Holcim (Australia) Pty Ltd

Dunloe Sand Quarry

Soil and Water Management Plan

October 2020

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1. Introduction

This Soil and Water Management Plan (SWMP) forms part of the Environmental Management Strategy (EMS) for Dunloe Sand Quarry. This SWMP has been prepared to meet the requirements of the Minister's Conditions of Approval (CoA) outlined in Development Consent No. 06_0030, the mitigation measures outlined in MOD2 (GHD 2017), the Environmental Impact Statement (EIS) (Planit 2007), the Environment Protection Licence 13077 (EPL) and relevant legislation.

1.1 Objectives

The key objective of the SWMP is to ensure that impacts on soil and water quality during operations are minimised and within the scope permitted by the development consent.

1.2 Targets

The following targets have been established for the management of soil and water impacts during the operational lifetime of Dunloe Sand Quarry:

- Ensure full compliance with the relevant legislative requirements and CoA
- Meet EPL water quality discharge parameters for all planned discharges
- Ensure training on soil and water management is provided to all relevant personnel through site inductions

1.3 Consultation

Extensive consultation was undertaken with the local community during preparation of the EIS. Any concerns identified by relevant stakeholders were addressed in the EIS and mitigation measures developed which have been incorporated into this SWMP. As per CoA 18(a), Schedule 3, the Environment Protection Authority (EPA) and Department of Industry (DoI) (now Department of Planning, Industry and Environment) (DPI&E) were consulted in relation to the SWMP. No response was received from DoI. Evidence of the consultation is provided in Appendix A.

2. Relevant legislation

2.1 Legislation

Legislation relevant to soil and water management includes:

- *Protection of the Environment Operations Act 1997 (POEO Act)*
- *Water Management Act 2000 (WM Act)*
- *Fisheries Management Act 1994 (FM Act)*
- *Water Act 1912 (Water Act)*

Further discussion of the above legislation is provided in the EMS, as well as the EIS and MOD2.

2.2 Guidelines

The following guidelines have been considered during development of this SWMP:

- Acid Sulfate Soils Manual (ASSMAC 1998)
- Soils and Construction, Managing Urban Stormwater, Volume 2E Mines and Quarries, 4th Edition (Blue Book) (Landcom 2004)
- NSW Aquifer Interference Policy (DPI – Office of Water 2012)
- Guidelines for Managing Risks in Recreational Water (NHMRC 2008)
- Code of Practice for Soil and Water Management on Construction Sites
- Development Design Specification D7 – Stormwater Quality and Tweed Urban Stormwater Quality Management Plan

2.3 Conditions of approval

The CoA relevant to this SWMP are listed below in Table 2-1. A cross reference is also included to indicate where the condition is addressed in this SWMP or other environmental management documents.

Table 2-1 Conditions of approval relevant to this SWMP

<table>
<tr><th>Condition No.</th><th>Requirement</th><th>Reference</th></tr>
<tr><td>Schedule 3, Condition 8</td><td>Except as may be expressly provided for by an EPL, the Proponent must not discharge any water from the project or ancillary operational areas. The Proponent must ensure that the extraction pit subject to dredging is maintained and operated to prevent discharges of any surface water from these ponds.</td><td>Table 5-1</td></tr>
<tr><td>Schedule 3, Condition 9</td><td>The Proponent must aim to meet the water quality objectives in Table 4 for water in the dredge ponds and in groundwater adjacent the dredge ponds, unless otherwise approved by the Secretary.
Table 4: Water Quality Objectives
<table>
<tr><th>Pollutant</th><th>Unit of Measure</th><th>Water Quality Objectives</th></tr>
<tr><td>Turbidity</td><td>NTU</td><td>5-20</td></tr>
<tr><td>pH</td><td>pH</td><td>6.5-8.5</td></tr>
<tr><td>Oil and Grease</td><td>mg/L</td><td>10</td></tr>
<tr><td>Salinity</td><td>µS/cm</td><td><3000</td></tr>
<tr><td>Dissolved Oxygen</td><td>mg/L</td><td>>6</td></tr>
</table></td><td>Table 6-1</td></tr>
</table>

