically and geotechnically stable • Fit for the intended post-quarrying land use(s) • Establish the final landform and post-quarrying land use/s as soon as practicable after cessation of quarrying operations • Minimise post-quarrying environmental impacts • Integrated with surrounding natural landforms and other quarry rehabilitated landforms, to the greatest extent practicable • Minimise visual impacts when viewed from surrounding land to the greatest extent practicable • Ensure safety of native fauna and stock
Infrastructure	• All infrastructure that is not to be used as part of the final land use is removed. • All infrastructure that is to remain as part of the final land use is compatible with the intended post-quarrying land use/s, is safe and does not pose any hazard to the community.
Water	• Water retained on the site is appropriately licensed and fit for the intended post-quarrying land use/s • Groundwater quality is consistent with, or better than the pre-disturbance water quality
Final void	• Optimise the size and depth of the final void to ensure the final landform is stable and non-polluting • Minimise to the greatest extent practicable: - the drainage catchment and groundwater inflows; - any high wall instability risk; and - the risk of flood interaction. • Maximise potential for beneficial reuse, where practicable
Community	• Ensure public safety • Ensure the risk of bushfire is similar to or less than the pre-quarrying environment • Minimise adverse socioeconomic effects associated with quarry closure

53. The rehabilitation objectives in Table 10 apply to the entire site, including all landforms constructed under either this consent or previous consents. However, the Applicant is not required to undertake any additional earthmoving works on landforms that have been approved and constructed under previous consents, except where those earthworks are required for the establishment of a stable, non-polluting, and free-draining landform.

Progressive Rehabilitation

54. The Applicant must rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. All reasonable steps must be taken to minimise the total area exposed at any time. Interim stabilisation and temporary vegetation strategies must be employed when areas prone to dust generation, soil erosion and weed incursion cannot be permanently rehabilitated.

Note: This condition does not prevent further disturbance at some later stage of the development of areas that have been rehabilitated.

Rehabilitation Strategy

55. The Applicant must prepare a Rehabilitation Strategy for all land disturbed by the development. The strategy must:

(a) be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;

(b) be prepared in consultation with the Water Group, BCS, Council, and the CCC;

(c) use a risk-based approach;

(d) build upon the Rehabilitation Objectives in Table 10, describe the overall rehabilitation outcomes for the site and address all aspects of rehabilitation including quarry closure, final landform and final voids, post-quarrying land use/s and water management;

(e) align with strategic rehabilitation and quarry closure objectives and address the principles of the *Strategic Framework for Mine Closure* (AMZMEC and MCA, 2000);

(f) describe how rehabilitation will be integrated with the quarry planning process, including a plan to address premature or temporary quarry closure;

(g) include indicative quarry plans and scheduling for life-of-quarry showing each rehabilitation domain;

(h) include details of target vegetation communities and species to be established within proposed revegetation and tree screening areas;

(i) include a strategic plan for the refinement and improvement of the final landform and final void outcomes over time;

(j) include a post-quarry land use strategy to investigate and facilitate post-quarrying beneficial land uses for the site, that:

(i) align with regional and local strategic land use planning objectives and outcomes; and

(ii) support a sustainable future for the local community;

(k) include a stakeholder engagement plan to guide rehabilitation and quarry closure planning processes and outcomes;

(l) investigate ways to minimise adverse socio-economic effects associated with rehabilitation and quarry closure; and

(m) include a program to review and update the strategy every five years.

56. Within six months of the commencement of quarrying operations within the RIC Pit extension area (Modification 13), the Applicant must submit the Rehabilitation Strategy to the Planning Secretary for approval.

57. The Applicant must implement the Rehabilitation Strategy approved by the Planning Secretary.

Detailed feasibility study and final landform design

58. Within five years of the commencement of quarrying operations within the RIC Pit extension area (Modification 13), the Applicant must prepare a detailed final landform feasibility assessment. The detailed feasibility assessment must:

(a) be prepared by a suitably qualified and independent expert/s in relation to geotechnical, hydrological, and rehabilitation, whose appointment has been endorsed by the Planning Secretary;

(b) include a conceptual final landform study that includes but is not limited to:

(i) an assessment of alternative means of discharging water (including the option of nil release of water) from the rehabilitated quarry, including conceptual designs and cost estimates;

(ii) an investigation and conceptual design of potential post-quarrying land use options, including opportunities to align with relevant local and regional strategic land use objectives and surrounding land uses; and

(iii) an assessment of how the rehabilitation of the project can be proactively integrated with the rehabilitation strategies of neighbouring quarries; and

(iv) establishing in perpetuity vehicle access to the final landform that facilitates the proposed final land use.

59. Within five years of the commencement of quarrying operations within the RIC Pit extension area (Modification 13), the Applicant must submit the detailed final landform feasibility assessment to the Planning Secretary for approval.

60. The Applicant must revise the Rehabilitation Strategy to incorporate the outcomes of the detailed final landform feasibility assessment as approved by the Planning Secretary.

Rehabilitation Management Plan

61. The Applicant must prepare a Rehabilitation Management Plan for the development. The plan must:

(c) be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;

(d) be prepared in consultation with the Department and Council;

(e) include detailed quarry plans and scheduling for progressive rehabilitation to be initiated, undertaken and/or completed over the next five years, or other suitable time period as agreed with the Planning Secretary;

(f) include a plan of water management infrastructure that is required to enable the function of the final landform after rehabilitation is complete;

(g) include detailed completion criteria for each rehabilitation objective included in Table 10, and any other rehabilitation objective identified in the rehabilitation strategy;

(h) describe the measures to be implemented on the site to achieve the completion criteria;

(i) describe in detail the performance indicators to be implemented to ensure compliance with each completion criteria and the rehabilitation objectives in Table 10;

(j) include a program to monitor, independently audit and report on progress against the completion criteria and the effectiveness of the measures implemented to achieve the completion criteria;

(k) describe an adaptive management process that will be implemented if monitoring indicates that the measures implemented to achieve the completion criteria are not effective and/or if progress against the completion criteria is not consistent with the Rehabilitation Management Plan or Rehabilitation Strategy;

(l) describe any further studies, work, research, or consultation that will be undertaken to expand the site-specific rehabilitation knowledge base, reduce uncertainty and improve rehabilitation outcomes; and

(m) include a program to review and update the plan every five years including any revisions to the rehabilitation of the site identified by updates to the Rehabilitation Strategy.

62. Within six months of the commencement of quarrying operations within the RIC Pit extension area (Modification 13), the Applicant must submit the Rehabilitation Management Plan to the Planning Secretary for approval.

63. The Applicant must implement the Rehabilitation Management Plan as approved by the Planning Secretary.

Rehabilitation and Conservation Bond

64. Within 6 months of the date of this consent, the Applicant must lodge a Rehabilitation and Conservation Bond with the Department to ensure that the conservation commitments and rehabilitation of the site are implemented in accordance with the performance and completion criteria set out in the relevant plans and the relevant conditions of this consent. The sum of the bond must be an amount agreed by the Planning Secretary and determined by:

a. calculating the full cost of implementing the compensatory habitat area (see condition 49) and the offset areas (see condition 50A);

b. calculating the cost of rehabilitating all disturbed areas of the site, taking into account the likely surface disturbance over the next 3 years of quarrying operations; and

c. employing a suitably qualified quantity surveyor or other expert to verify the calculated costs.

Notes:

- *Alternative funding arrangements for long term management of the offset areas, such as provision of capital and management funding as agreed by BCS as part of a BioBanking Agreement, or transfer to conservation reserve estate can be used to reduce the liability of the bond.*
- *If capital and other expenditure required by the Flora and Fauna Management Plan or the Rehabilitation Management Plan is largely complete, the Planning Secretary may waive the requirement for lodgement of a bond in respect of the remaining expenditure.*
- *If the conservation commitments/or rehabilitation of the site area are completed (or partially completed) to the satisfaction of the Planning Secretary then the Planning Secretary will release the bond (or relevant part of the bond). If the Biodiversity Offset Strategy and rehabilitation of the site are not completed to the satisfaction of the Planning Secretary, then the Planning Secretary will call in all or part of the bond, and arrange for the completion of the relevant works.*

65. The Rehabilitation and Conservation Bond must be reviewed and if required, an updated bond must be lodged with the Department within 3 months following an update or revision to the Flora and Fauna Management Plan or the Rehabilitation Management Plan, or following the completion of an Independent Environmental Audit. This review must consider the:
    (a) effects of inflation;
    (b) likely cost of implementing the compensatory habitat area and offset areas and rehabilitating all disturbed areas of the site (taking into account the likely surface disturbance over the next 3 years of the development); and
    (c) performance of the implementation of the compensatory habitat area and offset areas and rehabilitation of the site to date.

66. Deleted

Reporting

67. The Applicant must include a progress report on the Rehabilitation Management Plan in the Annual Review.

TRAFFIC AND TRANSPORT

North Kiama Bypass

68. The Applicant must facilitate access to the North Kiama Bypass along Tabbita Road in accordance with the terms set out in the Deed of Agreement between the Applicant and Dunmore Sand and Soil Pty Ltd, dated 29 July 2004.

Transport Management Plan

69. The Applicant must prepare a Transport Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
    (a) be prepared by a suitably qualified traffic consultant, in consultation with TfNSW and Council, and submitted to the Planning Secretary for approval by 31 May 2014;
    (b) include a Drivers' Code of Conduct that includes procedures to ensure that drivers:
        (i) adhere to posted speed limits or other required travelling speeds;
        (ii) minimise trucking into Albion Park Rail during the morning peak hour period;
        (iii) avoid grouping or convoying, in particular at intersections; and
        (iv) implement safe and quiet driving practices;
    (c) describe the measures that would be implemented to ensure:
        - all drivers of development-related vehicles comply with the Drivers' Code of Conduct; and
        - compliance with the relevant conditions of this consent; and
    (d) include a program to monitor the effectiveness of the implementation of these measures.

    The Applicant must implement the approved management plan as approved from time to time by the Planning Secretary.

Cumulative Traffic Impact Study

70A. The Applicant must, in conjunction with the operators of the Bass Point Quarry and the Albion Park Quarry, cause to be prepared an independent Cumulative Traffic Impact Study. The study must:
    (a) be undertaken by a suitably qualified traffic consultant, whose appointment has been approved by the Planning Secretary;
    (b) be commissioned by 30 June 2014, and completed by 31 October 2014, or as otherwise agreed in writing by the Planning Secretary;
    (c) be co-funded by the operators of the Dunmore, Bass Point and Albion Park quarries, proportionate to the quarries' respective quarry product road transport limits, as approved at 30 June 2014;
    (d) include a comprehensive assessment of current and future projected cumulative traffic impacts of the three quarries on the classified road network, undertaken in consultation with the TfNSW; and

(e) identify any reasonable and feasible measures that can be implemented to minimise the traffic and road safety impacts of quarry trucks on Mount Ousley Road, and the likely cost of implementing these measures.

70B. The Applicant must, in conjunction with the operators of the Bass Point Quarry and the Albion Park Quarry, prepare and implement a program to implement any reasonable and feasible measures identified in the Cumulative Traffic Impact Study not already undertaken by the Applicant, in an equitable manner with the two other quarry operators, to the satisfaction of the Planning Secretary. The program must be submitted to the Planning Secretary for approval by 28 February 2015, or as otherwise agreed in writing by the Planning Secretary.

Transport Options Review

70C. Within three years of the determination of Modification 11, and every five years thereafter (if directed to do so by the Planning Secretary), the Applicant must commission and pay the full costs of a Transport Options Review for the development. This review must:

a) be conducted by a suitably qualified, experienced and independent expert/s whose appointment has been endorsed by the Planning Secretary;
b) be prepared in consultation with TfNSW and Council;
c) review the economic, social and environmental costs and benefits of all reasonable and feasible options for the transport of quarry products from the site (including by rail and road);
d) review and report on available rail terminal capacity;
e) recommend any appropriate measures or actions to:
    i. reduce the economic, social and environmental costs associated with transport of quarry products by road from the site; and
    ii. maximise the use of rail deliveries from the site; and
f) be conducted and reported to the satisfaction of the Planning Secretary.

Within three months of commencing this review, or within another timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the review report to the Planning Secretary and any other NSW agency that requests it, together with its response to any recommendations contained in the review report.

Parking

70. The Applicant must provide sufficient parking on-site for all quarry-related traffic to the satisfaction of the Planning Secretary.

Road Haulage

71. The Applicant must ensure that all loaded vehicles entering or leaving the site are covered.

72. The Applicant must ensure all loaded vehicles leaving the site are cleaned of materials that may fall on the road before they are allowed to leave the site.

ABORIGINAL HERITAGE

Aboriginal Cultural Heritage Management Plan

73. The Applicant must prepare an Aboriginal Cultural Heritage Management Plan for the development to the satisfaction of the Planning Secretary. The plan must:

(a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary;
(b) be prepared in consultation with BCS and the Registered Aboriginal Parties;
(c) be submitted to the Planning Secretary for approval prior to commencing quarrying operations in the Croome West Pit, unless the Planning Secretary agrees otherwise; and
(d) include a description of the measures that would be implemented to:
- protect, monitor and manage known sites or potential areas of archaeological significance (including any proposed archaeological investigations or salvage measures);
- manage unanticipated finds including new Aboriginal objects and Aboriginal skeletal remains that are discovered during the development;
- store and display salvaged Aboriginal heritage items; and
- ensure ongoing consultation and involvement of the Registered Aboriginal Parties in the conservation and management of Aboriginal cultural heritage on the site.

The Applicant must implement the approved Aboriginal Heritage Management Plan as approved by the Planning Secretary.

HISTORIC HERITAGE

74. If unexpected archaeological deposits or relics not identified and considered in the supporting documents for this approval are discovered, work must cease in the affected area(s) and the Heritage Council of NSW must be notified in accordance with Section 146 of the *Heritage Act 1977*. Additional assessment and approval may be required prior to works continuing in the affected area(s) based on the nature of the discovery.

VISUAL IMPACT

Visual Amenity

75. The Applicant must minimise the visual impacts of the development to the satisfaction of the Planning Secretary.

76. Prior to carrying out any development that would be visible from the areas to the south west of the quarry, the Applicant must construct, and subsequently maintain, the proposed visual/ noise bund between the Croome Farm extraction area and the Jamberoo Valley to the satisfaction of the Planning Secretary.

77A. The Applicant must:
(a) construct the blending plant in the location shown on the figure in Appendix 4; and
(b) ensure the maximum height of the blending plant is no greater than 15.2 m.

Lighting Emissions

77. The Applicant must take all practicable measures to prevent and/or minimise any off-site lighting impacts from the development.

78. All external lighting associated with the development must comply with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*.

WASTE MANAGEMENT

Waste Minimisation

79. The Applicant must minimise the amount of waste generated by the development to the satisfaction of the Planning Secretary.

Waste Classification

80. [9]All liquid and non liquid wastes resulting from activities and processes at the site must be assessed, classified and managed in accordance with the EPA's Environmental Guidelines*: Assessment, Classification and Management of Liquid and Non-liquid Wastes (1999),* or any other EPA document superceding this guideline.

Reporting

81. The Applicant must describe what measures have been implemented to minimise the amount of waste generated by the development in the Annual Review.

EMERGENCY AND HAZARDS MANAGEMENT

Dangerous Goods

82. The Applicant must ensure that the storage, handling, and transport of dangerous goods is done in accordance with the relevant Australian Standards, particularly AS1940 and AS1596, and the Dangerous Goods Code.

Safety

83. The Applicant must secure the development to ensure public safety to the satisfaction of the **Planning Secretary**.

[9] Incorporates EPA GTA

Emergency Management

84. [10]Within 6 months of the date of this consent, the Applicant must document, and subsequently implement measures to minimise the environmental impacts of any emergency situations that could arise as a result of the operation of the Dunmore Quarry to the satisfaction of the EPA. This documentation must:
    (a) identify any significant threats to the environment and/ or public health that could arise from activities associated with the operation of the quarry or construction works associated with the production increase. These threats may include excessive rainfall, problems during construction and operation, pump failures, excess flocculation, power or other utility failure, natural disaster, landslip, accidental spills and discharges, train derailment, spillage from trucks, fire etc;
    (b) identify any subsequent direct or indirect environmental effects as a result of the threats;
    (c) identify the pollution that would result due to these threats and impacts on operations and what impact the pollution would have on the health of the community and the environment;
    (d) develop actions to effectively respond to the disruption of operations so the risk of pollution is minimised;
    (e) develop a communications strategy for alerting relevant agencies and the potentially affected community in the event of the disruption to operations leading to significant pollution;
    (f) ensure that all relevant employees are familiar with the documentation; and
    (g) when developing this documentation identify any opportunities to integrate with Boral Emergency plans.

BUSHFIRE MANAGEMENT

85. The Applicant must:
    (a) ensure that the development is suitably equipped to respond to any fires on-site; and
    (b) assist the Rural Fire Service and Emergency Services as much as possible if there is a fire on-site.

86. Within 6 months of the date of this consent, the Applicant must prepare a Bushfire Emergency Management and Evacuation Plan for the development, to the satisfaction of Council and the Rural Fire Service.

PRODUCTION DATA

87. The Applicant must:
    a. provide annual production data to the MEG using the standard form for that purpose; and
    b. include a copy of this data in the Annual Review.

[10] Incorporates EPA GTA

SCHEDULE 4A
ADDITIONAL PROCEDURES

NOTIFICATION OF EXCEEDANCES

1. As soon as practicable and no longer than 7 days after obtaining monitoring results showing an exceedance of any noise or air quality criterion in Schedule 4 of this consent, the Applicant must provide the details of the exceedance to any affected landowners and/or tenants.

2. For any exceedance of the air quality criteria in Schedule 4 of this consent, the Applicant must also provide to any affected landowners and/or tenants a copy of the fact sheet entitled "Mine Dust and You" (NSW Health, 2017).

INDEPENDENT REVIEW

3. If a landowner considers the development to be exceeding any relevant noise or air quality criterion in Schedule 4 of this consent, they may ask the Planning Secretary in writing for an independent review of the impacts of the development on their residence or land.

4. If the Planning Secretary is not satisfied that an independent review is warranted, the Planning Secretary will notify the landowner in writing of that decision, and the reasons for that decision, within 21 days of the request for a review.

5. If the Planning Secretary is satisfied that an independent review is warranted, within 3 months, or other timeframe agreed by the Planning Secretary and the landowner, of the Planning Secretary's decision, the Applicant must:
   (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Planning Secretary, to:
      (i) consult with the landowner to determine their concerns;
      (ii) conduct monitoring to determine whether the development is complying with the relevant criterion in Schedule 4 of this consent; and
      (iii) if the development is not complying with the relevant criterion, identify measures that could be implemented to ensure compliance with the relevant criterion;
   (b) provide the Planning Secretary and landowner a copy of the independent review; and
   (c) comply with any written requests made by the Planning Secretary to implement any findings of the review.

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT, MONITORING, AUDITING AND REPORTING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

1. If the Planning Secretary requires, the Applicant must prepare an Environmental Management Strategy for the development to the satisfaction of the Planning Secretary. This strategy must:
   (a) be submitted to the Planning Secretary for approval within 6 months of the Planning Secretary requiring preparation of the strategy by notice to the Applicant;
   (b) provide the strategic framework for the environmental management of the development;
   (c) identify the statutory approvals that apply to the development;
   (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the development;
   (e) describe the procedures that would be implemented to:
      - keep the local community and relevant agencies informed about the operation and environmental performance of the development;
      - receive, handle, respond to, and record complaints;
      - resolve any disputes that may arise during the course of the development;
      - respond to any non-compliance; and
      - respond to emergencies; and
   (f) include:
      - copies of any strategies, plans and programs approved under the conditions of this consent; and
      - a clear plan depicting all the monitoring required to be carried out under the conditions of this consent.

   The Applicant must implement any Environmental Management Strategy as approved from time to time by the Planning Secretary.

Evidence of Consultation

1A. Where consultation with any State or local agency is required by the conditions of this consent, the Applicant must:
   (a) consult with the relevant agency prior to submitting the required document;
   (b) submit evidence of this consultation as part of the relevant document;
   (c) describe how matters raised by the agency have been addressed and any matters not resolved; and
   (d) include details of any outstanding issues raised by the agency and an explanation of disagreement between any agency and the Applicant.

Management Plan Requirements

2. 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;
   (b) a description of:
      - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
      - any relevant limits or performance measures/criteria; and
      - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;
   (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
   (d) a program to monitor and report on the:
      - impacts and environmental performance of the development; and
      - effectiveness of any management measures (see (c) above);
   (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;
   (f) a program to investigate and implement ways to improve the environmental performance of the development over time;
   (g) a protocol for managing and reporting any:
      - incidents;
      - complaints;
      - non-compliances with statutory requirements; and
      - exceedances of the impact assessment criteria and/or performance criteria;
   (h) a protocol for periodic review of the plan; and

(i) a document control table that includes version numbers, dates when the management plan was prepared and reviewed, names and positions of people who prepared and reviewed the management plan, a description of any revisions made and the date of the Planning Secretary's approval.

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

Application of Existing Strategies, Plans or Programs

3A. The Applicant must continue to apply existing approved strategies, management plans, or monitoring programs that have most recently been approved under this consent, until the approval of a similar strategy, plan or program under this consent.

Updating & Staging Submission of Strategies, Plans or Programs

3. To ensure the strategies, plans or programs under this consent are updated on a regular basis, and that they incorporate any appropriate mitigation measures to improve the environmental performance of the development, the Applicant may at any time submit revised strategies, plans or programs to the Planning Secretary for approval. With the agreement of the Planning Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis.

With the agreement of the Planning Secretary, the Applicant may revise any strategy, plan or program approved under this consent without consulting with all the parties nominated under the applicable conditions of consent.

Notes:

- *While any strategy, plan or program may be submitted on a staged basis, the Applicant will need to ensure that the existing operations associated with the development are covered by suitable strategies, plans or programs at all times.*
- *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage/s of the development to which the strategy, plan or program applies; the relationship of this stage/s to any future stages; and the trigger for updating the strategy, plan or program.*

Revision of Strategies, Plans & Programs

4. Within 3 months of the submission of an:
   (a) incident report under condition 7 below;
   (b) Annual Review under condition 9 below;
   (c) audit report under condition 10 below; and
   (d) any modifications to this consent,

   the Applicant must review, and if necessary revise, the strategies, plans, and programs required under this consent, to the satisfaction of the Planning Secretary.

Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.

Adaptive Management

5. The Applicant must assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures in Schedule 4. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation.

Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity:
(a) take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur;
(b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
(c) implement remediation measures as directed by the Planning Secretary,

to the satisfaction of the Planning Secretary.

COMMUNITY CONSULTATIVE COMMITTEE

6. The Applicant must operate a Community Consultative Committee (CCC) for the development, to the satisfaction of the Planning Secretary. This CCC must be operated in general accordance with the Department's *Community Consultative Committee Guidelines: State Significant Projects* (2016) (as may be updated or replaced from time to time).

Notes:

- *The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Applicant complies with this consent.*
- *In accordance with the guideline, the committee should be comprised of an independent chair and appropriate representation from the Applicant, Council, and the local community.*
- *The requirement for this CCC may be fulfilled by a regional CCC for any two or more of Boral's quarrying operations in the South Coast area.*

REPORTING AND AUDITING

Incident Reporting

7. The Applicant must immediately notify the Department and any other relevant agencies after it becomes aware of an incident. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name) and set out the location and nature of the incident.

Non-Compliance Notification

7A Within seven days of becoming aware of a non-compliance, the Applicant must notify the Department of the non-compliance. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name), set out the condition of this consent that the development is non-compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

***Note**: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.*

Regular Reporting

8. The Applicant must provide regular reporting on the environmental performance of the development on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this consent.

Annual Review

9. By the end of September each year, or other timing as may be agreed by the Planning Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Planning Secretary. This review must:
   (a) describe the development (including rehabilitation) that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year;
   (b) include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against the:
      - relevant statutory requirements, limits or performance measures/criteria;
      - requirements of any plan or program required under this consent;
      - monitoring results of previous years; and
      - relevant predictions in the documents listed in condition 2 of Schedule 3;
   (c) identify any non-compliance over the last financial year, and describe what actions were (or are being) taken to ensure compliance;
   (d) identify any trends in the monitoring data over the life of the development;
   (e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
   (f) describe what measures will be implemented over the current financial year to improve the environmental performance of the development.

   The Applicant must ensure that copies of the Annual Review are submitted to Council and are available to the Community Consultative Committee (see condition 6 of Schedule 5) and any interested person upon request.

INDEPENDENT ENVIRONMENTAL AUDIT

10. Prior to 1 April 2017, and every three years thereafter, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. This audit must:
   (a) be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Planning Secretary;
   (b) include consultation with the relevant agencies and the CCC;
   (c) assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent and any relevant EPL and/or Water Licences (including any assessment, plan or program required under these approvals);

(d) review the adequacy of any approved strategies, plans or programs required under the abovementioned approvals;
(e) recommend appropriate measures or actions to improve the environmental performance of the development, and/or any assessment, plan or program required under the abovementioned approvals; and
(f) be conducted and reported to the satisfaction of the Planning Secretary.

Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Planning Secretary.

11. Within 12 weeks of commencing this audit, or as otherwise agreed by the Planning Secretary, the Applicant must submit a copy of the audit report to the Planning Secretary and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report.

ACCESS TO INFORMATION

12. By 31 December 2016, unless otherwise agreed by the Planning Secretary, the Applicant must:
(a) make the following information publicly available on its website:
- the documents listed in condition 2 of Schedule 3;
- current statutory approvals for the development;
- approved strategies, plans or programs required under the conditions of this consent;
- a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;
- a complaints register, updated quarterly;
- the Annual Reviews (over the last 5 years);
- any independent environmental audit, and the Applicant's response to the recommendations in any audit;
- any other matter required by the Planning Secretary; and

(b) keep this information up-to-date,
to the satisfaction of the Planning Secretary.

APPENDIX 1
SCHEDULE OF LAND

Land to which the Development Application refers:

Local Government Area:

Shellharbour

Suburb, town or locality:

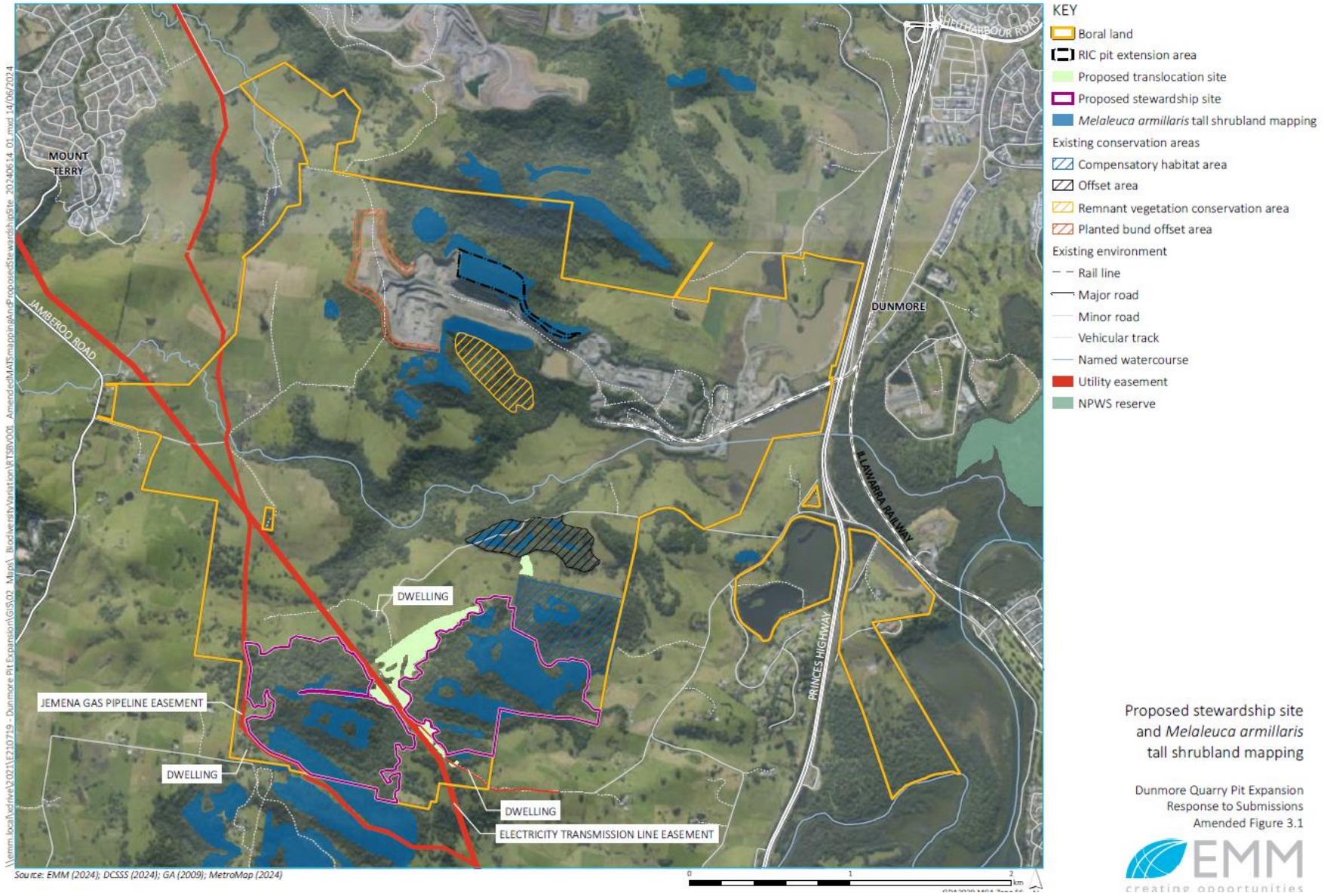
Dunmore

Land:

Lot No.	DP No.
Lot 1	DP 213575
Lot 3	DP 1030504
Lot 4	DP 1030504
Lot 4	DP 227046
Lot 1	DP 1002951
Lot 1	DP 224597
Lot 2	DP 224597
Lot 4	DP 571406
Lot 6	DP 1001931

APPENDIX 2
SENSITIVE RECEIVERS

APPENDIX 3
CONSERVATION AREAS



Proposed stewardship site and *Melaleuca armillaris* tall shrubland mapping

Dunmore Quarry Pit Expansion
Response to Submissions
Amended Figure 3.1

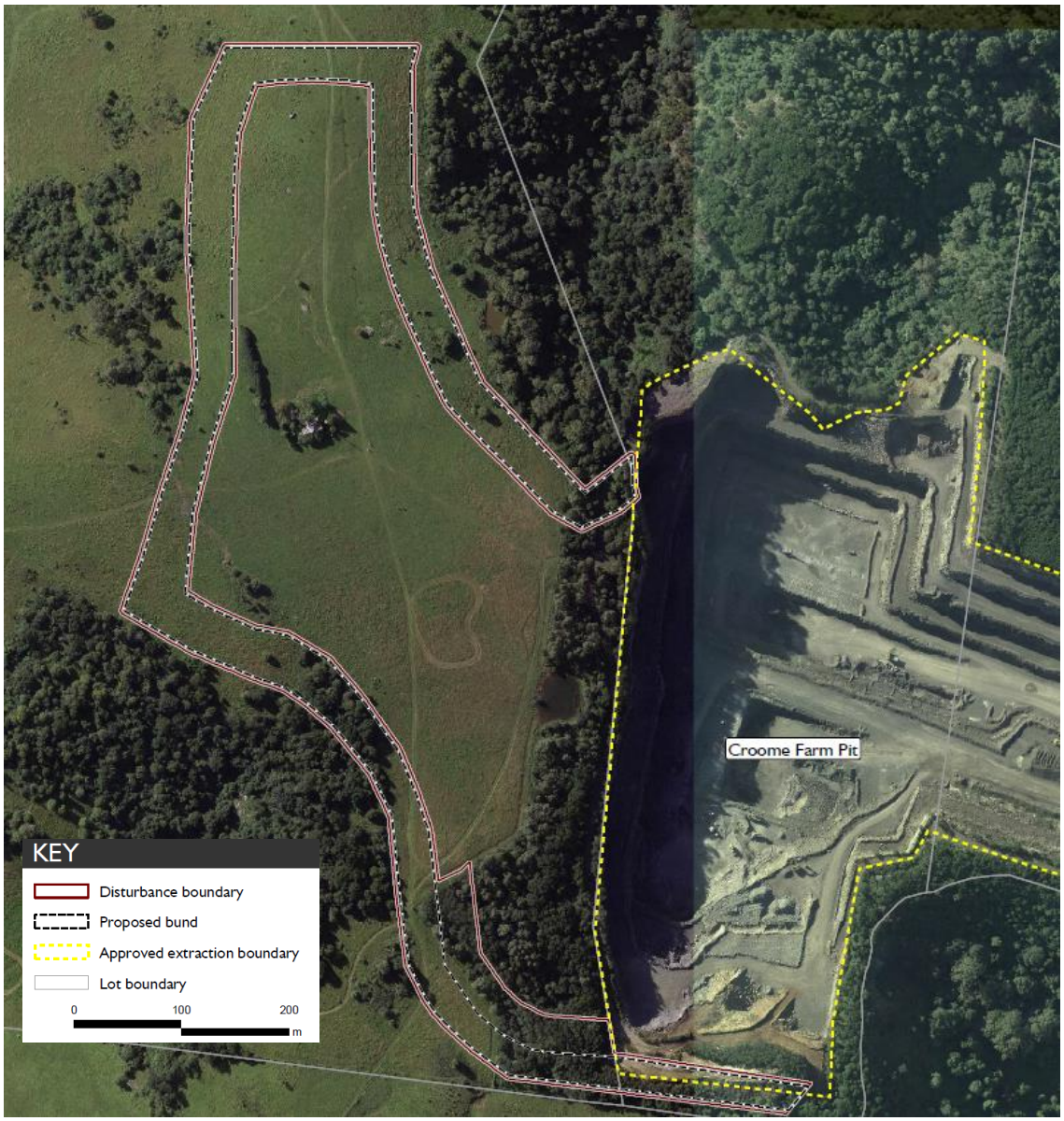
EMM
creating opportunities

APPENDIX 4
LOCATION OF BLENDING PLANT

FIGURE 3
Blending plant location

DUNMORE HARD ROCK QUARRY - PROPOSED BLENDING PLANT

APPENDIX 5
LOCATION OF BUND



Appendix B
Environment Protection Licence

EMM
creating opportunities

Environment Protection Licence

Licence - 77

Licence Details	
Number:	77
Anniversary Date:	01-July

Licensee

BORAL RESOURCES (NSW) PTY LTD

PO BOX 6041

NORTH RYDE NSW 2113

Premises

BORAL DUNMORE QUARRY

PRINCES HIGHWAY

DUNMORE NSW 2529

Scheduled Activity

Crushing, grinding or separating

Extractive activities

Fee Based Activity	Scale
Crushing, grinding or separating	> 2000000 T annual processing capacity
Extractive activities	> 2000000 T annually extracted or processed

Contact Us

NSW EPA

6 Parramatta Square

10 Darcy Street

PARRAMATTA NSW 2150

Phone: 131 555

Email: info@epa.nsw.gov.au

Locked Bag 5022

PARRAMATTA NSW 2124

Environment Protection Licence

Licence - 77

Environment Protection Licence

Licence - 77

Environment Protection Licence

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

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The EPA publication “A Guide to Licensing” contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

BORAL RESOURCES (NSW) PTY LTD
PO BOX 6041
NORTH RYDE NSW 2113

subject to the conditions which follow.

Environment Protection Licence

Licence - 77

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Crushing, grinding or separating	Crushing, grinding or separating	> 2000000 T annual processing capacity
Extractive activities	Extractive activities	> 2000000 T annually extracted or processed

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
BORAL DUNMORE QUARRY
PRINCES HIGHWAY
DUNMORE
NSW 2529
LOT 1 DP 224597, LOT 2 DP 224597, LOT 4 DP 227046, LOT 1 DP 1002951, LOT 3 DP 1030504

A2.2 The premises location is shown on the map below.

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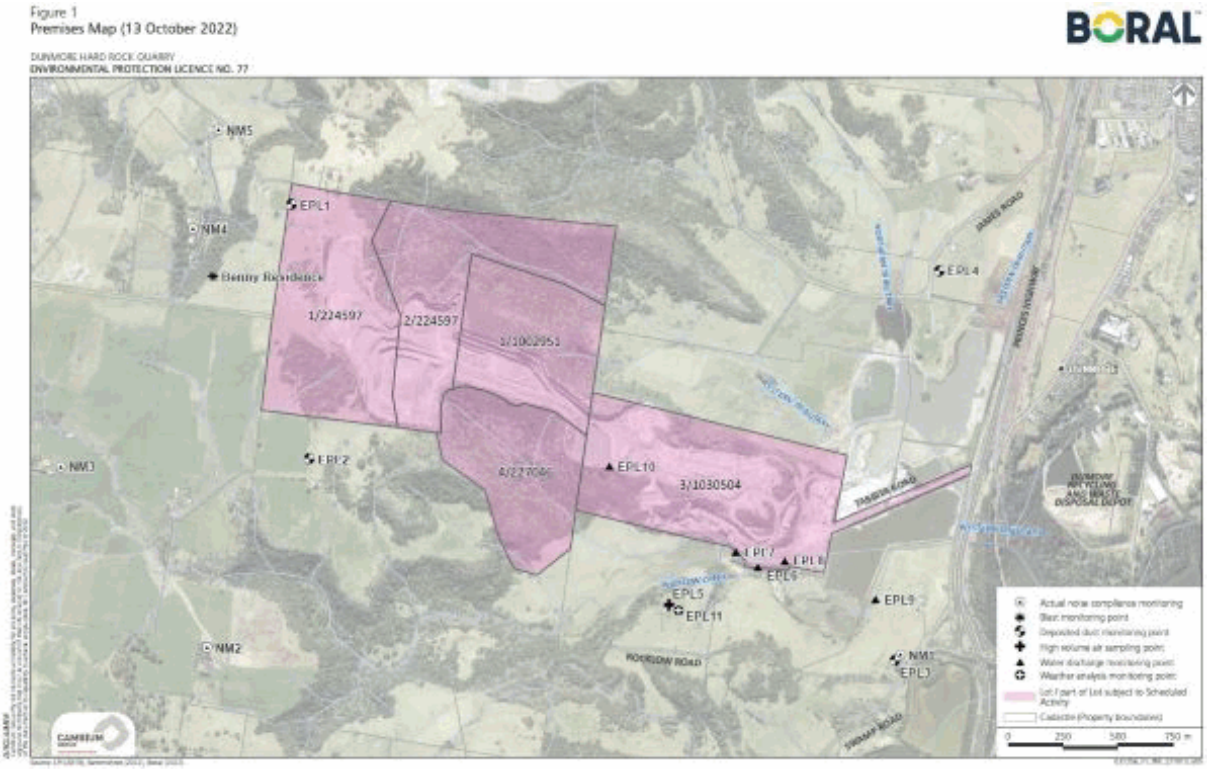

A3 Information supplied to the EPA

A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

A3.2 Further to condition A3.1, the works and activities must be carried out in accordance with:

a) Correspondence entitled “Application to vary Environment Protection Licence No.77”, dated 20 June 2006, record number WOF14132.
b) Correspondence entitled “Response to Variation” emailed to DECC on 27 September 2006, including map “Boral Dunmore Quarry EPL 77 – Monitoring Location”, record number DOC06/51716.
c) Correspondence entitled “Dunmore Quarry – Revised Biodiversity Offset for Quarry Extension” prepared for Department of Planning and copied to the EPA, dated 22 September 2008.
d) “Boral Resources (NSW) Pty Ltd, Dunmore Quarry Water Management, Draft Water Management Plan” dated 28 April 2008, prepared by Evans and Peck.

Environment Protection Licence

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air

EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Air Emissions Monitoring - Dust Deposition		Dust deposition gauge located at Croome Farm north and labelled "EPL1" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
2	Air Emissions Monitoring - Dust Deposition		Dust deposition gauge located at Croome Farm south and labelled "EPL2" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
3	Air Emissions Monitoring - Dust Deposition		Dust deposition gauge located on the south-eastern side of quarry and labelled "EPL3" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
4	Air Emissions Monitoring - Dust Deposition		Dust deposition gauge located on the north-east side of quarry and labelled "EPL4" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
5	Air emissions monitoring - high volume air sampler or equivalent		High volume air sampler or equivalent located on the southern side of the quarry and labelled "EPL5" on the map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2

P1.2 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

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.

Water and land

Environment Protection Licence

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EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
6	Discharge to waters and discharge quality monitoring	Discharge to waters and discharge quality monitoring	Discharge from the bio-filtration swale to Rocklow Creek labelled as "EPL6" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
7	Discharge to waters and discharge quality monitoring	Discharge to waters and discharge quality monitoring	Uncontrolled discharge from upgraded existing stormwater treatment dam to Rocklow Creek labelled "EPL7" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
8	Effluent quality monitoring		At the discharge point end of the upgraded existing stormwater treatment dam labelled "EPL8" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
9	Discharge to waters and stormwater quality monitoring		Rocklow Creek at the boundary between Boral Quarry and Creagan Property labelled "EPL9" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2
10	Discharge to waters and discharge quality monitoring	Discharge to waters and discharge quality monitoring	Uncontrolled discharge from top stormwater treatment dam to Rocklow Creek labelled "EPL10" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2

P1.4 The following point(s) in the table are identified in this licence for the purpose of the monitoring of weather parameters at the point.

EPA Identification Number	Type of Monitoring Point	Description of Location

11	Weather Analysis	Weather station located on the southern side of the quarry and labelled "EPL11" on map titled "Premises Map Dunmore Hard Rock Quarry", dated 13 October 2022 and filed as DOC22/937668 and displayed in licence condition A2.2

3 Limit Conditions

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 Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table/s 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.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L2.4 Water and/or Land Concentration Limits

POINT 6

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Total suspended solids	milligrams per litre				50

L3 Noise limits

L3.1 Noise from the premises must not exceed the limits in the following table when measured at the nominated receiver locations. Note that the noise limits represent the noise contribution from the premises.

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L3.2 Noise Limits for the Dunmore Quarry Operations - LAeq(15 minute)

Receiver Locations (See Note)	Day dB(A)	Evening dB(A)	Night dB(A)	Shoulder dB(A)
Location K Stocker Residence	49	44	38	47
Location O Dunmore Lakes	49	44	38	47
Location J Cregan Residence	Negotiated Agreement in Place	Negotiated Agreement in Place	Negotiated Agreement in Place	Negotiated Agreement in Place
Location AA	38	38	38	38
Locations AB and T	36	36	36	36
Locations D, F, G and Z	40	40	40	40
Location S	37	37	37	37
Other privately-owned residences	35	35	35	35

L3.3 Noise Limits for the Dunmore Quarry Operations LA1 - (1 minute)

Receiver Locations (See Note)	Night dB(A)	Shoulder dB(A)
Location K Stocker Residence	48	55
Location O Dunmore Lakes	48	55
Location J Cregan Residence	Negotiated Agreement in Place	Negotiated Agreement in Place
Location AA	45	45
Locations AB and T	45	45
Locations D, F, G and Z	45	45
Location S	45	45
Other privately-owned residences	45	45

Note: 1. Receiver location and monitoring points as nominated in Figure 3.1 of Dunmore Quarry Noise Management Plan prepared by EMM dated 11 December 2017.

2. The above table may be varied in the instance that negotiated agreements are entered into by the licensee and affected residents or if existing arrangements become void.

3. In conditions L3.2 and L3.3:
- “Day” refers to 07.00 am to 06.00 pm Monday to Saturday and 08:00 am to 06:00 pm Sundays and public holidays.
- “Evening” refers to 06.00 pm to 10.00 pm.
- “Night” refers to 10.00 pm to 06.00 am Monday to Saturday and 10:00 pm to 08:00 am Sundays and public holidays.

- “Shoulder” refers to 06.00 am to 07.00 am Monday to Saturday.

L3.4 Noise from the premises is to be measured at 1m from the dwelling façade to determine compliance with the LA1(1minute) noise limits.

L3.5 The noise emission limits identified above apply under meteorological conditions of:
a) Wind speed up to 3m/s at 10 metres above ground level; or
b) Temperature inversion conditions of up to 3oC/100m and wind speed up to 2m/s at 10 metres above the ground.

L4 Blasting

L4.1 The overpressure level from blasting operations at the premises must not exceed 120dB (Lin Peak) at any time. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L4.2 The overpressure level from blasting operations at the premises must not exceed 115dB (Lin Peak) for more than five per cent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L4.3 Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 10mm/sec at any time. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L4.4 Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 5mm/sec for more than five per cent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.

L4.5 BLASTING TIMES AND FREQUENCY

Blasting operations on the premises may only take place:
a) between 9.00am and 5.00pm Monday to Saturday inclusive;
b) are limited to 2 blasts each day; and
c) at such other times as may be approved by the EPA.

L5 Hours of operation

L5.1 All work at the premises must be conducted between the following hours:

Activity	Days of the Week	Time
Extraction and Processing	Monday to Saturday	6:00am to 10:00pm
Product Transfer to Stockpiles	Monday to Saturday	6:00am to Midnight
Distribution of Product (Sales)	Monday to Saturday	24 hours

Distribution of Product (Sales)	Sunday	Limited - See Condition L5.2
Maintenance	Monday to Sunday	24 hours

L5.2 EXEMPTION FOR DISTRIBUTION OF PRODUCT FROM THE PREMISES (SALES) ON SUNDAYS

Distribution of product from the premises (Sales) on Sunday by road are to be no more than 15 Sundays in any one licensing year between the hours of 8-00am – 6-00pm unless prior approval is obtained from the EPA. This restriction does not apply to sales by rail, which are allowed 24 hours.

A logbook must be kept in the office building for the purpose of identifying Sundays when sales have occurred. An entry must be made in that log book on any Sunday when sales activities occur (excluding sales activities that consist of rail loading alone).

Note: Sales includes transfer of product to road and rail vehicles from stockpiles and subsequent haulage off-site. It does not include transfer of product from the processing plant to the product stockpile areas.

Note: The above contingency condition (L5.2) was developed to enable *Distribution of Product (Sales)* at times when rail distribution is compromised.

L6 Other limit conditions

L6.1 OVERSIZED MATERIAL

L6.2 Oversized raw feed material must not be processed during the shoulder period, being 6-00am – 7-00am.

Note: For the purpose of this condition oversized raw feed material is defined as where more than 50% of the shot is over 900mm in diameter.

Note: In consultation with the proponent the EPA will review at the EPL review stage the necessity to amend or continue the restriction in processing oversized raw feed material based on the findings of any submitted noise monitoring reports.

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:

a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

O4 Processes and management

O4.1 WATER POLLUTION CONTROL

O4.2 The storm water management system is to be managed and operated in accordance with the operating principles of the revised Water Management Plan prepared by Evans and Peck, dated April 2008.

O4.3 The stormwater management system must be maintained at its design capacity. In this regard the licensee must inspect the drainage system and associated stormwater infrastructure every three months and following heavy rainfall and arrange for routine maintenance as required. Inspection sheets certifying this work has been completed and detailing actions arising from the inspections must be kept in accordance with the requirements of this licence.

O4.4 Any proposal for a change of flocculant other than those specified in the report titled Dunmore Quarry - Response to Water Management Issues, prepared by Environmental Resources Management Australia and dated February 2004, requires EPA approval and may require an appropriate eco-toxicological risk assessment to the satisfaction of the EPA. The flocculants nominated in the abovementioned report were aluminium sulphate and ferric chloride.

O4.5 Impervious bunds must be constructed around all fuel, oil and chemical storage areas and the bund volume must be large enough to contain 110 per cent of the volume held in the largest container.

O5 Waste management

O5.1 All liquid and non liquid wastes resulting from activities and processes at the premises must be assessed, classified and managed in accordance with the EPA's Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes (1999), or any other EPA document superseding this guideline.

5 Monitoring and Recording Conditions

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.

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.

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.

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:

M2.2 Air Monitoring Requirements

POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
Ash	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Insoluble solids	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Soluble matter	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Total Solid Particles	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016

POINT 2

Pollutant	Units of measure	Frequency	Sampling Method
Ash	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Insoluble solids	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Soluble matter	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Total Solid Particles	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016

POINT 3

Pollutant	Units of measure	Frequency	Sampling Method
Ash	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Insoluble solids	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Soluble matter	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Total Solid Particles	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016

POINT 4

Pollutant	Units of measure	Frequency	Sampling Method
Ash	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Insoluble solids	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Soluble matter	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016
Total Solid Particles	grams per square metre per month	Monthly	AS/NZS 3580.10.1:2016

POINT 5

Pollutant	Units of measure	Frequency	Sampling Method
PM10	micrograms per cubic metre	Every 6 days	AS/NZS 3580.9.6:2015

M2.3 Water and/ or Land Monitoring Requirements

POINT 6

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Daily during any discharge	In situ
Flow	kilolitres per day	Continuous during discharge	Special Method 1
Oil and Grease	Visible	Daily during any discharge	Inspection
pH	pH	Daily during any discharge	In situ
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample
Turbidity	nephelometric turbidity units	Daily during any discharge	In situ

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POINT 7

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Daily during any discharge	In situ
Oil and Grease	Visible	Daily during any discharge	Inspection
pH	pH	Daily during any discharge	In situ
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample
Turbidity	nephelometric turbidity units	Daily during any discharge	In situ

POINT 8

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Monthly	In situ
Oil and Grease	Visible	Monthly	Inspection
pH	pH	Monthly	In situ
Total suspended solids	milligrams per litre	Monthly	Grab sample
Turbidity	nephelometric turbidity units	Monthly	In situ

POINT 10

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Daily during any discharge	In situ
Oil and Grease	Visible	Daily during any discharge	Inspection
pH	pH	Daily during any discharge	In situ
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample
Turbidity	nephelometric turbidity units	Daily during any discharge	In situ

M2.4 For the purposes of the table(s) above Special Method 1 means measurement of flow at the controlled discharge from the upgraded existing stormwater treatment dam to the bio-filtration swale.

Note: In the event that the above monitoring locations become inaccessible due to site flooding, the associated monitoring requirements may be delayed until the affected locations become safely accessible. In the event site flooding prevents monitoring the licensee must notify the Environment Protection Authority.

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must

be done in accordance with:
a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2022* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M3.2 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.

M4 Weather monitoring

M4.1 For each monitoring point specified in the table below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1. The licensee must use the sampling method, units of measure, averaging period and sample at the frequency, specified opposite in the other columns.

POINT 11

Parameter	Units of Measure	Frequency	Averaging Period	Sampling Method
Rainfall	millimetres	Continuous	1 hour	AS 3580.14
Wind speed @ 10 metres	metres per second	Continuous	15 minute	AS 3580.14
Wind direction @ 10 metres	degrees	Continuous	15 minute	AS 3580.14
Temperature @ 2 metres	degrees celcius	Continuous	15 minute	AS 3580.14
Temperature @ 10 metres	degrees celcius	Continuous	15 Minute	AS 3580.14
Additonal Requirements - Siting				AS/NZS 3580.1.1 & AS 3580.14
Additonal Requirements - Measurement				AS 3580.14

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.

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.

M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M6.3 The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.

M7 Blasting

M7.1 To determine compliance with limit conditions relating to blasting:

a) Airblast overpressure and ground vibration levels must be measured and electronically recorded at the "Benny Residence" monitoring station for all production blasts carried out in or on the premises; and
b) Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard AS 2187.2-2006.

M8 Other monitoring and recording conditions

M8.1 NOISE MONITORING

M8.2 Noise from the premises must be measured annually via attended noise surveys at potentially affected residences, including Location K Stocker Residence (as described elsewhere in the licence). The noise monitoring should be conducted during the period when it is known that noise propagation from the premises will be at its worst, that is, generally winter conditions.

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6 Reporting Conditions

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.

At the end of each reporting period, the EPA will provide to the licensee notification that the Annual Return is due.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect *EPA* or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

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R1.8 The licensee must supply with the Annual Return a report, which provides:
a) an analysis and interpretation of monitoring results; and
b) actions to correct identified adverse trends.

Note: In consultation with the licensee the EPA will review at the EPL review stage the necessity to expand, reduce, amend or continue any specific aspects of the monitoring program based on the findings of any submitted monitoring reports.

R1.9 REPORTING OF ENVIRONMENTAL MONITORING DATA

R1.10 A noise compliance assessment report, detailing the findings of the noise monitoring required by the monitoring conditions of this licence, must be submitted to EPA yearly as part of the Annual Return. The report shall be prepared by a suitably qualified acoustical consultant. The noise compliance assessment must include, but need not be limited to a comparison of actual noise levels from the premises with the noise limits specified in this licence.

R1.11 A dust deposition report, must be submitted to the EPA yearly as part of the Annual Return. This dust deposition report must contain:
a) A brief summary of the results for all dust deposition monitoring sites.

b) Tabulated monthly data and rolling annual averages for “insoluble solids” and “ash” for each site for the 12 month period covered by the Annual Return. Where the monthly insoluble solid level is greater than 4 g/m2/month an assessment to determine the likely reason for the elevated dust deposition level must be made of:
i) Weather data (including provision of a wind rose showing wind speed and direction for the period of the monitoring);
ii) Ash content of the sample;
iii) Operating conditions such as monthly production or quarry blasts that may have caused the elevated level; and
iv) Other relevant factors.

The findings of the above assessment must be included in the dust deposition report.

Where results are not available the licensee must provide an explanation for the reasons for such non-availability.

c) For each monitoring site, a graphical presentation(s) must be made of dust deposition results since 2002 which includes:
i) The rolling 12 month annual average insoluble solids trendline;
ii) The rolling average insoluble solids trendline since 2002;
iii) The rolling average ash trendline since 2002;
iv) The EPA’s impact assessment criteria for deposited dust; and
v) Annual quarry production rates.

d) Where the rolling average ash trendline shows an upward trend the licensee must provide details of programs and/or works and/or actions that will be put in place to ensure the EPA’s impact assessment criteria for dust is not exceeded.

Note: The EPA's Annual Impact Assessment Criteria for insoluble solids of 4 g/m2/month (12 month rolling average) has been chosen as the standard at which the licensee will do a detailed assessment, if monthly results exceed this figure.

Note: If individual results are also included on the graph it is appropriate to adjust the vertical axis to a lower value, say 6 g/m2/month, so that long term trends can be identified.

Note: This condition is included on the licence as air quality dispersion modelling has predicted an increase in deposited dust with increased quarry production. The EPA's deposited dust impact assessment criteria is expressed in terms of insoluble solids. However due to the nature of the product being quarried any assessment of long-term trends needs to include an assessment of "ash" as dust from the quarrying activities conducted on the premises is mostly inorganic and will predominantly be recorded as "ash".

R1.12 A Fine Particulate (PM10) Report must be submitted to the EPA yearly as part of the Annual Return. This fine particulate report must contain:
a) A brief summary of all the results for PM10 conducted over the licensing year;
b) Graphical presentation of all results for PM10 conducted over the licensing year as well as the annual average and lines representing the impact assessment criteria for PM10 detailed in the publication "Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales";
c) Where levels exceed the impact assessment criteria, an assessment to determine the likely reason for the elevated reading must be undertaken and included in the report. For individual results this may include:
i) Weather data (including an assessment of wind speed and direction for the 24 hours of the test);
ii) Operating conditions such as blasting that may have coincided with the 24 hour monitoring period; and
iii) Other relevant factors.

R1.13 A summary of the monitoring of all blasts undertaken during the licence period must be included in the Annual Return. The summary must include, but may not be limited to, the date, time, ground vibration (mm/sec - peak particle velocity), and airblast overpressure of (dB(Lin Peak)).

R2 Notification of environmental harm

Note: The licensee or its employees 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 requirements of Part 5.7 of the Act.

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which they became aware of the incident.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying

out of the activities authorised by this licence, and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Other general conditions

G2.1 **Completed Programs**

Program	Description	Completed Date

Environment Protection Licence

PRP 1 - Undertake a noise assessment	Original Title: Undertake a Noise Assessment and Determine Appropriate Project Specific Noise Levels for the Site. Assessment of ambient noise levels within the residential areas surrounding quarry to determine project specific noise levels for site. Noise to be determined in accordance with the Industrial Noise Policy.. Boral to fully disclose environmental impact of noise from quarry	31-January-2002
PRP 2 – Dust Control Work Plan Quarry Roads	Original Title: Prepare a Plan of Works for the Control of Dust from Quarry Roads. Upgrade controls for dust emissions from quarry roads so that when implented quarry roads will not be a source of vehicle generated dust	01-March-2002
PRP 3 – Stormwater Pollution Control Work	Original Title: Prepare a Plan of Works for the Control of Stormwater Pollution from the Quarry. Develop a system of controls that captures all of the contaminated stormwater run off for reuse in dust suppression and/or treatment and discharge to Rocklow Creek.	03-May-2002
PRP 4 – Dust Control Work Plan - High Risk Ops	Original Title: Prepare a Plan of Work for the Control of Dust from the Screenhouse and Bunkers and the Secondary Crusher and Related Transfer Points. Ensure all dust generated within the screenhouse and bunker systems, and the area of the secondary crusher and related transfer points is suppressed.	01-June-2002
PRP 5 – Fixed Water Spray Installation	Original Title: Install Fixed Water Sprays on the roadway between the Site Offices/Weighbridge and the Crushing and Screening Plant Control Room. Installation of sprinkler system to suppress dust from quarry roads. Less dust from quarry road transport into sales area	30-September-2002
PRP 6 – Installation of Dust Controls	Original Title: Install the Following Dust Controls; Clad the Southern Side of the Quarry Product Bunkers; Install Fabric Filter Dust Controls at the tail and head of Conveyor 4 and; Install Fabric Filter Dust Collector at the discharge to Crushers CR6 and CR7. Dust control from screenhouse and other buildings. Prevention of wind and minimise emissions of dust	30-September-2002
PRP 7 – Air Quality Impact Assessment	Original Title: Undertake Air Quality Impact Assessment in Relation to Proposed Increased Extraction Rates. Air pollution assessment for the increased production proposal. Determine impacts to assist planning decisions	31-March-2004
PRP 8 – Emergency Contingency Management	Original Title: Develop an Emergency Contingency Management Plan. Emergency Contingency Management. Document and implement measures to minimise the environmental impacts of any emergency situations that could arise as a result of the operation of the Dunmore Quarry.	18-May-2005

Environment Protection Licence

PRP 9 – Dust Control Effectiveness Program	Original Title: Develop a Dust Control Effectiveness Program. Investigate the effectiveness of dust mitigation controls in relation to the production increase at the premises	01-December-2005
PRP 10 Construct Stormwater Pollution Control Dam	Original Title - Construct and commission stormwater pollution control dam. To capture and treat polluted runoff waters from storm events of less than and including a 1:10 year, 24 hours duration, average recurrence interval	26-June-2009
PRP 11 - Integrated Water Management Program	Original Title: Integrated Water Management Program. To address the external annual water demand for the operation of the premises, which has been estimated at an upper limit of 117 ML/year.	18-November-2005
PRP 12 – Water Control Installation	Original Title: Install Works to achieve better water pollution control. To implement the recommended works detailed in the report titled "Dunmore Quarry - response to water management issues"	13-July-2006
PRP 13 – Install a Rainfall Station	PRP 13 - Install a rainfall station. Install and maintain a rainfall monitoring device which will assist in determining compliance with the conditions of this licence	18-August-2005
PRP 15 - Nearfield Noise Monitoring Investigations	Original Title: Conduct Nearfield Noise Monitoring Investigations. To determine near field trigger levels which would assist in demonstrating compliance and verify the effectiveness of noise mitigation works	18-May-2005
PRP 16 - Fines Stockpile Management Plan	Original Title: Develop a Fines Stockpile Management Plan. Implement measures for the management of the minus 4mm stockpiles with the aim to stabilize the surface of the stockpiles to minimize wind blown dust emissions and to minimize erosion due to stormwater run off	01-March-2005
PRP 17 - Noise Compliance Investigation Program	PRP 17 - Noise Compliance Investigation Program. Identify a range of options to facilitate compliance with the EPL noise limits through physical attenuation measures and/or operational/management processes.	01-July-2006
PRP 18: Clad Secondary Crusher	Original Title: Enclose Secondary Crusher to Reduce Noise. The licensee has advised that cladding the Secondary Crusher will reduce noise at the source by about 12 dBA and this will allow noise limit compliance at the nearest noise receptor.	01-July-2006
PRP 19: Enclose Screen 1 and Fill In gaps	Original Title: Enclose Screen 1 and enclose gaps between the Primary Crusher and the Secondary Crusher. Reduce noise levels so as to comply with licence noise limits.	01-October-2006
PRP 20 Tertiary Screenhouse dust emissions	PRP 20: Improved Dust Controls for the Tertiary Screenhouse. Investigations and then works into reducing dust emissions from the Tertiary Screenhouse. Reduced dust emissions from the premises.	30-June-2010

8 Special Conditions

E1 Biodiversity Conservation Offset

E1.1 The Licensee will conserve, maintain, enhance and ensure long term security of the vegetation offset by a means agreed to by the EPA.

Note: The vegetation offset is detailed in correspondence to the Department of Planning and copied to the EPA, dated 22 September 2008 (refer to A4.2).

E2 Implementation of Updated Ambient Dust Monitoring Network

E2.1 **Background**

Special Condition SC E2 *Review and Update of Ambient Dust Monitoring Network* required the licensee to undertake a review of the existing dust monitoring network at the premises and provide a proposal for a revised air quality monitoring system that uses real-time dust monitors to inform a trigger action response plan.

This condition now requires the licensee to implement the proposal.

E2.2 **Requirements**

The licensee must implement and commission a real-time dust monitoring network in accordance with the proposal titled '*Dunmore Quarry Review & Update of the Ambient Dust Monitoring Network*' dated 9 May 2024. When implementing the proposal, the licensee must confirm in writing to the EPA, the completion of each of the following steps (1-4) by the due date:

1. By **6 December 2024** install the real-time dust monitor operating system to the control room and main office.

2. By **6 June 2025** trial and finalise a site-specific trigger action response plan and alert system for the real-time dust monitors.

3. By **6 June 2025**, commission the real-time dust monitoring network and associated systems and procedures to a fully operational status in accordance with the proposal.

4. By **27 June 2025**, provide to the EPA a report confirming the real-time dust monitoring network and associated systems and procedures are fully operational. The report must include details of the proposed alert system and trigger action response plan that the licensee developed during the trial phase.

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder describe d at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste
Wellhead	Has the same meaning as in Schedule 1 to the Protection of the Environment Operations (General) Regulation 2021.

Mr Nigel Sargent

Environment Protection Authority

(By Delegation)

Date of this edition: 14-December-1999

Environment Protection Licence

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End Notes

1	Licence varied by notice V/M upgrade, issued on 08-Jul-2000, which came into effect on 08-Jul-2000.
2	Licence transferred through application 140020, approved on 27-Sep-2000, which came into effect on 31-Aug-1999.
3	Licence varied by notice 9418, issued on 09-Mar-2000, which came into effect on 30-Mar-2000.
4	Licence varied by notice 1012272, issued on 19-Oct-2001, which came into effect on 13-Nov-2001.
5	Licence varied by notice 1013531, issued on 14-Dec-2001, which came into effect on 08-Jan-2002.
6	Licence varied by notice 1016381, issued on 12-Aug-2002, which came into effect on 06-Sep-2002.
7	Licence varied by notice 1021119, issued on 11-Oct-2002, which came into effect on 05-Nov-2002.
8	Licence varied by notice 1026479, issued on 08-Jul-2003, which came into effect on 08-Jul-2003.
9	Licence varied by notice 1035077, issued on 17-Nov-2004, which came into effect on 18-Nov-2004.
10	Licence varied by notice 1056152, issued on 15-Feb-2006, which came into effect on 12-Mar-2006.
11	Licence varied by change to DEC Region allocation, issued on 16-Mar-2003, which came into effect on 16-Mar-2003.
12	Licence varied by notice 1057794, issued on 12-Apr-2006, which came into effect on 12-Apr-2006.
13	Licence varied by notice 1061796, issued on 23-Jun-2006, which came into effect on 23-Jun-2006.
14	Licence varied by notice 1065559, issued on 29-Sep-2006, which came into effect on 29-Sep-2006.
15	Licence varied by notice 1073479, issued on 17-May-2007, which came into effect on 17-May-2007.
16	Licence varied by notice 1081122, issued on 16-May-2008, which came into effect on 16-May-2008.
17	Licence varied by notice 1088505, issued on 14-Jul-2008, which came into effect on 14-Jul-2008.
18	Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>

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19	Licence varied by notice 1102292, issued on 12-Aug-2009, which came into effect on 12-Aug-2009.
20	Licence varied by notice 1106096, issued on 14-Sep-2009, which came into effect on 14-Sep-2009.
21	Licence varied by notice 1502449 issued on 03-Nov-2011
22	Licence varied by notice 1502884 issued on 15-May-2012
23	Licence varied by notice 1506167 issued on 17-May-2012
24	Licence varied by notice 1512744 issued on 27-Mar-2013
25	Licence varied by notice 1518429 issued on 22-Nov-2013
26	Licence varied by notice 1538680 issued on 26-Sep-2016
27	Licence varied by notice 1578483 issued on 17-Jul-2020
28	Licence fee period changed by notice 1600038 on 07-Sep-2020
29	Licence varied by notice 1610852 issued on 22-Jul-2021
30	Licence varied by notice 1621903 issued on 07-Nov-2022
31	Licence varied by notice 1635481 issued on 12-Jan-2024
32	Licence varied by notice 1640416 issued on 02-Aug-2024

Appendix C
Water Access Licence

EMM
creating opportunities

Information about a water licence or approval

Use this tool to search for information about water licences and approvals issued under the *Water Act 1912* or *Water Management Act 2000*.