<table>
<tr><th>Condition No.</th><th>Requirement</th><th>Reference</th></tr>
<tr><td></td><td>
<table>
<tr><td>Chlorophyll-a</td><td>µg/L</td><td>2-10</td></tr>
<tr><td>Faecal coliforms</td><td>Median No./100mL</td><td><1000</td></tr>
<tr><td>Enterococci</td><td>Median No./100mL</td><td><230</td></tr>
<tr><td>Algae and blue green algae</td><td>No. cells/mL (M. aeruginosa)</td><td><50000</td></tr>
<tr><td></td><td>mm^3/L (total biovolume)</td><td><4</td></tr>
<tr><td>Sodium</td><td>mg/L</td><td>500</td></tr>
<tr><td>Potassium ion</td><td>mg/L</td><td>40</td></tr>
<tr><td>Magnesium</td><td>mg/L</td><td>100</td></tr>
<tr><td>Chloride ion</td><td>mg/L</td><td>1000</td></tr>
<tr><td>Sulphate ion</td><td>mg/L</td><td>800</td></tr>
<tr><td>Bicarbonate ion</td><td>mg/L</td><td>400</td></tr>
<tr><td>Soluble Iron ion</td><td>mg/L</td><td>20</td></tr>
<tr><td>Soluble aluminium ion</td><td>mg/L</td><td>0.5</td></tr>
<tr><td>Ammonium ion</td><td>mg/L</td><td>20</td></tr>
</table>
Notes:
· The objectives for dissolved oxygen, turbidity and algae are relevant to surface water only.
· The Department acknowledges that short term exceedances of these objectives may occur during natural events such as flooding.
· The Department acknowledges that pre-existing water quality may not meet the objectives for some analytes, including salinity. The proponent must strive to meet the water quality objectives through implementation of the Soil and Water Management Plan (see condition 18 below), as far as is reasonable and feasible and within the Proponent's control, to the satisfaction of the Secretary.
</td><td></td></tr>
<tr><td>Schedule 3, Condition 10</td><td>The Proponent must ensure that all excavated potential acid sulfate soil fines material is returned back to below the watertable as soon as possible to prevent oxidation. No potential acid sulfate soil must be removed from the site, unless adequately neutralised in accordance with methods approved under the Soil and Water Management Plan.</td><td>Table 5-1</td></tr>
<tr><td>Schedule 3, Condition 11</td><td>The Proponent must ensure that all potential acid sulfate soil fines material is discharged into the pond at a depth of no less than 3 metres from the water surface, and that all fines are deposited to a final depth of at least 8 metres from the water surface, unless an alternative method(s) is approved by DoI and the Secretary.</td><td>Table 5-1
Depositing the fines at a depth of 8 m is not practical, so the control in Table 5-1 has been amended to reflect the fines being deposited at a minimum depth of 3 m</td></tr>
</table>