Select the type of licence or approval and enter the licence or approval number:

- **Water access licence (WAL):** a WAL number starts with the letters 'WAL' followed by several numbers; a WAL also has a reference number that starts with a two digit number, followed by 'AL' and then several numbers.
- **1912 water licence:** a water licence number starts with a two digit number, followed by a two letter code and then several numbers. Note: a PT reference number cannot be entered.
- **Approval:** an approval number starts with a two digit number, followed by a two letter code (WA, UA, CA or FW) and then several numbers.

Search for information about either a:

Water access licence (WAL) issued under the *Water Management Act 2000*

Water Access Licence (WAL) Number AL 25152

A WAL number starts with the letters 'WAL' followed by several numbers

Can't find your WAL number? Do you have a reference number? A reference number starts with a two digit number, followed by 'AL' and then several numbers. Use the following tool to find your WAL by entering your reference number. Enter the reference number to find the WAL number.

Notes:

The search results will list the conditions imposed on the water access licence. Any approved water supply work/s nominated on the water access licence are identified by the approval number/s for the work/s.

The information about a water access licence provided in the search results is a summary and may not always be up to date. If you require full and up to date details about a particular water access licence (including current holders, share and extraction component details, encumbrances and notations) you should search the Water Access Licence Register administered by NSW Land Registry Services.

Water Act 1912 Licences and Authorities

Approval issued under the *Water Management Act 2000*

Find out if a *Water Act 1912* licence has been converted

Water licence conversion status

Previous Search Print Export

Search Results

Category [Subcategory]	Status	Water Source	Tenure Type	Management Zone	Share Components (units or ML)

Unregulated River	Current	Illawarra Rivers Water Source	Continuing	Minnamurra River Management Zone	227.00

Extraction Times or Rates

Subject to conditions water may be taken at any time or rate

Nominated Work Approval(s)

10WA103611

- Conditions

Plan Conditions

Water sharing plan **Greater Metropolitan Region Unregulated River Water Sources**

Take of water

MW0025-00002 In the Minnamurra River Management Zone of the Illawarra Rivers Water Source, from 1 July 2016, if the flow is less than 3 ML/day at Minnamurra River at the Browns Lane gauge [No. 214010] for a period of 24 or more consecutive hours, then there must be a minimum flow of 3 ML/day at that gauge for at least 24 hours before water can be taken.

MW0112-00001 The maximum water allocation that may be carried over in the account for this access licence from one water year to the next water year is:
A. a volume equal to 100 % of the share component of the licence, or
B. 1 ML/unit share of the share component of the licence.

MW0036-00002 The volume of water taken in any three (3) consecutive water years from 1 July 2012 must be recorded in the logbook at the end of those three water years. The maximum volume of water permitted to be taken in those years must also be recorded in the logbook.

MW0605-00001 Water must be taken in compliance with the conditions of the approval for the nominated work on this access licence through which water is to be taken.

MW0670-00001 Water must only be taken if there is visible flow in the water source at the location where water is to be taken.

This restriction does not apply if water is to be taken:
A. from an off-river pool, an in-river pool, a runoff harvesting dam or an in-river dam pool, or
B. from the following Weirs: Maldon, Douglas Park, Menangle, Camden, Sharpes, Cobbity, Mount Hunter Rivulet, Brownlow Hill, Theresa Park and Wallacia.

MW0080-00005 From 1 July 2016, water must not be taken from the Minnamurra River Management Zone of the Illawarra Rivers Water Source when flows are in the Very Low Flow Class, which means that the flow is 3 ML/day or less at Minnamurra River at the Browns Lane gauge [No. 214010].

This restriction does not apply if water is to be taken from a runoff harvesting dam or an in-river dam pool.

MW0004-00002 From 1 July 2012, the total volume of water taken in any three (3) consecutive water years under this access licence must not exceed a volume which is equal to the lesser of either:
A. the sum of:
i. water in the account from the available water determinations in those 3 consecutive water years, plus
ii. water in the account carried over from the water year prior to those 3 consecutive water years, plus
iii. any net amount of water assigned to or from this account under a water allocation assignment in those 3 consecutive water years, plus
iv. any water re-credited by the Minister to the account in those 3 consecutive water years,

or

	B. the sum of: i. the share component of this licence at the beginning of the first year in those 3 consecutive water years, plus ii. the share component of this licence at the beginning of the second year in those 3 consecutive water years, plus iii. the share component of this licence at the beginning of the third year in those 3 consecutive water years, plus iv. any net amount of water assigned to or from this account under a water allocation assignment in those 3 consecutive water years, plus v. any water re-credited by the Minister to the account in those 3 consecutive water years.
	Monitoring and recording
MW2338-00001	The completed logbook must be retained for five (5) years from the last date recorded in the logbook.
MW2337-00001	The following information must be recorded in the logbook for each period of time that water is taken: A. date, volume of water, start and end time when water was taken as well as the pump capacity per unit of time, and B. the access licence number under which the water is taken, and C. the approval number under which the water is taken, and D. the volume of water taken for domestic consumption and/or stock watering.
MW2339-00001	A logbook must be kept, unless the work is metered and fitted with a data logger. The logbook must be produced for inspection when requested by the relevant licensor.
	Reporting
MW0051-00002	Once the licence holder becomes aware of a breach of any condition on this access licence, the licence holder must notify the Minister as soon as practicable. The Minister must be notified by: A. email: water.enquiries@dpi.nsw.gov.au, or B. telephone: 1800 353 104. Any notification by telephone must also be confirmed in writing within seven (7) business days of the telephone call.

Other Conditions

NIL

Disclaimer: WaterNSW is making the information available on the understanding that it does not warrant that the information is suitable for any intended use. In using the information supplied, the user acknowledges that they are responsible for any deductions or conclusions arrived at from interpretation of the data.

Privacy: The information provided is limited to meet the requirements of section 57 of the *Privacy and Personal Information Act 1998*.

Exporting and printing: Search results show a maximum of 50 rows per page. Search results can only be printed page by page.

More information: Should you require further information or technical assistance, please submit your request to water.enquiries@waternsw.com.au or contact 1300 662 077

Information about a water licence or approval

Use this tool to search for information about water licences and approvals issued under the *Water Act 1912* or *Water Management Act 2000*.

Select the type of licence or approval and enter the licence or approval number:

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- **1912 water licence:** a water licence number starts with a two digit number, followed by a two letter code and then several numbers. Note: a PT reference number cannot be entered.
- **Approval:** an approval number starts with a two digit number, followed by a two letter code (WA, UA, CA or FW) and then several numbers.

Search for information about either a:

○ **Water access licence (WAL) issued under the *Water Management Act 2000***

Water Access Licence (WAL) Number WAL

A WAL number starts with the letters 'WAL' followed by several numbers

Can't find your WAL number? Do you have a reference number? A reference number starts with a two digit number, followed by 'AL' and then several numbers. Use the following tool to find your WAL by entering your reference number. Enter the reference number to find the WAL number.

Cancelled WALs are not searchable on the NSW Water Register.

Notes:

The search results will list the conditions imposed on the water access licence. Any approved water supply work/s nominated on the water access licence are identified by the approval number/s for the work/s.

The information about a water access licence provided in the search results is a summary and may not always be up to date. If you require full and up to date details about a particular water access licence (including current holders, share and extraction component details, encumbrances and notations) you should search the Water Access Licence Register administered by NSW Land Registry Services.

○ *Water Act 1912* Licences and Authorities

○ Approval issued under the *Water Management Act 2000*

Find out if a *Water Act 1912* licence has been converted

○ Water licence conversion status

Search Results

Category [Subcategory]	Status	Water Source	Tenure Type	Management Zone	Share Components (units or ML)	IDEC (Daily flow shares)
Aquifer	Current	Sydney Basin South Groundwater Source	Continuing		250.00	N/A

Extraction Times or Rates

Subject to conditions water may be taken at any time or rate

- Conditions

Plan Conditions

Water sharing plan Greater Metropolitan Region Groundwater Sources 2023

Take of water

MW0605-00001	Water must be taken in compliance with the conditions of the approval for the nominated work on this access licence through which water is to be taken.
MW0547-00001	The total volume of water taken under this licence in any water year must not exceed a volume equal to: A. the sum of water in the account from the available water determination for the current year, plus B. the water carried over in the account from the previous water year, plus C. the net amount of water assigned to or from the account under a water allocation assignment, plus D. any water re-credited by the Minister to the account.
MW0919-00001	A maximum water allocation of 0.1 ML/unit share may be carried over in the account for this access licence from one water year to the next water year if a water meter is installed on each water supply work nominated on this licence and each meter is maintained in working order.
MW0929-00001	From 1 July 2018, if the water supply work nominated on this access licence is located at or less than 40 m from the top of the high bank of a river then: A. water must not be taken in this groundwater source when flows are in the Very Low Flow Class for an unregulated river access licence in that river. B. This restriction will only apply when the system that confirms when water can be taken is available on the relevant licensor website. C. the relevant licensor will inform the licence holder in writing of the applicable restrictions and how to access the information on its website when this system becomes operative.

Monitoring and recording

MW0606-00001	The volume of water taken in the water year must be recorded in the logbook at the end of each water year. The maximum volume of water permitted to be taken in that water year must also be recorded in the logbook.
MW2336-00001	The purpose or purposes for which water is taken, as well as details of the type of crop, area cropped, and dates of planting and harvesting, must be recorded in the logbook each time water is taken. This condition ceases to apply to a work on the day that the recording and reporting requirements apply to that work under the Water Management (General) Regulation 2018.
MW2339-00001	A logbook must be kept, unless the work is metered and fitted with a data logger. The logbook must be produced for inspection when requested by the relevant licensor.
MW2338-00001	The completed logbook must be retained for five (5) years from the last date recorded in the logbook.
MW2337-00001	The following information must be recorded in the logbook for each period of time that water is taken: A. date, volume of water, start and end time when water was taken as well as the pump capacity per unit of time, and B. the access licence number under which the water is taken, and C. the approval number under which the water is taken, and D. the volume of water taken for domestic consumption and/or stock watering. This condition ceases to apply to a work on the day that the recording and reporting requirements apply to that work under the Water Management (General) Regulation 2018.

Reporting

MW0051-00002	Once the licence holder becomes aware of a breach of any condition on this access licence, the licence holder must notify the Minister as soon as practicable. The Minister must be notified by: A. email: water.enquiries@dpi.nsw.gov.au, or B. telephone: 1800 353 104. Any notification by telephone must also be confirmed in writing within seven (7) business days of the telephone call.

Other Conditions

NIL

Appendix D

Water supply works approval

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Statement of Approval

Water Management Act 2000

Approval details

Approval number	10WA103611
Status	CURRENT*
Approval kind	Water Supply Works
Water sharing plan	GREATER METROPOLITAN REGION UNREGULATED RIVER WATER SOURCES 2023
Date of effect	01/Jul/2011
Expiry date	30/Jun/2034
Approval holder(s)	Schedule 1
Water supply works	Schedule 2
Conditions	Schedule 3

Contact for service of documents

Name	BORAL RESOURCES (N S W) PTY LTD
Address	Po Box 6041 North Ryde NSW 2113

* **Note: An approval has effect for such period as is specified in the approval, or if the period is extended under section 105, that extended period. If an application for extension of an approval is lodged before the approval expires, the term of the expiring approval is extended until either the date of the final decision on the application, or a date fixed by the Minister for the approval, whichever is the later date. An approval which has expired can be the subject of an application to extend it but it needs to be accompanied by a statutory declaration of the reasons for the delay in making the application. If the Minister accepts these reasons the term of the approval is taken to have been extended, and the application may be dealt with, as if the application had been made before the approval expired.**

It is an offence under the Water Management Act 2000 to breach a term or condition of the approval or to construct and use works to which the approval does not relate. It is also an offence to use works the subject of an approval if the approval has expired, been surrendered or cancelled.

Schedule 1 - Approval holders

The holders of this approval are:

Approval holder(s)	ACN (if applicable)
BORAL RESOURCES (N S W) PTY LTD	000 756 507

Important notice - change of landholder or contact

Please advise the Office in the event of any of the following, as soon as practicable:

- If there is a change in the ownership or occupation of the land benefited by this approval (see Schedule 2). Under the Water Management Act 2000, an approval is typically held by the owner or lawful occupier of the benefited land. Consequently, a change in occupation may cause a change in your legal obligations as an approval holder.*
- If there is a change to the contact person. You will be required to lodge a written statement signed by all the holders.*
- If there is a change to the mailing address for the nominated contact person. This should be done by the contact person in writing.

** An updated Statement of Approval will be issued free of charge*

Schedule 2 - Water supply works

Part A: Authorised water supply works

Subject to the conditions of this approval, in relation to each numbered work in the table, the holders of this approval are authorised to construct and use a water supply work of the type shown at the location specified:

Work 1

Work identifier	1000132511
Specified work	100MM CENTRIFUGAL PUMP
Specified location	3//1030504 Whole Lot
Management zone (if applicable)	
Water source	MINNAMURRA RIVER WATER SOURCE
Water sharing plan	GREATER METROPOLITAN REGION UNREGULATED RIVER WATER SOURCES 2023

Work 2

Work identifier	1000132512
Specified work	BYWASH DAM
Specified location	3//1030504 Whole Lot
Management zone (if applicable)	
Water source	MINNAMURRA RIVER WATER SOURCE
Water sharing plan	GREATER METROPOLITAN REGION UNREGULATED RIVER WATER SOURCES 2023

Schedule 3 - Conditions

The approval is subject to the following conditions:

Plan conditions

Water sharing plan ***Greater Metropolitan Region Unregulated River Water Sources 2023***

Monitoring and recording

MW8614-00001

A. Before water is taken through the water supply work authorised by this approval, the approval holder must confirm that cease to take conditions do not apply and water may be taken.
B. Where the approval holder is required to keep a logbook, the approval holder must record the confirmation, including the way in which the confirmation was established, in a logbook.
C. This condition does not apply to a water supply work that is used only for the purpose of taking water under a basic landholder right.

MW6612-00001

A logbook used to record water take information must be retained for five (5) years from the last date recorded in the logbook.

MW8481-00001

A. The approval holder must record the following information in a logbook each time that water is taken using a water supply work authorised by this approval:
i. date, start and end time when water is taken, and the volume of water taken, and
ii. the access licence number or the authority (such as a licence exemption) under which the water is taken, and
iii. the purposes for which water is taken, and
iv. details of any cropping carried out using the water taken through the water supply work including the type of crop, area cropped, and dates of planting and harvesting, and
v. where metering equipment has been installed for use in connection with the water supply work, the meter reading before water is taken, and
vi. where metering equipment has not been installed for use in connection with the water supply work, details of all pumping activities for the water supply work including pump running hours, pump power usage or pump fuel usage, pump start and stop times and pump capacity per unit of time.
B. This condition does not apply to a water supply work that:
i. is used only for the purpose of taking water under a basic landholder right, or
ii. has both an operational meter that complies with Australian Standard AS 4747 - Meters for non-urban water supply, and data logger.
C. This condition ceases to apply to this approval on the day that the mandatory metering equipment condition applies to this approval under the Water Management (General) Regulation 2018.

Other conditions

Water management works

DK0888-00001 Any water supply work authorised by this approval used for the purpose of conveying, diverting or storing water must be constructed or installed to allow free passage of floodwaters flowing into or from a river or lake.

DK0871-00001 The water supply work authorised by this approval must be constructed and maintained in a way that will:
A. ensure the work's safe construction and operation, and
B. prevent the possibility of damage being caused by the work, or resulting from the work, to any public or private interest.

DK0878-00001 A. The construction, installation or use of the water supply work authorised by this approval must not cause or increase erosion to the channel or bank of the watercourse.
B. If erosion is observed, the area must be stabilised with grass cover, stone pitching or any other material that will prevent any further occurrence of erosion.

DK1217-00001 The location of the dam(s) as shown on a plan retained in the office of the relevant licensor shall not be altered.

DK0241-00254 The level of the crest of the bywash of the dam shall be fixed at not higher than 0.35 m below the level of a bench mark established on a fence post on the left bank of the watercourse near the work and particulars of which are retained in the office of the relevant licensor.

Glossary

cease to take - Cease to take conditions means any condition on this approval, or on the access licence under which water is proposed to be taken, that prohibits the taking of water in a particular circumstance.

licensor - WaterNSW or DPI Water, depending on which organisation administers your licences and/or approvals

logbook - A logbook is a document, electronic or hard copy, that records specific required information.

General Notes

All conditions on an approval require compliance. An appeal to the Land and Environment Court against a decision to impose certain conditions on an approval can be made within 28 days after the date the decision is made. Conditions identified with the first letter "D" are those that can be appealed during the appeal period.

The words in this approval have the same meaning as in the *Water Management Act 2000*

Note: The words in this approval have the same meaning as in the WMA

END OF STATEMENT

Appendix E
Water quality data

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E.1 Groundwater quality

Table E.1 Groundwater quality results

	Units	WQO value[1]	GW1			GW2			GW3		
			# Samples/ exceed.	Min value	Max value	# Samples/ exceed.	Min value	Max value	# Samples/ exceed.	Min value	Max value
Analytical results - general											
Electrical conductivity	µS/cm	200-300	10/10	**834**	**3,970**	10/10	**1,074**	**2,350**	10/10	**649**	**1,821**
pH	-	6.5-8.5	10/2	**6.4**	8.2	10/0	7.0	8.3	10/0	7.0	8.1
Total dissolved solids	NTU	-	4/0	1326	2737	4/0	1118	1527	4/0	552	630
Analytical results - nutrients											
Ammonia	mg N/L	0.020	9/8	0.02	**0.30**	9/8	0.02	**0.35**	9/4	<0.01	**0.17**
Oxidised nitrogen	mg N/L	0.040	9/4	0.02	**1.23**	9/6	<0.01	**0.19**	9/9	**0.06**	**2.58**
Total kjeldahl nitrogen	mg N/L	-	9/0	500	2700	9/0	400	800	9/0	<100	7400
Total nitrogen	mg N/L	0.35	9/9	**0.6**	**2.9**	9/9	**0.4**	**1.0**	9/8	0.2	**8.8**
Filterable reactive phosphate	mg P/L	0.020	4/3	<0.01	**0.08**	4/3	0.02	**0.08**	4/1	<0.01	**0.03**
Total phosphorus	mg P/L	0.025	9/9	**0.08**	**5.44**	9/9	**0.10**	**0.89**	9/9	**0.06**	**25.2**
Analytical results – inorganics											
Calcium	mg/L	-	9/0	43	384	9/0	41	125	9/0	15	80
Chloride	mg/L	-	9/0	78	719	9/0	72	382	9/0	52	80
Fluoride	mg/L	-	4/0	0.4	0.4	4/0	0.4	0.5	4/0	<0.1	0.7
Magnesium	mg/L	-	9/0	3	24	9/0	3	9	9/0	5	40
Potassium	mg/L	-	9/0	2	6	9/0	<1	3	9/0	<1	<1

	Units	WQO value[1]	GW1			GW2			GW3		
			# Samples/ exceed.	Min value	Max value	# Samples/ exceed.	Min value	Max value	# Samples/ exceed.	Min value	Max value
Silicon (as SiO_2)	mg/L	-	8/0	16.7	27.1	8/0	19.5	25.0	8/0	31.8	40.0
Sodium	mg/L	-	9/0	293	821	9/0	305	593	9/0	47	157
Sulfate (as SO_4)	mg/L	-	9/0	368	1130	9/0	347	690	9/0	35	59
Total alkalinity (as $CaCO_3$)	mg/L	-	9/0	300	554	9/0	101	523	9/0	230	358
Analytical results - metals (dissolved)											
Aluminium (Al)	mg/L	0.055	9/0	<0.01	0.02	9/0	<0.01	0.03	9/0	<0.01	0.02
Arsenic (As)	mg/L	0.013[3]	9/6	0.003	**0.055**	9/5	0.006	**0.033**	9/1	<0.001	**0.033**
Cadmium (Cd)	mg/L	0.0002	9/0	<0.0001	<0.0001	9/0	<0.0001	<0.0001	9/0	<0.0001	<0.0001
Cobalt (Co)	mg/L	0.0014[2]	4/0	<0.001	<0.001	4/0	<0.001	<0.001	4/0	<0.001	<0.001
Copper (Cu)	mg/L	0.0014	9/0	<0.001	0.001	9/1	<0.001	**0.002**	9/9	**0.002**	**0.369**
Total Chromium (Cr)	mg/L	0.001[3]	9/2	<0.001	**0.002**	9/2	<0.001	**0.002**	9/0	<0.001	<0.001
Manganese (Mn)	mg/L	1.9	9/0	0.237	0.87	9/0	0.185	0.422	9/0	0.018	0.544
Mercury (Hg)	mg/L	0.00006	4/0	<0.0001	<0.0001	4/0	<0.0001	<0.0001	4/0	<0.0001	<0.0001
Nickel (Ni)	mg/L	0.0011	9/8	0.001	**0.116**	9/8	0.001	**0.019**	9/8	<0.001	**0.025**
Lead (Pb)	mg/L	0.0034	4/0	<0.001	<0.001	4/0	<0.001	<0.001	4/0	<0.001	<0.001
Zinc (Zn)	mg/L	0.008	9/5	<0.005	**0.016**	9/2	<0.005	**0.034**	9/8	<0.005	**0.044**
Iron (Fe)	mg/L	0.3[2]	9/1	<0.05	**0.76**	9/0	<0.05	0.22	9/1	<0.05	**0.31**

Notes: 1. WQO values are established in Table 2.6.

2. Trigger value refers to a low reliability trigger value that has been established using the methods recommended in Section 8.3.4.5 of ANZECC/ARMCANZ (2000).

3. For As, WQO values for As (V) were applied. For Cr (total), WQO values for Cr (VI) were applied.

Bold denotes WQO value is exceeded.

Appendix F

Water balance method statement

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F.1 Introduction

A site water balance model of the quarry water management system was developed in GoldSim version 12.0 (GoldSim Technology 2017). The water balance methodology and assumptions have been sourced from the water balance model presented in the *Modification 9 Surface Water Assessment* (RHDHV 2017). Where applicable, the model has been updated to reflect changes to the water management system since the 2017 *Surface Water Assessment.* An overview of the functionality of the water management system is presented in Figure F.1.