Condition No.	Requirement	Reference
Schedule 3, Condition 12	The Proponent must manage on-site sewage to the satisfaction of Council and EPA. The facility must comply with the requirements of the *Environment and Health Protection Guidelines – On-site Sewage Management for Single Households (1998)*.	Table 5-1
Schedule 3, Condition 13	The Proponent must ensure that flood bunding around the Stage 1 and Stage 2 works does not exceed 300 mm in height above natural surface level, to a maximum height of 2.0 m AHD, unless otherwise approved by the Secretary.	Table 5-1
Schedule 3, Condition 14	The Proponent must ensure that perimeter drainage must be installed and operational prior to the construction of bunding or the placement of fill on site.	Table 5-1
Schedule 3, Condition 15	All earthworks, including flood and acoustic bunding works, must be contained wholly within the site.	Table 5-1
Schedule 3, Condition 16	The Proponent must cease dredging and processing activities not less than 24 hours prior to the commencement of overflow from any dredge pond. No dredging or processing must occur when the dredge ponds are overflowing.	Table 5-1
Schedule 3, Condition 17	The Proponent must ensure that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the project. Details of the available flood storage capacity must be reported in the Annual Review.	Table 5-1
Schedule 3, Condition 18	The Proponent must prepare a Soil and Water Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with DoI and EPA; (b) include a: • Water Balance; • Erosion and Sediment Control Plan; • Acid Sulfate Soil Management Plan; • Blue-Green Algae Management Plan; • Surface Water Monitoring Program; and • Groundwater Monitoring Program; and (c) be submitted to the Secretary prior to starting quarrying operations, and prior to carrying out any development on the site in the case of the Erosion and Sediment Control Plan. The Proponent must implement the plan as approved by the Secretary.	This plan
Schedule 3, Condition 19	The Water Balance must include: (a) details of all water extracted, transferred, used and/or discharged by the quarry; (b) the source of all water collected or stored on the site, including rainfall, stormwater and groundwater; and (c) measures to minimise water use by the project.	Section 3.6
Schedule 3, Condition 20	The Erosion and Sediment Control Plan must: (a) be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004* (Landcom), and Council's codes including its *Code of Practice for Soil and Water Management on Construction Sites, Development Design Specification D7 – Stormwater Quality and Tweed Urban Stormwater Quality Management Plan*; (b) identify activities that could cause soil erosion and generate sediment; (c) describe measures to minimise 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	Table 5-1 and Appendix B

Condition No.	Requirement	Reference
	(e) describe what measures would be implemented to maintain these structures over time.	
Schedule 3, Condition 21	The Acid Sulfate Soil Management Plan must: (a) be consistent with the *NSW Acid Sulphate Soil Advisory Committee's Acid Sulfate Soil Manual*; and (b) define procedures for managing the potential acid sulfate soils on the site, including sample testing and procedures.	Table 5-1 and Appendix C
Schedule 3, Condition 22	The Blue-Green Algae Management Plan must: (a) be prepared by a suitably qualified blue-green algae expert, whose appointment has been approved by the Secretary; (b) be consistent with extant guidelines for blue-green algae management including the NHMRC's *Guidelines for Managing Risks in Recreational Water*; (c) describe the measures that would be implemented to prevent and control the sources of algal blooms over the short, medium and long term; and (d) define procedures for the management and notification of identified algal blooms.	Table 5-1
Schedule 3, Condition 23	The Surface Water Monitoring Program must include: (a) detailed baseline data on surface water quality; (b) surface water impact assessment criteria; (c) a program to monitor surface water flows and quality; (d) a program to manage water releases from the site; (e) a program to monitor bank and bed stability; and (f) a protocol for the investigation, notification and mitigation of identified exceedances of the surface water impact assessment criteria.	Table 6-1
Schedule 3, Condition 24	The Ground Water Monitoring Program must include: (a) detailed baseline data on groundwater levels and quality, based on statistical analysis; (b) groundwater impact assessment criteria; (c) a program to monitor ground water levels and quality; (d) a program to monitor ground water level effects on vegetation, and on ground water supply to adjoining properties; and (e) a protocol for the investigation, notification and mitigation of identified exceedances of the groundwater impact assessment criteria.	Table 6-1

Condition No.	Requirement	Reference
Schedule 5, Condition 1A	The Proponent must ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
	(a) a summary relevant background or baseline data;	Section 3
	(b) a description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; and the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 2, Section 1.2 and Table 6-1
	(c) a description of the measures that to be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Table 5-1
	(d) a program to monitor and report on the: • impacts and environmental performance of the project; and • effectiveness of any management measures (see (c) above);	Table 6-1
	(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;	Table 6-2
	(f) a program to investigate and implement ways to improve the environmental performance of the project over time	Table 6-1
	(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; and	Section 6.4
	(h) a protocol for periodic review of the plan.	Section 7

2.4 Environment Protection Licence

The EPL conditions outline the location of monitoring, the concentrations of pollutants permitted to be discharged, sampling frequency, sampling method and the rainfall events and locations when the concentration limits can be exceeded. The requirements of the EPL have been included in this plan, where relevant.