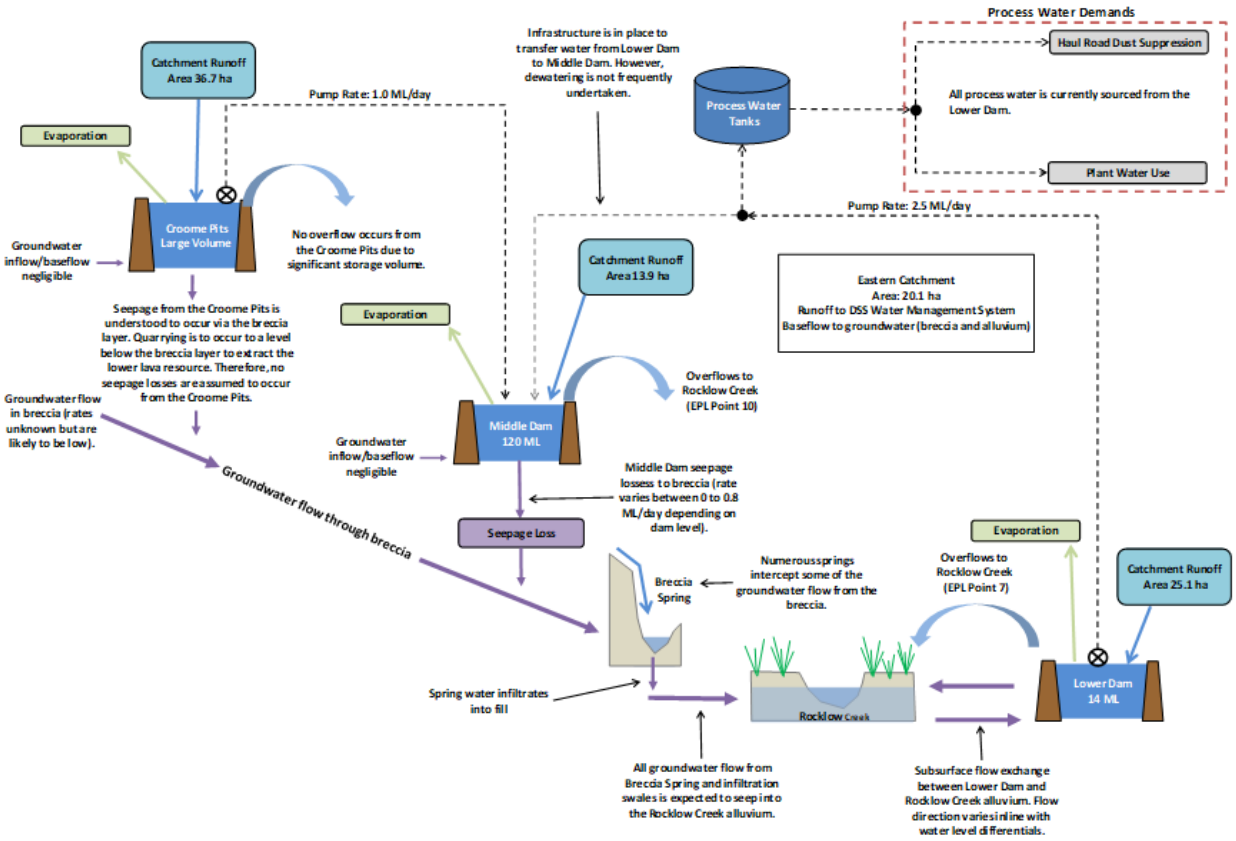

Figure F.1 Water management system

F.2 Model objectives

The objectives of the water balance modelling are to:

- assess the frequency and volume of site discharge mechanisms
- assist in the determination of water licensing requirements.

F.3 Modelling Approach

F.3.1 GoldSim Model

The water balance model applies a continuous simulation methodology that simulates the response of the water management system under a range of climatic conditions (i.e. rainfall and evaporation). The water balance model is created by representing each process of the water management system with pre-determined responses that reflect how the proposed water management system will operate.

Rainfall and evaporation are the key environmental variables applied to the model. The response of the system to these variables is evaluated by investigating specific outputs across the system over the simulation timeframe.

F.3.2 Time step and simulation time

The model simulated the water management system using 118 years of historical rainfall, using daily time steps.

F.3.3 Operating scenarios

The water balance model has been used to simulate the performance of the existing water management system described in Section 4.1 and the proposed water management system described in Section 5.3.2.

F.4 Model Assumptions

F.4.1 Climate Data

i Rainfall

Daily rainfall data from the Albion Park Post Office (68000) rainfall gauge over the period January 1900 to December 2018 period was applied to the model. SILO (Scientific Information for Land Owners) Patched Point Data from the Queensland Climate Change Centre of Excellence was used to 'patch' any missing historical rainfall by interpolating data from nearby station records. Further detail regarding the simulation rainfall period is provided in Section 3.2.1.

ii Evaporation

Average monthly evaporation rates (as described in Section 3.2.3) were applied to the model to calculate direct evaporation from water storages (i.e. Lower Dam, Middle Dam and Croome Pits) using a pan factor of 0.7. Each storage includes a stage storage relationship whereby the assumed exposed surface area of stored water varies with the volume of water stored each day.

iii Potential evapotranspiration

Average monthly potential evapotranspiration rates (as described in Section 3.2.3) were applied to the model for use in the runoff calculations. Potential evapotranspiration was used to estimate soil moisture losses.

F.4.2 Runoff

Surface water runoff was estimated using the Australian Water Balance Model (AWBM). The AWBM was developed by Boughton (2003) and is widely used across Australia to estimate stream flow and runoff. Runoff was used to estimate the volume of water that would contribute to each of the water management dams over the simulation time frame. Parameters within the AWBM were modified to reflect the different hydrological responses that are expected within the catchment area. Catchment areas and corresponding runoff coefficients area described in Table F.1. The runoff coefficients presented in Table F.1 are similar to those presented in Table 4.1 of the *Modification 9 Surface Water Assessment* (RHDHV 2017).

Table F.1 Catchment areas and runoff coefficients

Catchment	Area (ha)	Land-use	Annual runoff coefficient[1]
Lower Dam	25.1	Haul roads, stockpiles, processing plant and some vegetated areas.	0.44
Middle Dam	13.9	Remnant quarry workings, haul roads and water management dam.	0.56
Croome Pits	36.7	Rock extraction and in-pit processing areas, haul roads and stockpiles.	0.50
Eastern Catchment	20.1	Haul roads, site administration and work shop areas, stockpiles and vegetated areas.	0.36

Notes: 1. Annual runoff coefficients based on typical median rainfall year.

F.4.3 Process water demands

Process water is required for dust suppression of haul roads and within the processing plant. Dust suppression application rates were calculated using to the following equation:

Dust Suppression (t) = [(ET (t)) – Rainfall (t) + Loss Factor] x Area

Where:

ET (t) = Daily evapotranspiration rate (mm/day)

Rainfall (t) = Rainfall rate (mm/day)

Loss Factor = Dust Suppression Loss Factor 3 mm/day

Area = 9.0 (ha)

A loss factor of 3 mm/day and an application area of 9.0 ha produced a good representation of the typical daily application rates Table 4.3.

The water demand for the processing plant was applied at a constant rate of 75 kL/day. Process water demands have been calculated based on a 5.5 day operation week.

F.4.4 Water management dams

The adopted water management dam storage volumes used in the water balance model are presented in Table F.2. The location of the water management dams and Croome Pits are shown in Figure 4.2.

Table F.2 Water management dam sizes

Storage	Volume	Overflows to
Lower Dam (existing)	14 ML	Rocklow Creek
Lower Dam (proposed)	16.7 ML	Rocklow Creek
Middle Dam	120 ML[1]	Rocklow Creek
Croome Pits	Greater than 500 ML	Middle Dam

Notes: 1. Middle dam is estimated to contain an additional 30 ML of sediment storage volume that has not been included in the total storage volume for water balance modelling purposes.

F.4.5 Groundwater flows

i Groundwater pit inflows

Groundwater inflows to the pit are expected to be negligible over the life of the quarry. The site Groundwater Assessment (EMM 2016) estimated a maximum annual inflow volume of 0.8 ML/year (pre Modification 13), occurring during the initial stages of Modification 9 and decreasing to 0.07 ML/year for the final pit void. Groundwater inflows to the pit have not been included in the site water balance model as any inflows will evaporate on the quarry face.

ii Groundwater ingress to Lower Dam

It is estimated that the quarry operation uses between 176 and 188 ML of process water per year. Historically, all process water has been extracted from the Lower Dam, with the majority of the water being drawn from the Rocklow Creek alluvium via groundwater ingress into the dam. For the purpose of water balance modelling, it is assumed that the ingress of water into Lower Dam is equal to the volume of process water extracted when the water level is below 2.0 m AHD.

iii Lower Dam seepage

Seepage from the Lower Dam into the adjoining Rocklow Creek alluvium is expected to occur for short periods of time when the dam level is higher than the creek surface water/groundwater levels. For the purpose of water balance modelling, it has been assumed that seepage from Lower Dam occurs at a rate of 200 kL/day when the dam's water level is above 2.5 m AHD.

iv Middle Dam seepage

Daily seepage loss rates were calculated by Royal HaskoningDHV (2017) from the water level data provided in Section 4.2.2. The change in storage volume for each day was calculated, and the days with no influence of runoff from Croome Pits dewatering were censored for further analysis. The censored daily change in storage volume was adjusted for evaporation losses, with the remaining loss assumed to be associated with seepage. The resulting daily seepage loss estimates are presented in Figure F.2.

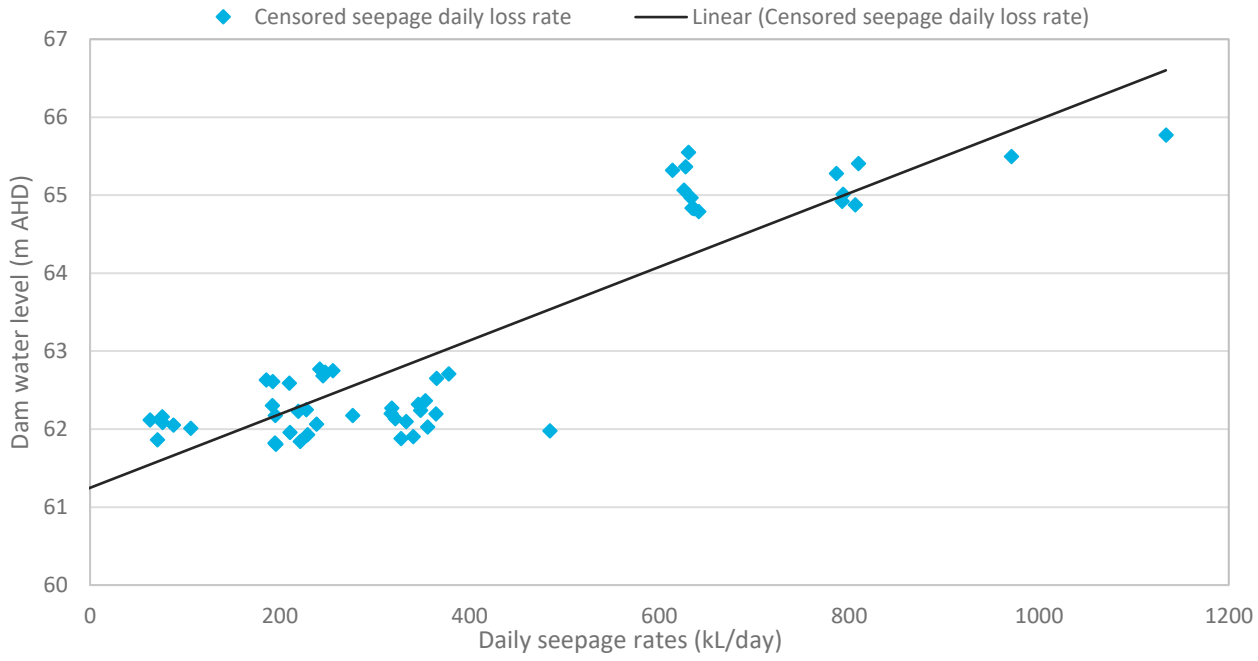

Figure F.2 Middle Dam daily seepage loss rates (source: RHDHV 2017)

Seepage losses for Middle Dam were applied to the water balance model using a linear water level to seepage rate relationship as per the trend line in Figure F.2. A maximum seepage rate of 800 kL/day was adopted to better represent the clustered data points shown in Figure F.2.

v Croome Pits seepage

No seepage is expected to occur from the Croome Pits as the Modification 9 pit involves quarrying through the breccia layer to extract the underlying Lower Lava Flow resource.

F.4.6 Water transfers

Water transfer between storages, demands and sources are controlled using transfer rules based on storage levels, demand requirements and source availability. Table F.3 describes the transfer rates that apply for both existing and proposed scenarios.

Table F.3 Existing and proposed water management system transfers

Quarry component	Existing scenario	Proposed scenario
Process water supply	All process water sourced from Lower Dam	Preferentially sourced in the following order: 3. Croome Pits (when storage is above 5 ML[1]) 4. Middle Dam (when more than 30% full) 5. Lower Dam
Lower Dam to process water transfer rate	2.5 ML/day	2.5 ML/day
Croome Pits to Middle Dam dewatering trigger	Storage above 5 ML	Storage above 10 ML[2]
Croome Pits and Middle Dam process water transfer rate	Not applicable	Equal to daily process water demand
Croome Pits to Middle Dam pump rate	1.0 ML/day when Middle Dam is below 60% of storage capacity	1.0 ML/day when Middle Dam is below 60% of storage capacity

Notes: 1. A 5 ML storage trigger has been used for water balance purposes to ensure that the volume of stored water in the Croome Pits is greater than the process water demand in a given time step. In reality, the Croome Pits will be dewatered below the nominated 5 ML trigger.

2. For water balance model purposes, dewatering occurs at a greater storage volume for the proposed case to maintain a 5 ML buffer above the process water trigger. This allows for more water being available for process water use.

F.5 Model Results

Water balance results for typical dry (10th percentile), median (50th percentile) and wet (90th percentile) rainfall years for existing and proposed scenarios are presented in Section 4.3 and Section 5.3.3 respectively.

Appendix G
Preliminary engineering design

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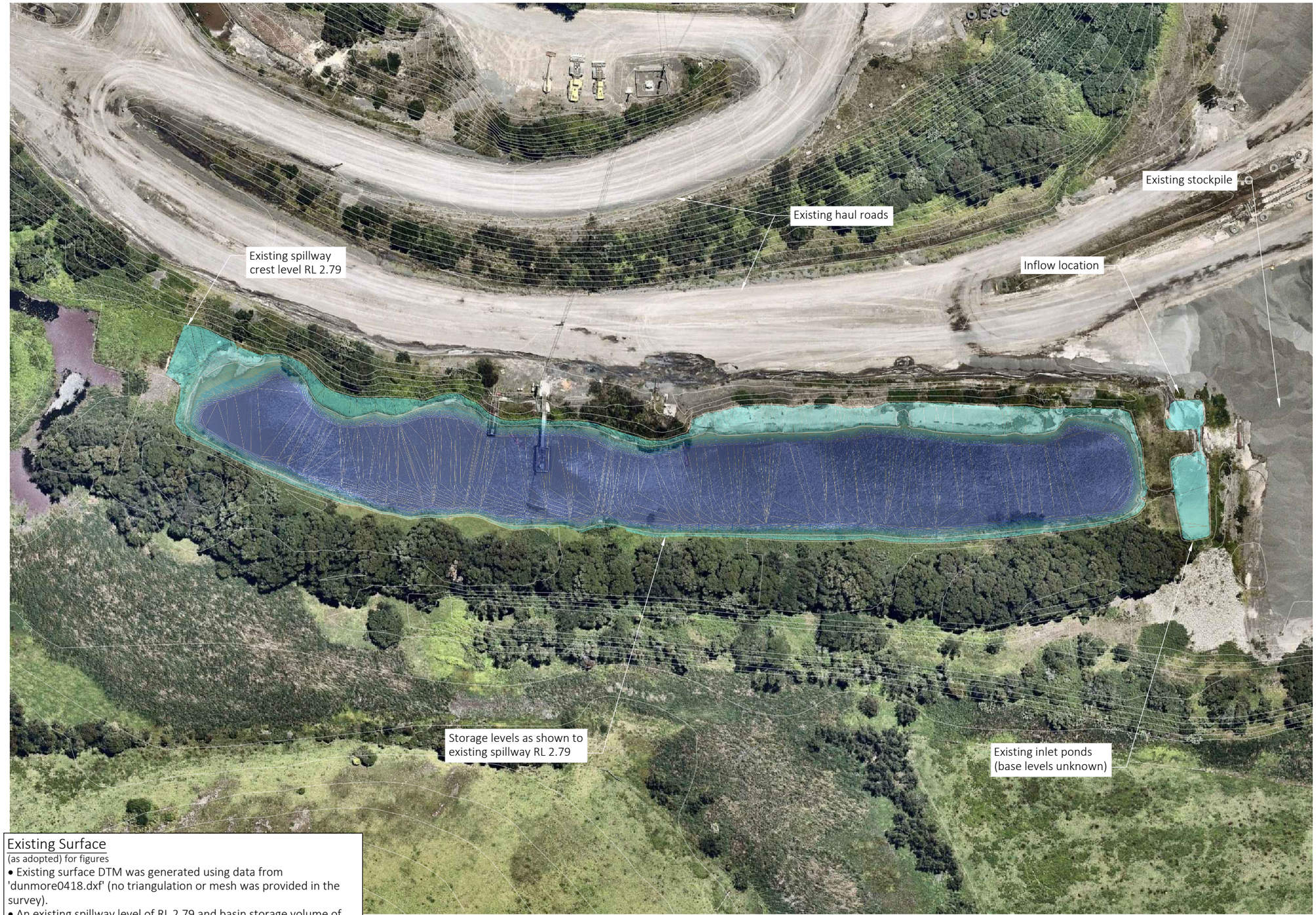


Existing Surface

(as adopted) for figures

- Existing surface DTM was generated using data from 'dunmore0418.dxf' (no triangulation or mesh was provided in the survey).
- An existing spillway level of RL 2.79 and basin storage volume of 13,135m³ (14,000m³ adopted) was provided by Boral.
- A volume of the DTM surface indicated an existing basin storage volume (to RL 2.79) of 9,250m³ (noting the basin lowest point within the survey was RL 1.258).
- A new basin floor was created at RL 0.26 this was a projection of the existing batters to the last known level (RL 1.258). A volume of 14,040m³ as shown above was calculated using this method.

Note: Utility information not available.

Existing Site Plan

SCALE 1: 1000

Existing storage

RL	Volume (m³)
2.79	14040
2.7	13385
2.6	12685
2.5	12002
2.4	11338
2.3	10684
2.2	10045
2.1	9441
2.0	8853
1.9	8278
1.8	7711
1.7	7152
1.6	6601
1.5	6057
1.4	5522
1.3	4993
1.2	4472
1.1	3960
1.0	3457
0.9	2962
0.8	2476
0.7	1998
0.6	1530
0.5	1069
0.4	618
0.3	175
0.2	0

Existing dam configution and storage volumes

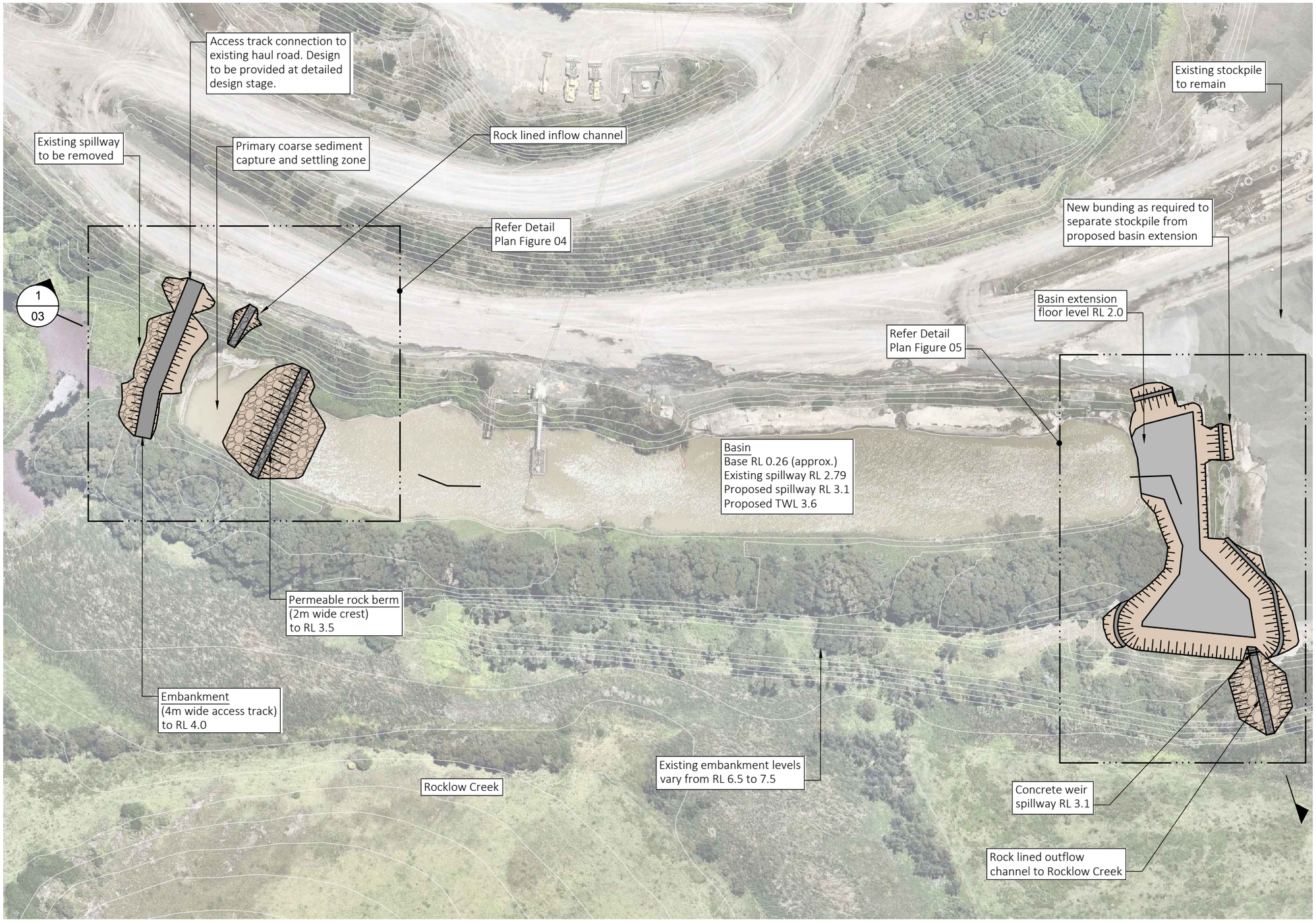
Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 01
Preliminary Design

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

0 10 20 50 m
1: 1000 @ A3 MGA Zone 56 AHD

N

EMM



Site Plan

SCALE 1: 1000

Legend

- Earthwork Batters
- Basin Extension Floor
- Earthworks Crest or Spillway
- Rock Lining or Permeable Berm
- Existing Surface Contour — 3 —
- Earthworks Windrow or Berm

Proposed work overview plan

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 02
Preliminary Design

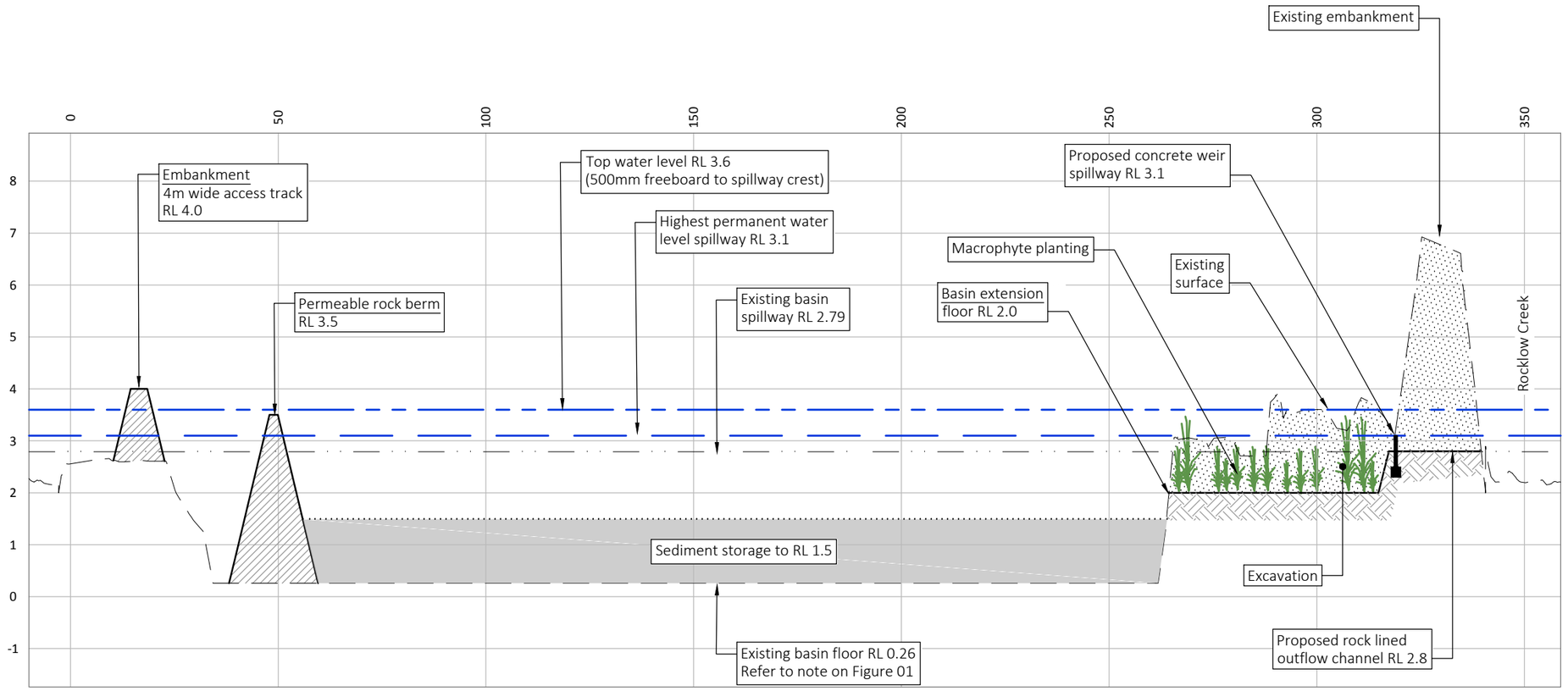
J180462 - DUNMORE \ Figure 02 Version 1 date 2019 03 13

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

0 10 20 50 m
1: 1000 @ A3 MGA Zone 56 AHD

N

EMM



DATUM R.L. -2.8

DESIGN FSL			3.50		0.87	3.47																					2.00	2.00	2.00	2.00	2.00	2.80	2.80			
MODIFIED SURVEY	2.56	2.62	2.61	1.43	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	3.04	2.98	3.85	3.60	3.73	3.78	6.77	2.49	2.22	
CHAINAGE	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	349	

SCALE 1: 1250(H) 1: 100(V)

Section 1/02

Legend

- Floor of Excavation
- Excavated Material
- Earthworks Filling / Embankment
- Sediment Storage
- Existing Surface
- Existing Spillway RL 2.79
- Highest PWL 3.1
- TWL 3.6

Site section

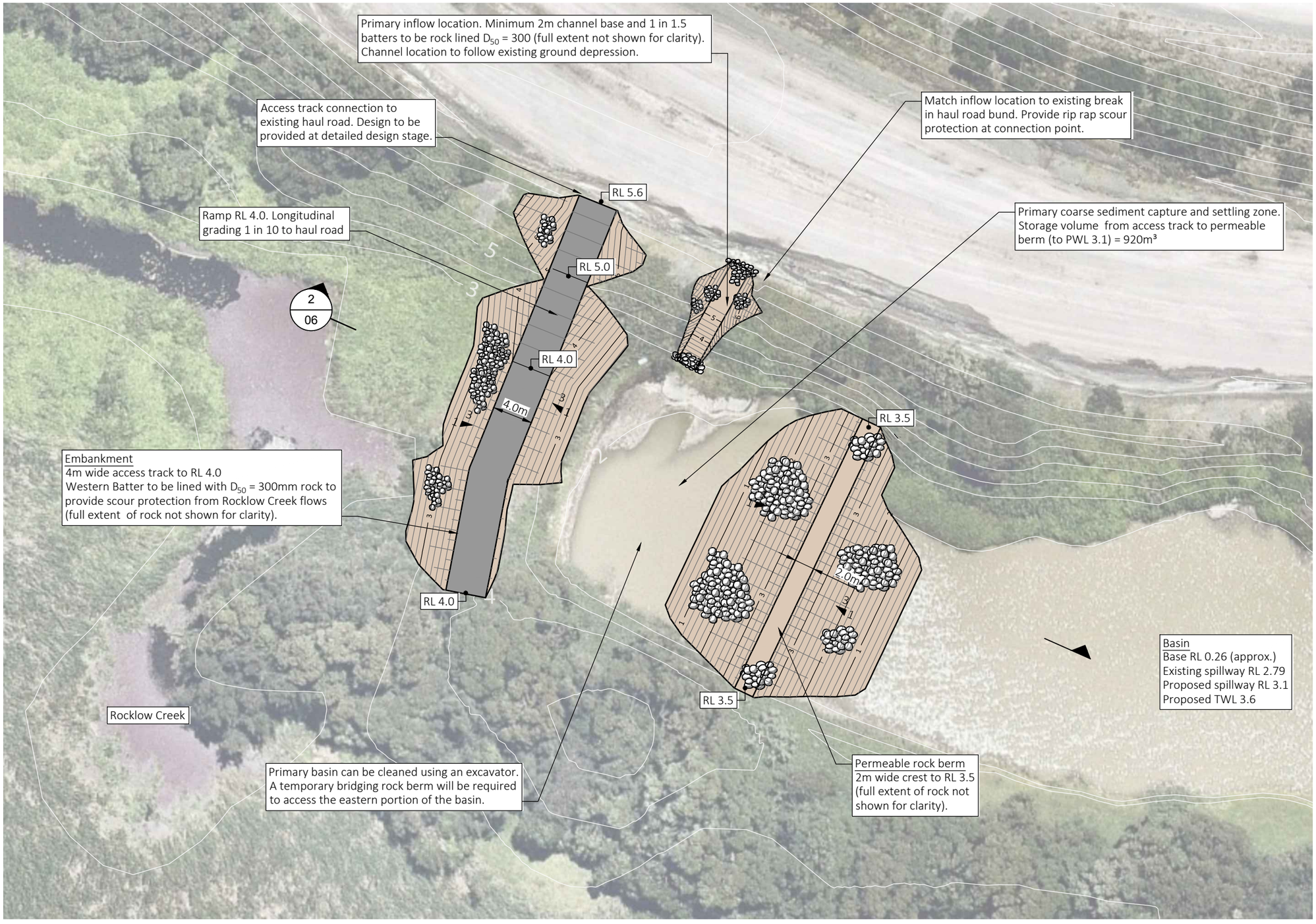
Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 03
Preliminary Design

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

0 12.5 25 62.5 m
1: 1250 @ A3 MGA Zone 56 AHD

0 1 2 5 m
1: 100 @ A3 MGA Zone 56 AHD

EMM



Detail Plan

SCALE 1: 400

Legend

- Earthwork Batters
- Access Track (Trafficable Pavement)
- Design FSL Contour Major — 2
- Design FSL Contour Minor
- Existing Surface Contour — 3

General arrangement
detail plan sheet 1

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 04
Preliminary Design

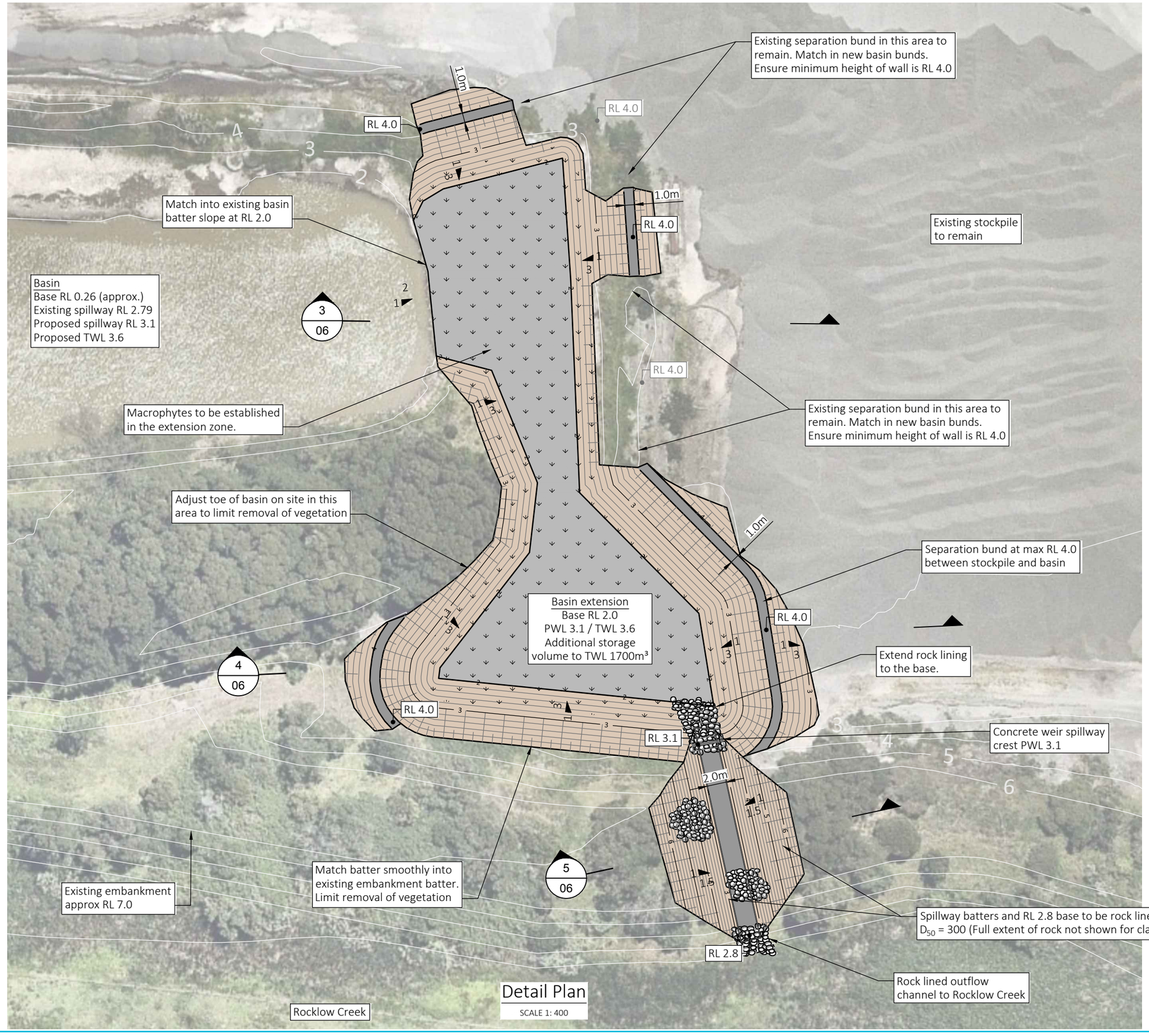
J180462 - DUNMORE \ Figure 01 Version 1 date 2019 03 13

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

0 4 8 20 m
1: 400 @ A3 MGA Zone 56 AHD

N

EMM



Detail Plan

SCALE 1: 400

Legend

- Earthwork Batters
- Basin Extension Floor
- Macrophyte Planting
- Earthworks Crest or Spillway
- Design FSL Contour Major — 2
- Design FSL Contour Minor
- Existing Surface Contour — 3

THE STABILITY OF THE EXISTING SEPARATION BUND WALLS AND SUITABILITY FOR RE-USE SHALL BE CONFIRMED PRIOR TO DETAILED DESIGN

General arrangement detail plan sheet 2

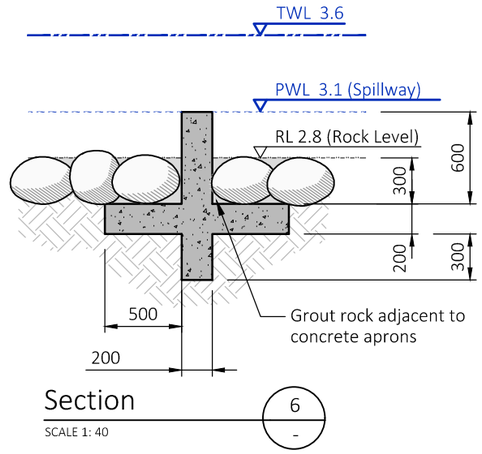
Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 05
Preliminary Design

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

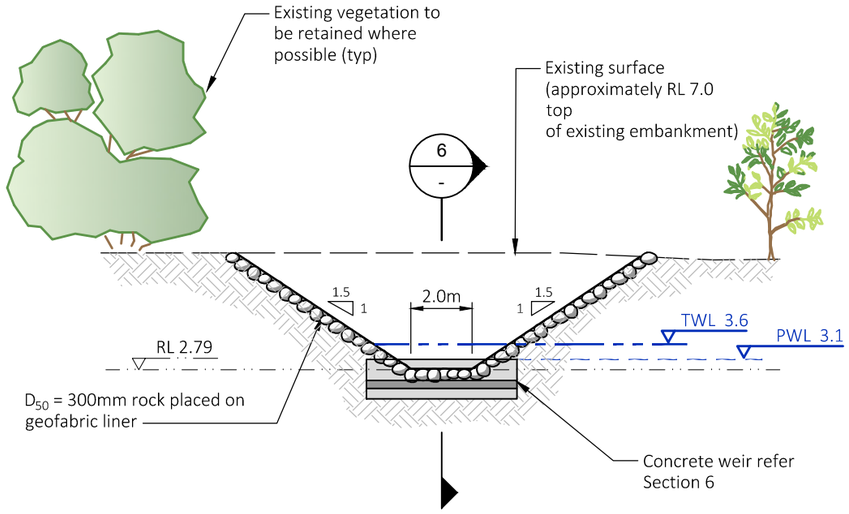
0 4 8 20 m
1: 400 @ A3 MGA Zone 56 AHD

N

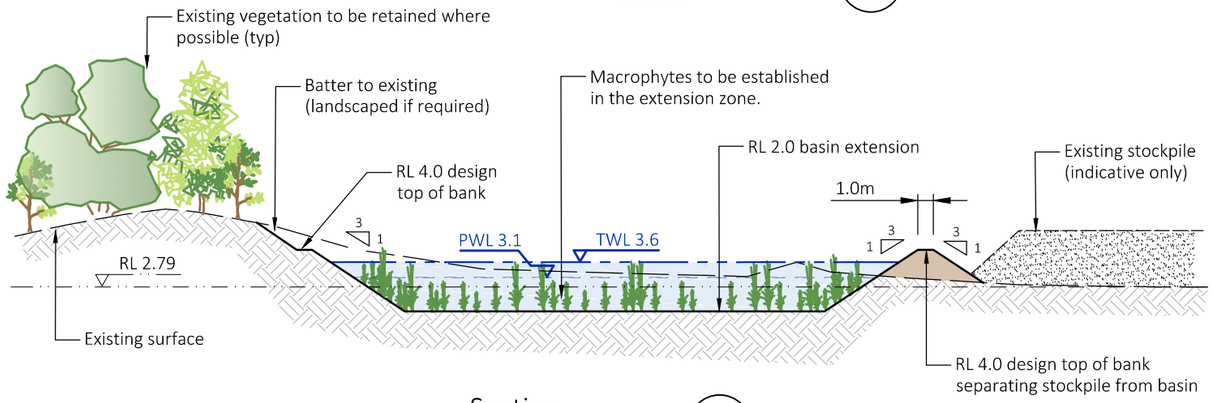
EMM



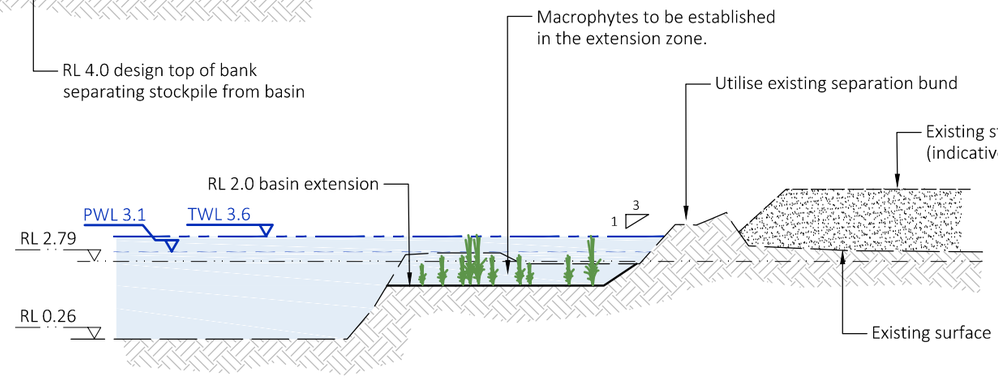
Section 6
SCALE 1: 40



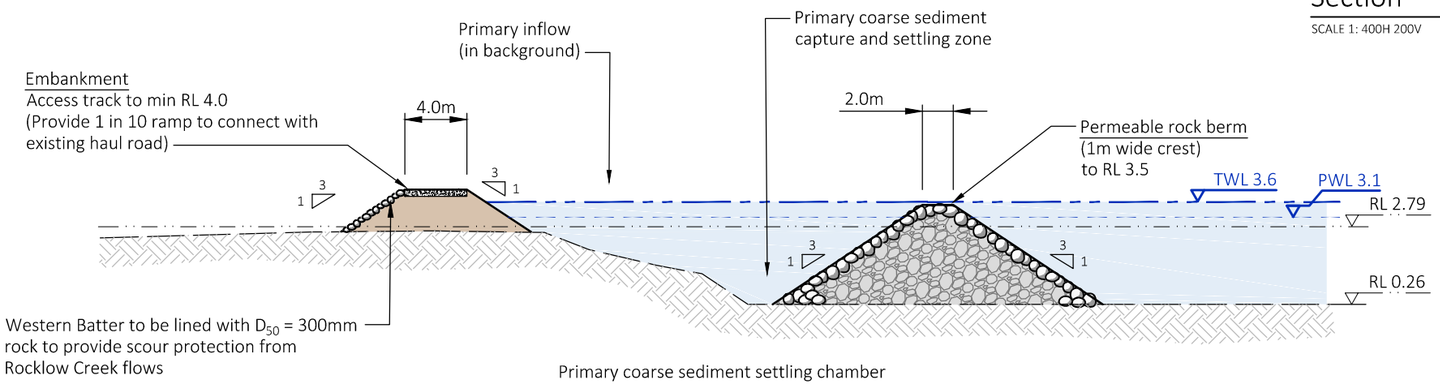
Section 5
SCALE 1: 200 (H) 1:100 (V)



Section 4
SCALE 1: 400H 200V



Section 3
SCALE 1: 400H 200V



Section 2
SCALE 1: 400H 200V

Legend

- Undisturbed Ground
- Existing Stockpile (Indicative)
- Earthworks (Filling)
- Permeable Berm
- Rock Lined Surface
- Existing Surface
- Existing Spillway RL 2.79
- PWL (Proposed Spillway) 3.1
- TWL (500mm Freeboard) 3.6
- Existing Vegetation