2.5 Water Act license

The NSW DPI – Office of Water issued the following monitoring bore licenses for the Dunloe Sand Quarry on the 16 September 2004:

- 30BL183076
- 30BL183077
- 30BL183078
- 30BL183079
- 30BL183080
- 30BL183081
- 30BL183082
- 30BL183084
- 30BL183086

3. Existing environment and impacts

The following sections summarise the existing environment, based upon the information provided in the EIS (Planit 2007).

3.1 Regional geology

The Tweed 1:250,000 Geological Series Sheet identifies the topographically elevated ridgeline to the west and north of the site as outcrops of greywacke, slate, phyllite and quartzite (part of the regionally extensive Neranleigh Fernvale Group). The low-lying floodplain sections of the site generally consisted of unconsolidated deposits of river gravels, alluvium, sand and clay of Holocene age.

3.2 Soil landscape

As classified under the Great Soil Group Classifications (GSGC), the soil landscapes in the local area are defined as Kingscliff (variant) and Pottsville soil landscapes. Descriptions of soil landscapes in the local area were conducted by Morand (1996), the following general descriptions where noted.

- Kingscliff soil landscape variant (Kib) – These soil landscapes were identified throughout most of Lot 1 DP755721, in the western half of Lot 1 DP780199 and throughout most of Lot 2 DP780199. This soil landscape typically consists of extremely low, level to gentle undulating Pleistocene sand sheet overlaying peat and alluvium. Soils are described as Podzols, are non-cohesive, highly erodible, permeable, have low fertility and are prone to water logging with high water tables.
- Pottsville soil landscape (po) – These soil landscapes were identified in the eastern portions of Lot 1 DP755721 and Lot 2 DP780199, adjacent to Mooball Creek. This soil landscape typically consists of poorly drained depressions within Pleistocene sand sheets and dunes. Ponded surface water is common, as is shallow (0.1m below ground level) water tables. Soils are described as poorly drained Podzols, Humus Podzols, poorly drained Humic Gleys and Acid Peats. Soils are non-cohesive, highly erodible and permeable, have low fertility and are prone to water logging and high water tables.

Site investigations indicate the site is generally underlain by a uniform soil profile consisting of a small amount of topsoil (a silty sand of less than 0.3 m depth), overlaying the resource of fine to medium grained sand of average depth 12 m. Marine clay of variable thickness (0.5 m to 5 m) generally underlies the sand resource located at an average depth of 13 m.

Generally the topsoil materials are greyish brown to brownish black silty sands which grade gradually to very dark grey to yellowish grey, fine to medium sands. Topsoil materials occasionally contained trace dark fine silt. Areas of brown/black indurated sands were encountered at depths between approximately 6 m to 15 m below natural ground level in sporadic location.

3.2.1 Acid sulfate soils

An acid sulfate soils assessment encountered negligible to low acid producing potential within the sandy materials proposed for excavation. Using the van Beers method, 227 of the 713 samples tested exhibited a violent reaction within the parameters of potential acid sulfate soils. Most of the remaining samples exhibited nil to slight reactions.

Generally, the potential acid sulfate soils were associated with the grey – dark grey fine to medium grained sands encountered at variable depths throughout the profile (but generally above 5.5 m below ground level) and the basal mineral clay material. The clay is not proposed for extraction.

3.3 Site contamination

No previous uses which may have contaminated the site have been identified and no visual signs of contamination were recorded. The Preliminary Contamination Assessment concluded:

- Based on the information obtained from the site history investigation, it is understood that the subject lots have been used for low intensity grazing and sugar cane production.
- No potentially contaminating activities were identified during the site history investigation or the site investigation across the subject lots.
- In relation to land contamination issues, the subject lots are considered to be suitable for the proposed development of a sand quarry.

3.4 Groundwater

3.4.1 Hydrogeological context

Artificial surface expressions comprise approximately four (4) small groundwater soaks (groundwater-fed dams) located across the site to facilitate the watering of cattle. In conjunction with this, natural surface expressions of groundwater are located generally within the topographically low points to the north of the site associated with the SEPP 14 wetland communities.

A total of 10 bores are located within 2.5 km of the site. Of these ten (10) boreholes, one (1) is located south of the site. All remaining bores are located to the west, generally within the low ridgeline that borders the western boundary of Mooball Creek Floodplain. Several bores were also observed approximately 3 km north of the site adjacent to the township of Pottsville.

Available borehole installation records and location details suggest that the majority of the bores were not installed within the unconfined aquifer associated with the low-lying coastal section of the Mooball Floodplain, but installed within unconfined/semi-confined unconsolidated alluvium and fractured rock materials in the low ridgeline to the west of the site.

There is likely to only be minimal hydraulic connectivity between the unconsolidated sand aquifer and potential groundwater aquifers in the ridgeline. However, previous drilling in the location around the town of Pottsville suggest the bores located approximately 3 km away are likely to be installed within the shallow unconfined coastal sand aquifer that would be likely to extend southward to include the Mooball Creek Floodplain section of the site.

3.4.2 Site groundwater

Conditions within the aquifer were unconfined across the site, with no discernible difference in groundwater head noted between the shallow and deep monitoring piezometers. Groundwater levels within this aquifer are generally at or near the topographical surface with variations in groundwater observed at the site following seasonal rainfall, which indicates that surface and groundwater within the site are closely associated.

The only significant occurrence of groundwater noted during the hydrogeological assessment was associated with the fine-medium grained unconsolidated quartzose sand stratum. As confirmed during the groundwater assessment, the indurated sands and marine clay which generally formed the residual basement are considered to be of extremely limited aquifer potential due to the high content silt and clay.

Given that the ground water level is relatively uniform across the site, it is unlikely that any significant lateral groundwater movement currently occurs within the Mooball Creek Floodplain portion of the site. Significant increases in the level of groundwater following rainfall events suggests that the groundwater recharge response is closely related to precipitation and surface water run-in from upstream catchment areas. Groundwater levels are likely to subside relatively quickly following the cessation of rainfall with the most significant hydrological groundwater outputs likely to be associated with direct evapotranspiration from pasture areas and groundwater baseflow into the site's three major drainage lines and Mooball Creek.

Table 3-1 Groundwater level

Site	30/08/2004 (m AHD)	06/09/2004 (m AHD)	13/09/2004 (m AHD)	17/12/2004 (m AHD)
DLP1	0.30	0.25	0.28	0.83
DLP1A	0.26	0.25	0.23	0.99
DLP2	0.23	0.20	0.18	1.25
DLP3	0.31	0.25	0.13	0.45
DLP3A	0.21	0.30	0.30	0.72
DLP4	0.29	0.29	0.28	13.7
DLP5	0.33	0.29	0.21	0.75
DLP6	0.33	0.33	0.34	1.19
DLP7	0.29	0.27	0.25	1.09
DLP7A	0.23	0.23	0.21	0.79
DLP8	0.43	0.42	0.38	1.16
DLP8A	0.41	0.40	0.37	1.28
DLP9	0.31	0.29	-	0.53
DLP10	0.42	0.38	0.37	1.31
DLP10A	0.24	0.25	0.24	1.36
DLP11	0.24	0.23	0.21	0.80

3.4.3 Groundwater water quality

The results of the sampling and analysis program undertaken suggest that groundwater quality within the Mooball Creek Floodplain (near the site) is typically fresh and generally suitable for irrigation and domestic stock use in line with ANZECC 2000 requirements.