Typical sections

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 06
Preliminary Design

J180462 - DUNMORE \ Figure 06 Version 1 date 2019 03 13

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

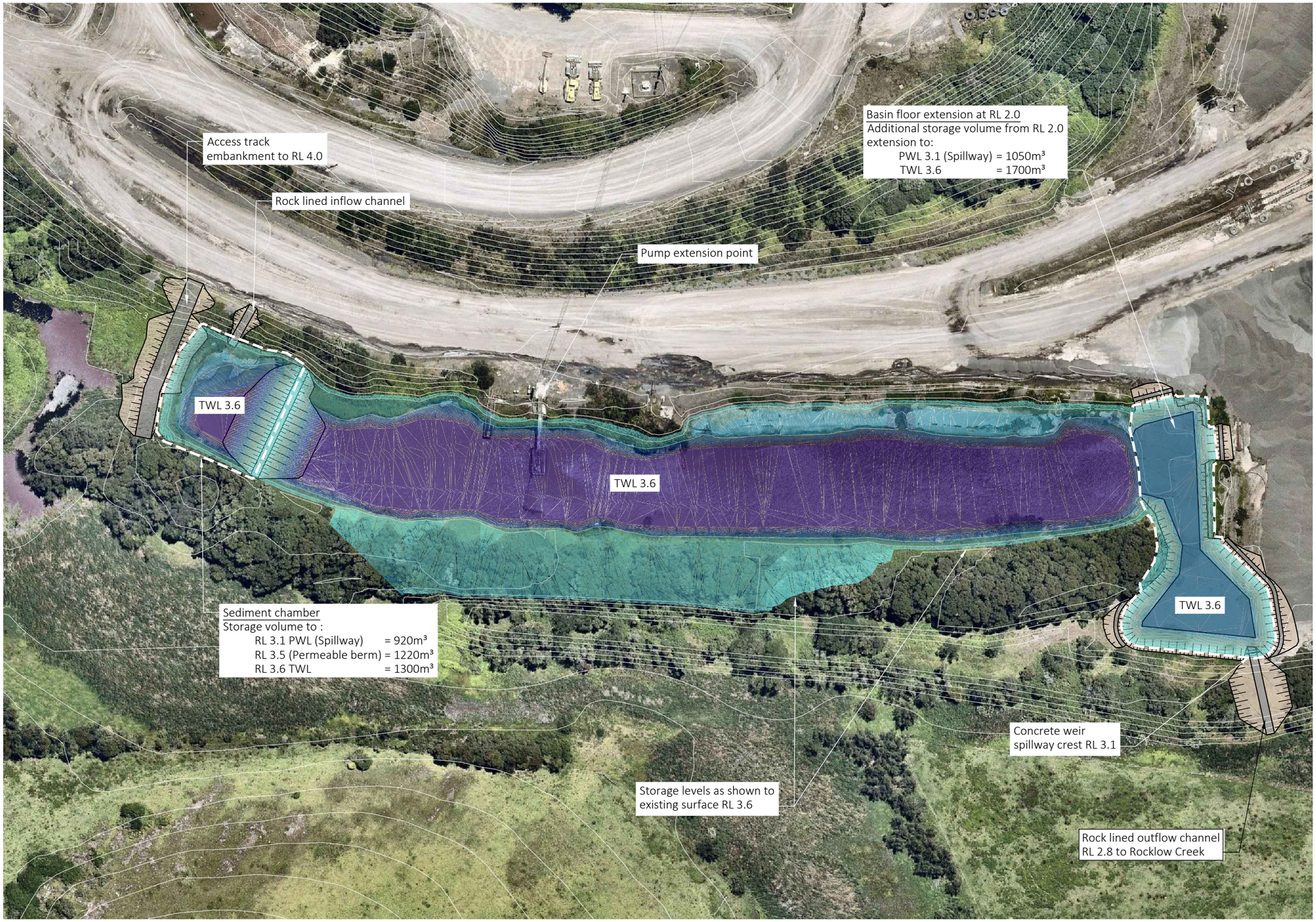
0 0.4 0.8 4 m
1: 40 @ A3 MGA Zone 56 AHD

0 1 2 5 m
1: 100 @ A3 MGA Zone 56 AHD

0 2 4 10 m
1: 200 @ A3 MGA Zone 56 AHD

0 4 8 20 m
1: 400 @ A3 MGA Zone 56 AHD

EMM



Storage Plan

SCALE 1: 1000

Storage (all areas)

RL	Volume (m³)
3.6	21925
3.5	20828
3.4	19756
3.3	18705
3.2	17677
3.1	16673
3.0	15712
2.9	14864
2.8	14057
2.7	13265
2.6	12488
2.5	11730
2.4	10994
2.3	10275
2.2	9577
2.1	8919
2.0	8283
1.9	7734
1.8	7195
1.7	6664
1.6	6143
1.5	5630
1.4	5126
1.3	4629
1.2	4142
1.1	3663
1.0	3194
0.9	2734
0.8	2283
0.7	1841
0.6	1408
0.5	984
0.4	568
0.3	161
0.2	1

Basin storage volumes

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 07
Preliminary Design

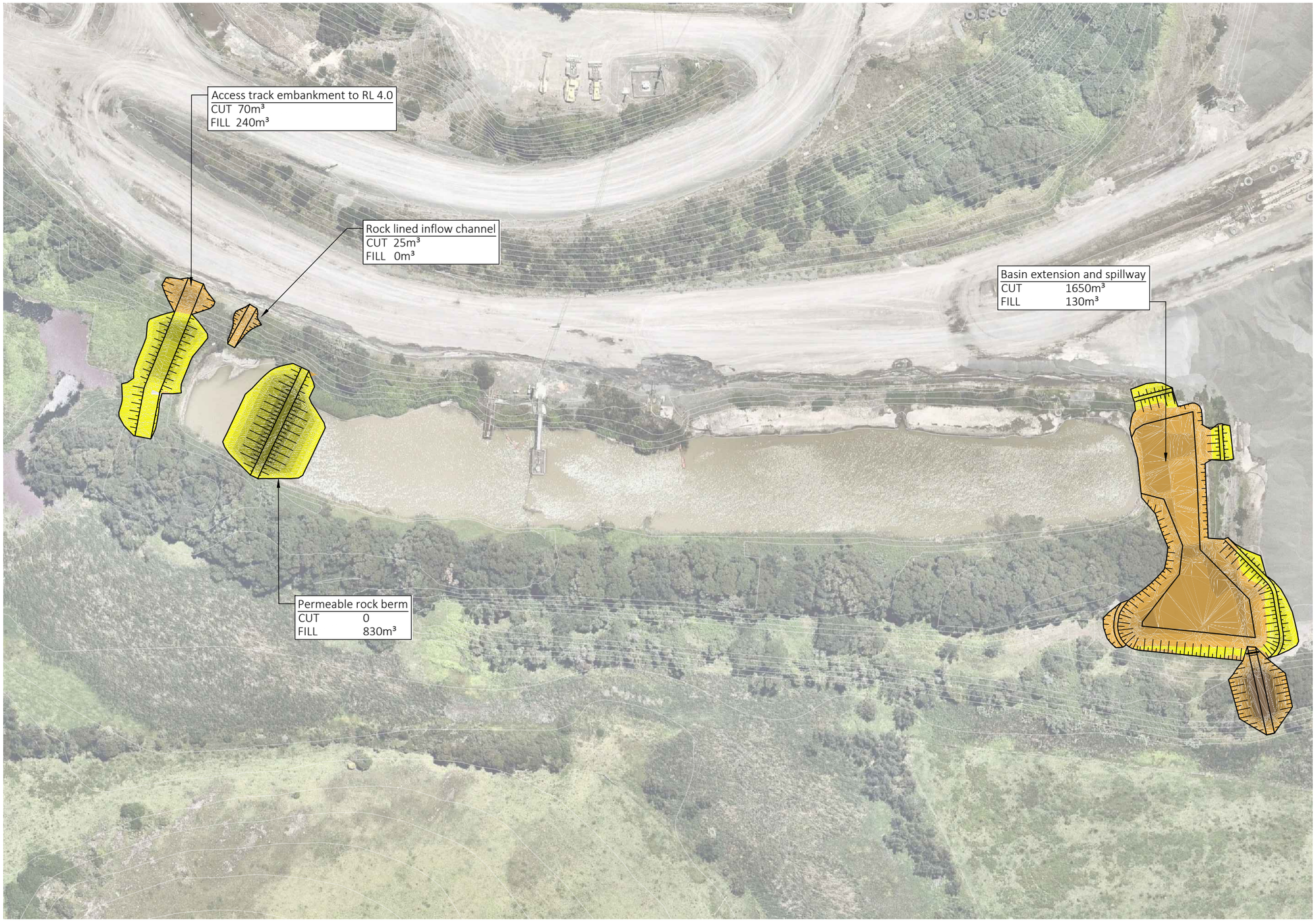
J180462 - DUNMORE \ Figure 07 Version 1 date 2019 03 13

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

0 10 20 50 m
1: 1000 @ A3 MGA Zone 56 AHD

N

EMM



Earthwork Volumes Plan

SCALE 1: 1000

VOLUME DEPTH TABLE

-4.2 (Max)	to	-3	CUT 1745m³
-3	to	-2.5	
-2.5	to	-2	
-2	to	-1.5	
-1.5	to	-1	
-1	to	-.5	
-.5	to	0	
0	to	.5	FILL 1200m³
.5	to	1	
1	to	1.5	
1.5	to	2	
2	to	2.5	
2.5	to	3	
3	to	3.5	
3.5	to	4.5 (Max)	

All volumes are in situ cubic metres from existing surface (no stripping) to finished surface levels as shown

0 10 20 50 m
1: 1000 @ A3 MGA Zone 56 AHD

N

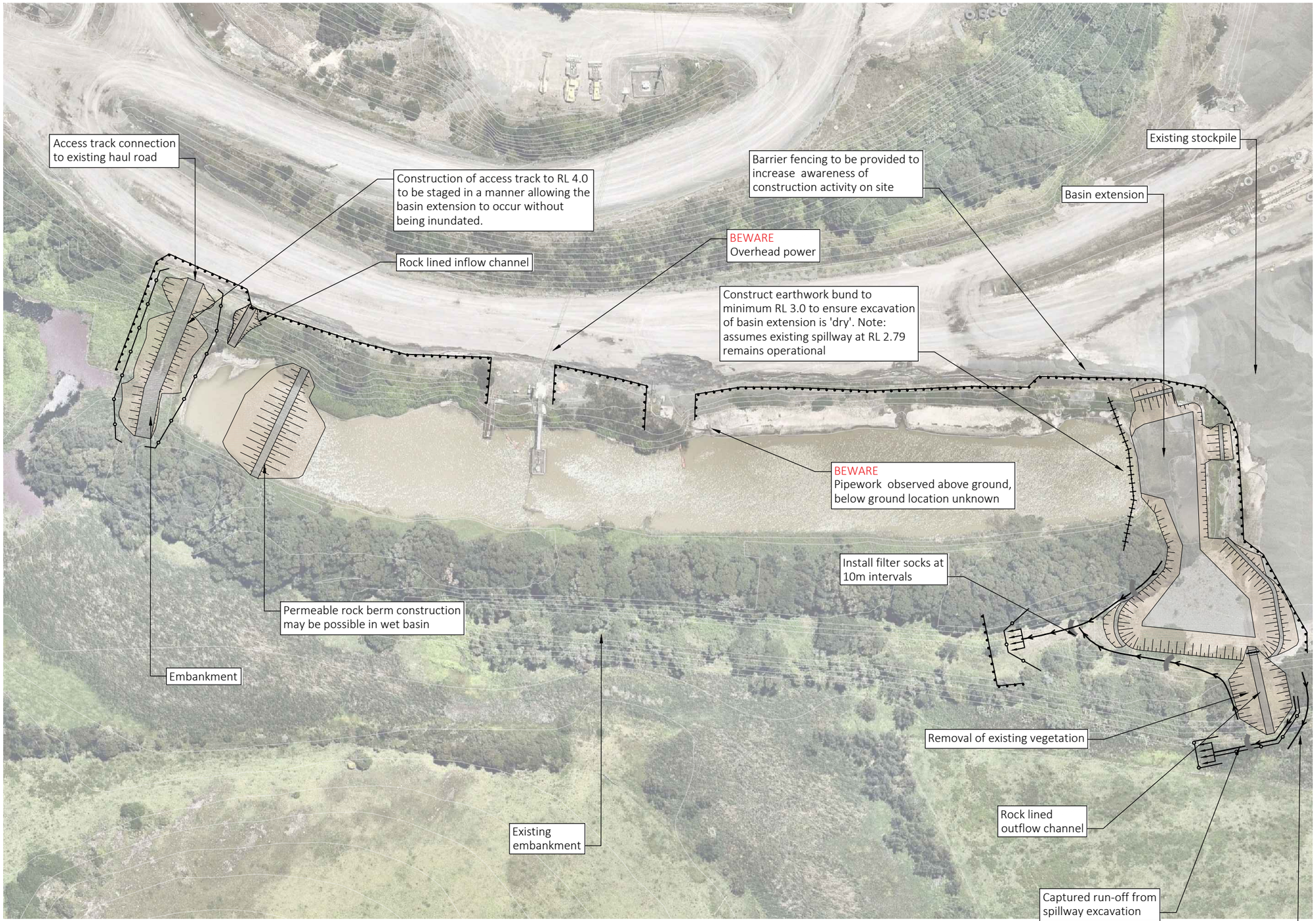
Earthwork volumes

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 08
Preliminary Design

EMM

J180462 - DUNMORE \ Figure 08 Version 1 date 2019 03 13

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION



Plan

SCALE 1: 1000

Legend

- Proposed Earthworks Footprint
- Proposed Stormwater Flows
- Barrier Fencing
- Sediment Fence
- Diversion Bund
- Discharge Structure
- Filter Sock

NOTE: Filter socks and proposed stormwater flows are shown in an indicative location only and will be progressively relocated to suit the construction staging of the basin.

Utility information not available.

Erosion and sediment control plan

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 09
Preliminary Design

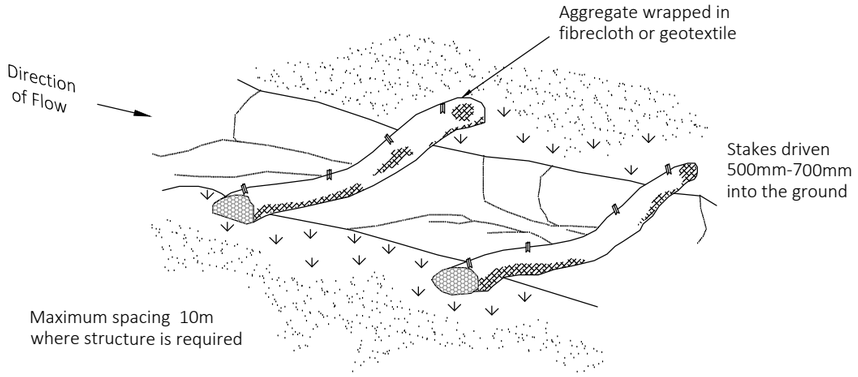
J180462 - DUNMORE \ Figure 09 Version 1 date 2019 03 13

PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

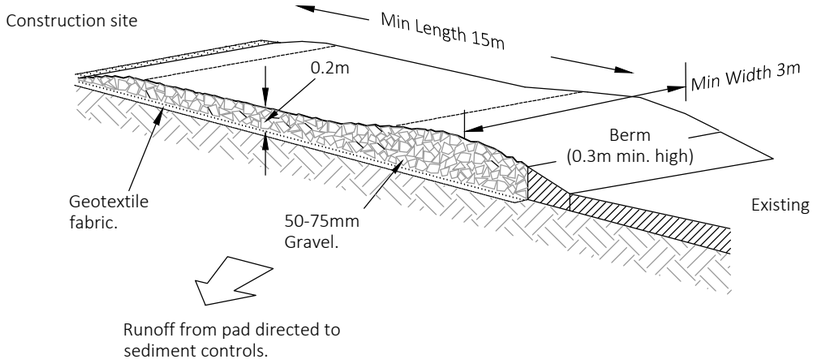
0 10 20 50 m
1: 1000 @ A3 MGA Zone 56 AHD

N

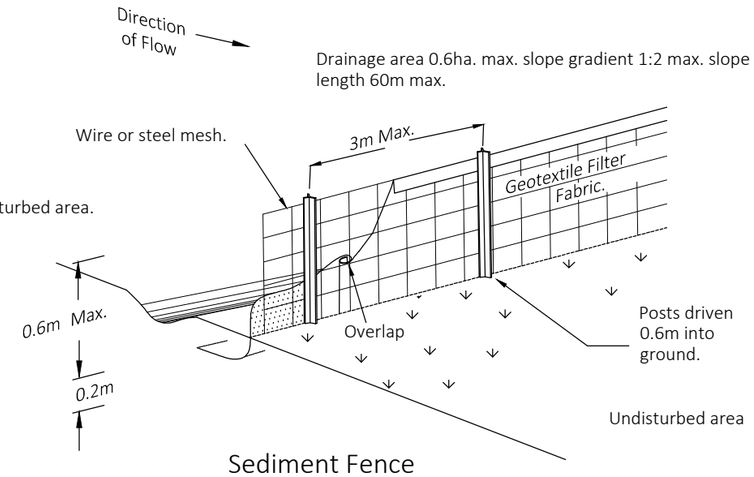
EMM



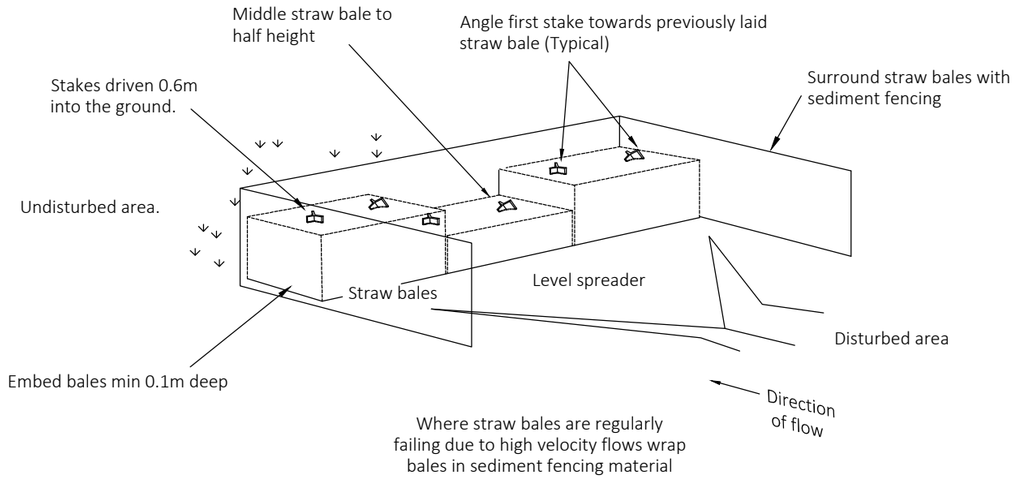
Filter Sock



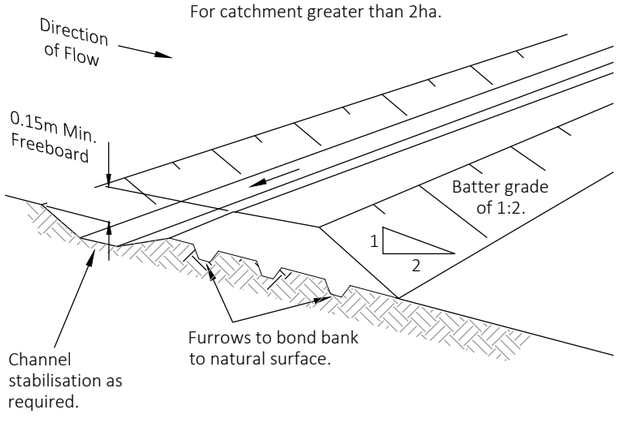
Temporary Construction Entry / Exit



Sediment Fence



Drainage Discharge Point



Diversioin Bank and Channel

Notes

1. These plans shall be used as a guide, all erosion and sediment controls shall be in accordance with the "Blue Book" Landcom 2004, 4th edition.
2. All Erosion and Sediment Controls (ESC) shall be checked weekly and immediately after rainfall. Sediment build up to be removed and controls repaired where necessary.
3. The contractor shall construct or install soil and sediment control measures to the satisfaction of the Superintendent prior to any disturbances to the site. Soil and sediment control devices shall be to the standard recommended by the NSW Department of Housings "Blue Book" titled "Managing Urban Stormwater and Construction - Volume 1" 4th edition.
4. The contractor shall regulaRLy maintain all Erosion and Sediment Control devices and remove accumulated sediment from such devices before 50% capacity is used. All the accumulated sediment shall be re-spread or removed in accordance with the superintendents instructions. The devices shall be maintained by the contractor until such time as the disturbed areas have been rehabilitated to a condition satisfactory to the superintendent.
5. The contractor shall maintain all re-vegetated areas including watering and fetilizing until such time as the vegetation has stabilized (minimum time is at least until the end of the works, or as per council requirements).
6. The contractor shall ensure temporary controls do not damage existing structures, kerbing, pavement or subgrades.
7. Vehicular access to the site shall be controlled through the access points identified. Vehicles not required in the performance of the works shall be parked off site away from disturbed areas.
8. All Erosion and Sediment Control measures to be installed prior to site disturbance to the extent that this can be practically achieved.
9. The contractor shall take care not to disturb any portion of the site other than in the immediate area of nominated undisturbed areas which shall be barricaded prior to the commencement of construction.
10. Drainage inlet protection to be provided from the commencement of the excavation.
11. All sediment control structures to be inspected following each rainfall event.
12. No disturbed area shall remain denuded for a period longer than 20 days.
13. The contractor must ensure the suitability and integrity of all works at the end of each days work.
14. All reasonable and practicable measures must be taken to ensure stormwater runoff from access roads and stabilized entry/exit systems, drains to an appropriate sediment control device.
15. Sediment deposited off site as a result of on-site activities must be collected and the area cleaned/rehabilitated as soon as reasonable and practicable. Concrete waste and chemical products, including petroleum and oil-based products, must be prevented from entering any internal or external water body, or any external drainage system, excluding those on-site water bodies specifically designed to contain and/or treat such material. Appropriate measures must be installed to trap these materials onsite. Stockpiles of erodible material must be provided with an appropriate protective cover (synthetic or organic) if the materials are likely to be stockpiled for more than 10 days.
16. Measures used must be appropriate for all working hours, out of hours, weekends, public holidays, and during any other shutdown periods.
17. All materials removed from Erosion and Sediment Control devices during maintenance, or decommissioning, whether solid or liquid, must be disposed of in a manner that does not cause any ongoing erosion or pollution hazard.

Erosion and sediment control details

Dunmore Hard Rock Quarry
Lower Dam Modification
Figure 10
Preliminary Design

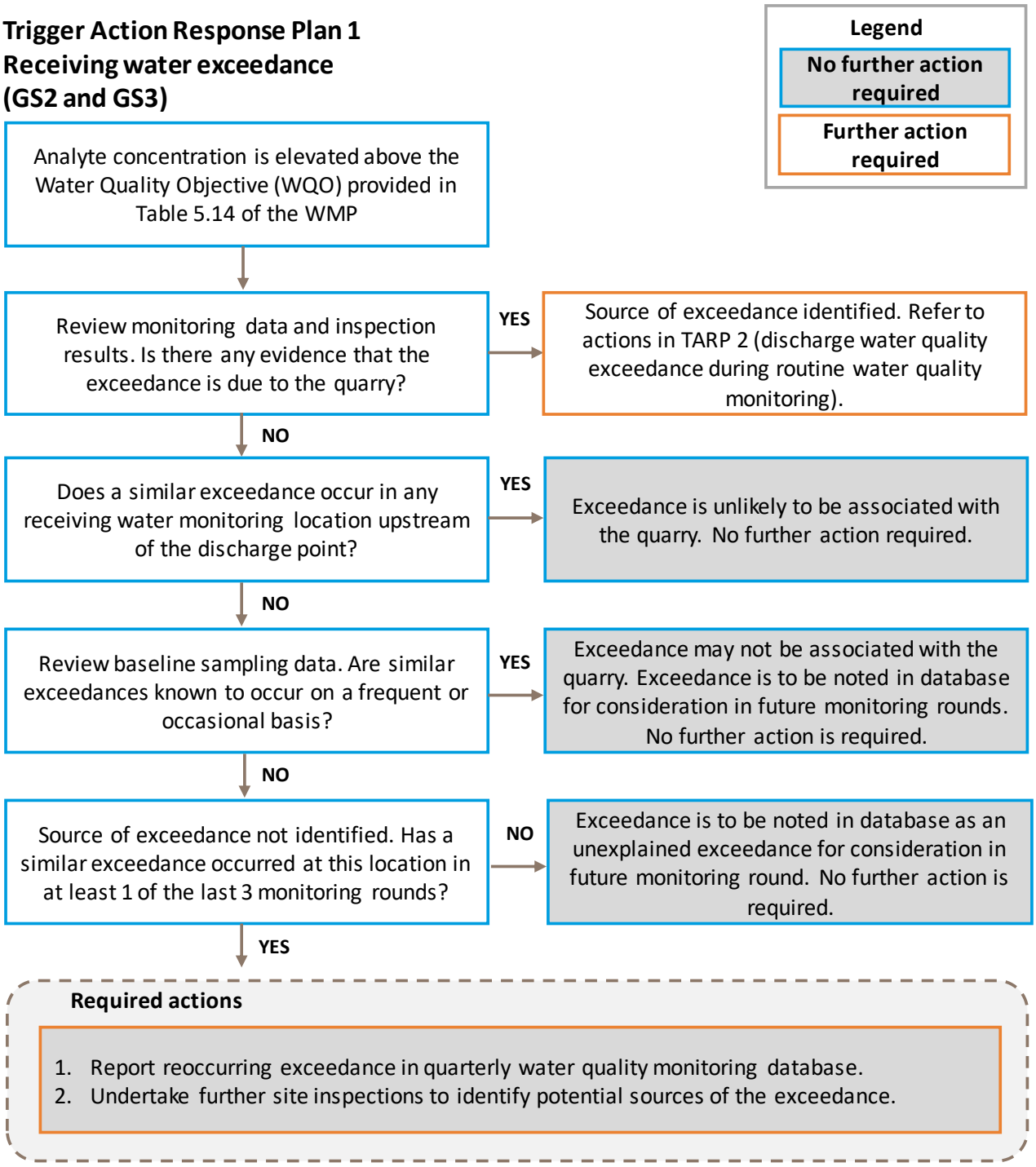
PRELIMINARY DESIGN
NOT FOR CONSTRUCTION

Appendix H

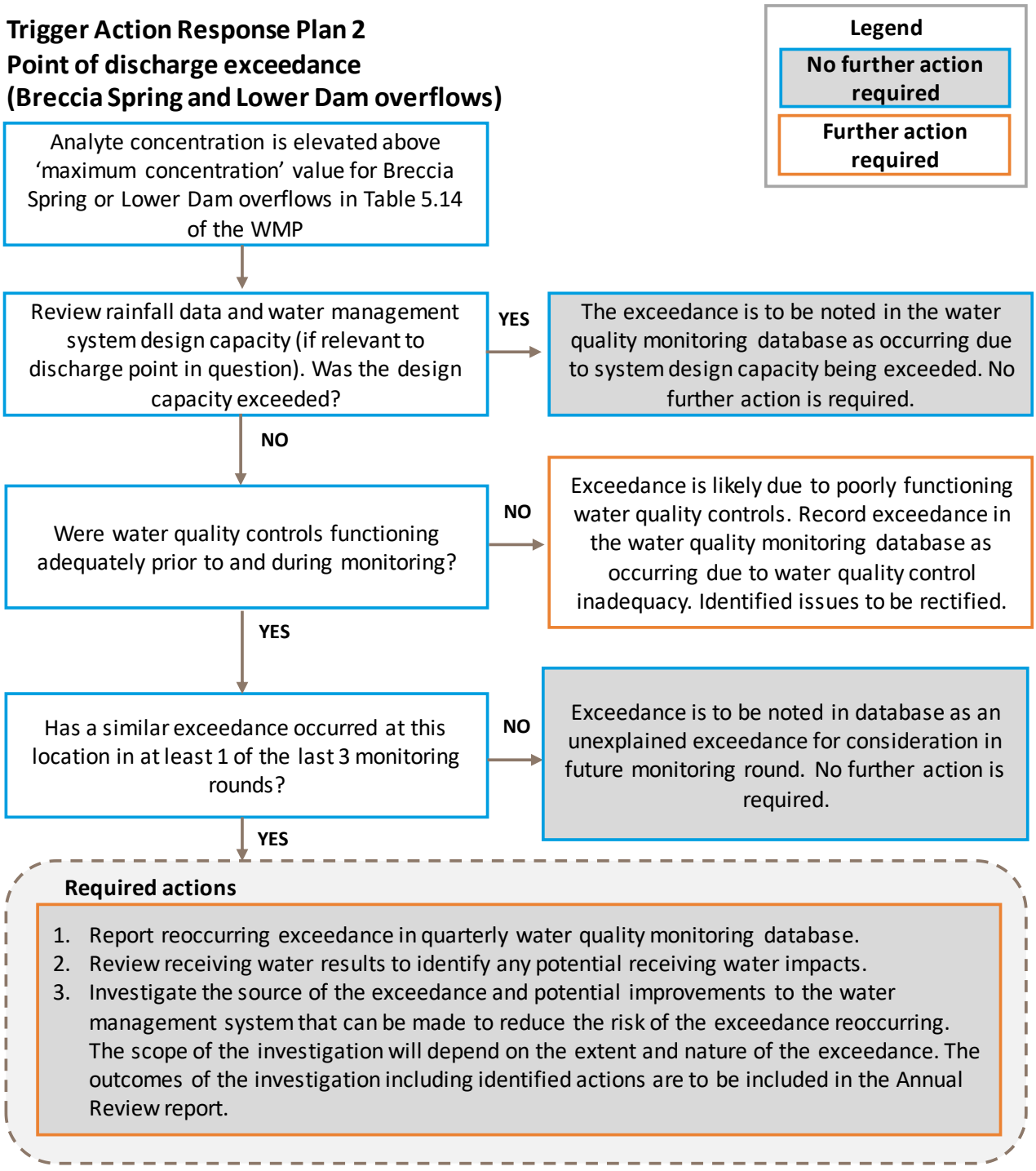
Trigger Action Response Plans

EMM
creating opportunities

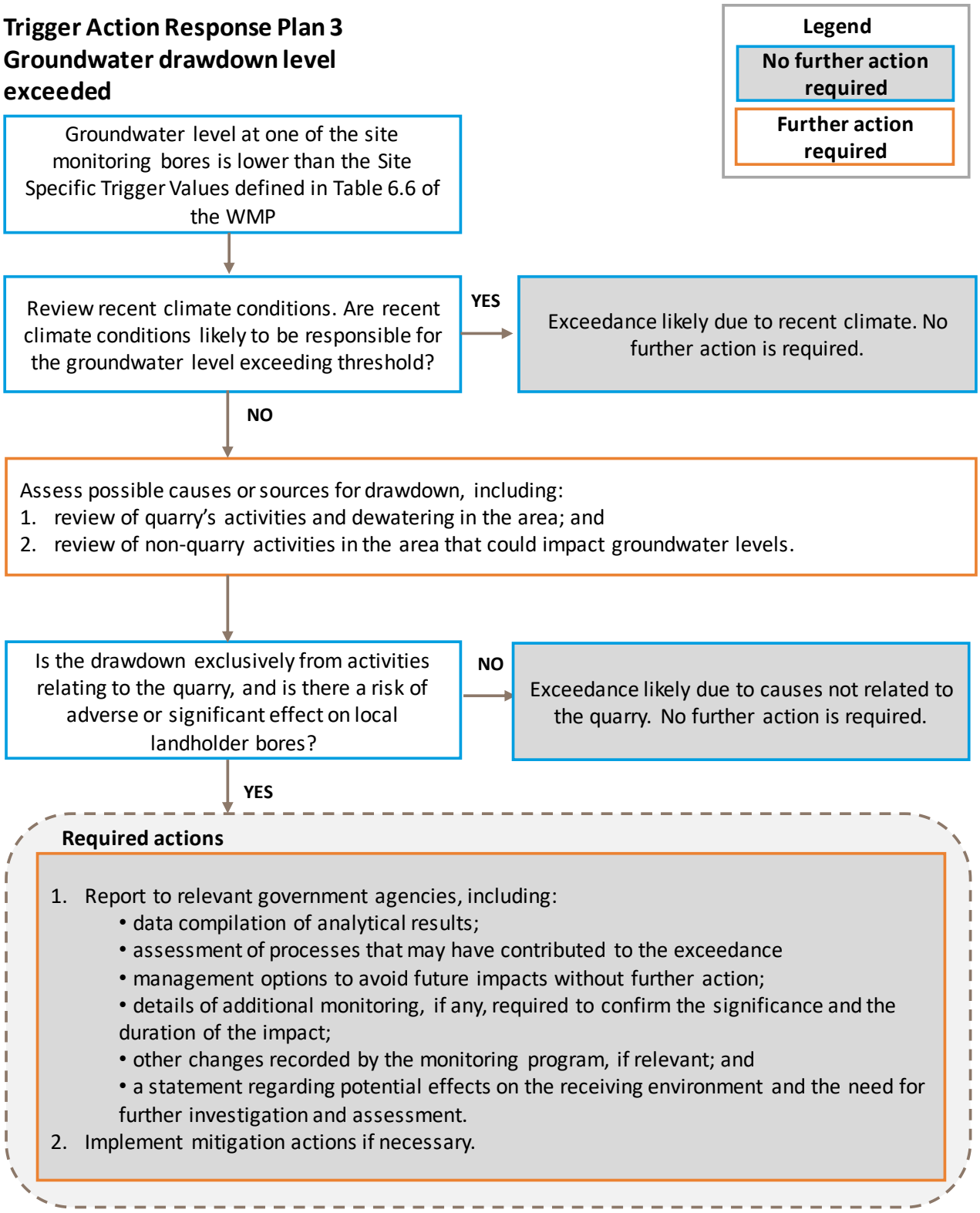
Trigger Action Response Plan 1
Receiving water exceedance
(GS2 and GS3)



Trigger Action Response Plan 2
Point of discharge exceedance
(Breccia Spring and Lower Dam overflows)



Trigger Action Response Plan 3
Groundwater drawdown level exceeded



Appendix I
ESCP checklist

EMM
creating opportunities

Environment Inspection Checklist DQ-ENV-FO-01

This checklist must be completed once a month, by an allocated person as decided by the Site Management. Actions arising from the inspection are to be listed in the spaces provided below, uploaded to SIMs and tracked by Site Managers. All completed checklists showing signed-off actions must be kept on file.

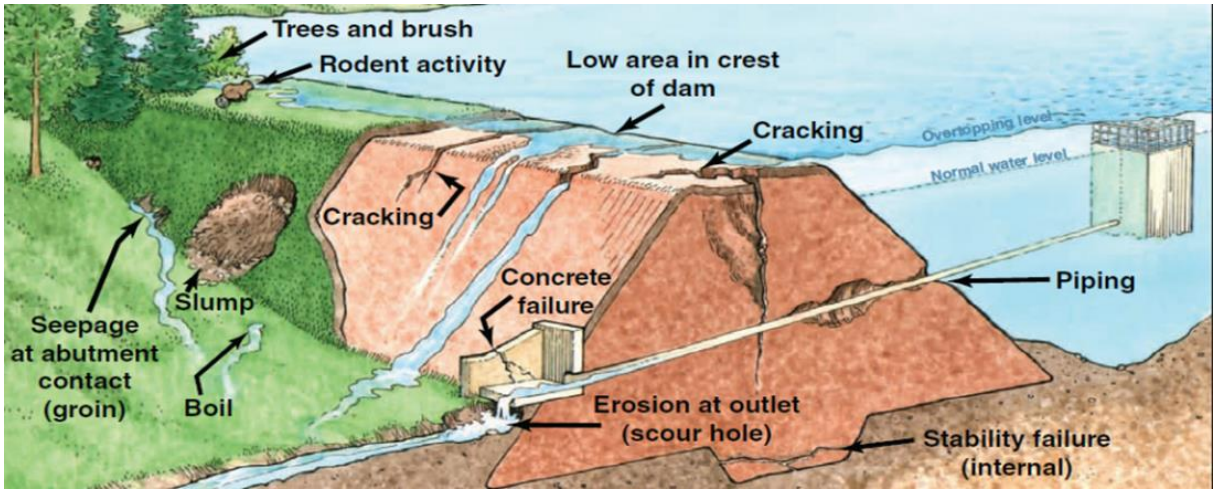
Inspector Name:		**Date:**		**Signature:**	

Item	Checklist Item	Status			Comments
		C	NC	N/A	
GENERAL REQUIREMENTS					
1.	Inspect site entrance – *check sediment on road, product build up on rail line, rubbish, drag ou, signage for covering loads and going through wheel wash – action clean up*				
2.	Inspect site boundary – *Fences in good condition etc.*				
3.	Check extraction boundaries are clearly marked out and intact.				
4.	Any complaints received in the last month have been recorded and managed through SIMS. All relevant complaints discussed at toolbox/pre-start meetings.				
5.	Site Emergency Response plan and PIRMP current and displayed .				
6.	All SWMS prepared have addressed relevant environmental management aspects (dust, noise, water, erosion etc).				
7.	Download weather station data and ensure station maintenance is up to date.				
LAND MANAGEMENT					
8.	No vegetation cleared with out approval as per GRP-HSEQ-8-03 Land Management.				
9.	Future vegetation clearing planned in next month has approval as per GRP-HSEQ-8-03 Land Management.				
10.	Any spills added to the site Contaminated Land Register				
FLORA AND FAUNA MANAGEMENT					
11.	No major infestations of Weeds and Feral animals.				
12.	No evidence of animal interaction on site, No animals being fed on site. Any wildlife found on site communicated to site supervisor and wildlife hotline contacted for injured wildlife.				
13.	Goodbush inspection has been undertaken for the month(see Environmental Coordinator for more details)				
14.	Management actions undertaken in accordance with management plans for Compensatory Habitat Area, Remnant Conservation Area and Offset Area. (Refer to FFMP and Environmental Coordinator)				
15.	All weed management inspections and records (identified weeds, chemicals and volumes used, etc.) filed in Environmental Management Records. Ensure that recommendations are followed up on.				
REHABILITATION MANAGEMENT					
16.	Rehabilitated areas and areas undergoing rehabilitation inspected – *Area clearly marked, no sign of disturbance.*				
17.	Review site operations, identify any areas for rehabilitation potential as per site rehabilitation management plan and plan future work where appropriate.				
WASTE MANAGEMENT					

Item	Checklist Item	Status			Comments
		C	NC	N/A	
18.	Designated Waste areas/bins available and inspected *- Recyclables (Cans, bottles, paper)* *- Oily waste (Rags, filters, empty containers, oil)* *- General waste / Other*				
19.	Waste/Spare tyre storage areas inspected and tyre storage register updated.				
20.	Waste Register/ Records maintained and up to date detailing; *Waste Sources Quantities, Disposal Methods, Disposal Routes.*				
21.	No evidence of illegal dumping on site – *report any to HSE.*				
22.	Operational and Workshop area tidy – good general house keeping and no evidence of littering and rubbish.				
23.	Waste storage tanks, in working order and have no leaks				
NOISE & BLAST MANAGEMENT					
24.	Check activities, plant and equipment isn't causing un-usual or excessive noise. (Annual Assessment due in July).				
25.	All blasts were compliant with monitoring criteria and blast reports filed.				
AIR MANAGEMENT					
26.	Dust controls in place and in working order such as – *Water Sprays, Water Carts, Bag Filters, Enclosed Equipment etc. Record any broken, unworking systems or areas that require maintenance*				
27.	No Air Emission from broken down plant and machinery				
28.	Fines stockpile kept at manageable volume. Transfer of fines to DSS operation maximised.				
29.	PM10 monitoring completed on schedule (monitoring run every 6 days), and maintenance of Hi-Vol Air Sampler up to date. (Refer to Environmental Coordinator)				
30.	Deposited Dust monitoring completed on schedule (monthly)				
31.	All monitoring data recorded, reviewed, and any exceedances investigated.				
32.	Is there any visible dust on site.				
TRANSPORT MANAGEMENT					
33.	All new road haul drivers inducted and provided code of conduct.				
HYDROCARBON / SPILL MANAGEMENT					
34.	Spill response equipment available - *spill kits, MSDS, PPE*				
35.	Bunds used for the storage of hydrocarbons and chemicals able to capture 110% of stored liquid. Not filled with rain water or spills				
36.	Flammable liquids stored in designated area fitted with dry chemical or carbon dioxide extinguisher				
37.	Dangerous Goods are clearly labelled, sealed and returned to bund/cabinet after use. *No fuel containers/paint tins lying around site*.				
38.	Batteries are stored on pallet above ground				
39.	Storage areas are appropriately signed				

Item	Checklist Item	Status			Comments
		C	NC	N/A	
40.	Any spills entered into SIMS				
41.	Above Ground Storage Tanks (ASTs) – *No visible leaks, include in comments condition of valves, pumps, lines, and correct signange.*				
42.	Inspect Fuel bay area – *Check for evidence of spillage or leaks, check spill capture area and clean-up if required.*				
43.	Are there any signs of spills across site				
44.	Inspect the oil bay for: • No used rubbish, rags, are bins emptied • Is there sufficient lighting • Clean rags available • Items stored safely and correctly • Are doors and locks in good operation • Are there any slip, trip and/or fall hazards • Warning signs visible and in good condition • Are fire fighting equipment available and in working order				
WATER MANAGEMENT					
45.	Lower Dam water quality monitored.				
46.	Any discharges from the site (controlled and/or uncontrolled) have been monitored and water quality recorded, with exceedances referred to the environmental coordinator (Refer to Water Management Plan)				
47.	Water transfer volumes recorded (in Litres), and entered into database.	Watercart use: Plant use: Lower Dam to Middle Dam: Middle Dam to Lower Dam: Croome Sumps to Middle Dam (Estimate): Controlled Discharge:			
48.	Dam and upstream rocklow creek pressure sensors monitoring data downloaded in the last 3 months?				
49.	**Stormwater Management / Erosion and Sediment Control Inspection (TO BE COMPLETED MONTHLY AND FOLLOWING >50mm RAINFALL)**				
	Is clean water runoff areas directed away from dirty water catchments?				
	Are there any signs of erosion on site associated with operational activities and roads?				
	Inspect dam water levels.				
	Inspect Lower dam entry points, spillway and entry into Rocklow creek, bio-filtration swale, pump and flow meter at controlled discharge point.				
	Inspect Middle Dam flow entry and exit points (spillways) for erosion, and rectify if required				
	Inspect Middle and Lower Dam and evaluate level of sedimentation. De-silt dams as required (dry material on site for re-use where appropriate (safety bunds etc)				

Item	Checklist Item	Status			Comments
		C	NC	N/A	
	Inspect all site catchments for evidence of erosion, inspect all drainage infrastructure and clean out/maintain if required. *(Croome West area, Pit area, RIC Catchment, Main product Stockplie area, Park up and Fuel Bay Area, Workshop and Office area, Processing plant area, rail and lower stockpile area.)*				
	Are existing erosion controls adequate (silt fencing, hay bales), and do these areas need to be de-silted?				
	Is there any evidence in the downstream waterway (Rocklow creek) of increased turbidity due to the Quarry operations?				
	If applicable are external surfaces of bunds vegetated?				
	Do water quality monitoring results indicate that the erosion and sediment controls are suitable for meeting the water quality objectives/criteria?				
	Are there any additional controls that could be implemented to minimise erosion and sedimentation.				
DAM MANAGEMENT					
50.	Middle Dam: Is there any signs of the following: • Slumping on the downstream side of the dam wall • Is there any cracking on the dam face • Is there any damage to the discharge valves • Is there an increase of seepage of water downstream of the dam • Is there any signs of animal borrowing on the dam face • Is there any signs of a sudden drop in dam water level				



Environment Inspection Checklist DQ-ENV-FO-01

Detail any items that require attention and/or remedial action. Actions are to be uploaded to SIMS as incident type 'Environmental'. The Site Manager must monitor progress and completion of actions.

Finding/Actions Required					
Item No.	**Comment**	**Action Taken**	**By Who**	**By When**	**SIMs No.**

Australia

SYDNEY
Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
422 Richards Street Unit 170
Vancouver BC V6B 2Z4
T 604 999 8297

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