Groundwater quality was generally consistent across the site, however, a slight increase in pH, electrical conductivity (EC), chloride-sulfate ratio and major cation concentrations were noted to occur with increased depth in the aquifer.

However these variations were generally slight, and are unlikely to result in any deleterious effects on groundwater quality should mixing of shallow and deep waters occur. It is expected that adequate neutralising of any slightly more acidic surface and/or groundwaters would occur during the operational phase of works due to abundance of shell throughout the soil profile and the relative excess of alkalinity in solution.

Table 3-2 outlines the findings of the groundwater quality which formed the baseline water quality conditions for the site.

Of note from the groundwater quality findings is the concentration of dissolved iron, which is elevated relative to most natural water. As a result, some iron flocs and staining may occur around the perimeter of the excavation area during operational works at the site.

3.5 Surface water

3.5.1 Catchment area

The site is located within the Mooball Creek catchment and Sheens Creek sub catchment area.

The catchment for the Mooball Creek floodplain extends 25 km inland along Burringbar Creek and has a total area of 103.9 km^2. The Sheens Creek sub catchment to the west of the site drains directly into agricultural drains that traverse the site and drain into Mooball Creek. The Sheens Creek sub catchment has an area of 14 km^2.

The site is located approximately 4 km upstream from the mouth of Mooball Creek. The site has a number of catch drains which merge into the main agricultural drains onsite.

The relatively flat topography of the site suggests that most surface run off infiltrates into the soils or flows to Mooball Creek. Surface ponding does occur after rainfall when the infiltration rate for the sand has been exceeded or the shallow groundwater table reaches the surface.

Tidal flows enter the agricultural drains traversing the site and travel varying distances up steam dependant on individual tide height. Three flood gates are present on the site and are used to regulate the flow of tidal waters to agricultural land to the west of the site.

The NSW Department of Primary Industries/Fisheries have requested these gates be left open for fish passage.

3.5.2 Surface water quality

Water quality over the site, summarised in Table 3-3, generally meets the relevant Tweed Shire Council or ANZECC guidelines or recommendations for each parameter measured. The water quality results in Table 3-3 outline the findings of the baseline water quality monitoring which formed the baseline water quality conditions for the site.

The electrical conductivity results support observations that the site is at least partially tidal up to the flood gates on the main agricultural drains traversing the site.

Dissolved oxygen was recorded as being slightly low, with the slight depression most likely reflecting base flow from groundwater which is typically very low in dissolved oxygen.

Nutrients were slightly elevated in some locations as expected due to the surrounding agricultural activities. In general, the sites surface water quality was relatively good and reflects conditions characteristic of agricultural drains in low lying floodplain environments.

3.5.3 Flooding

A flood analysis concluded that the proposed development would result in a decrease in flood levels of up to 270 mm at the upstream boundary of the site, which would have no significant adverse impact.

Table 3-2 Groundwater water quality

	DLP1	DLP1A	DLP2	DLP3	DLP3A	DLP4	DLP5	DLP6	DLP7	DLP7A	DLP8	DLP8A	DLP9	DLP10	DLP10A	DLP11
pH	5.12	7.78	6.82	5.14	6.36	5.45	5.64	4.65	5.25	7.30	5.74	8.50	5.83	5.57	7.79	6.20
EC (mS/cm)	0.198	2.260	0.253	4.770	6.550	0.339	0.189	0.122	0.250	4.420	0.135	0.538	0.099	0.122	1.615	0.747
DO (mg/L)	3.4	2.99	2.01	3.30	2.57	2.80	3.27	3.40	2.93	3.38	6.16	7.93	4.14	4.40	3.23	2.59
Temp. (C^o)	19.0	21.2	19.5	25.1	24.5	19.4	20.2	18.8	20.3	19.6	18.6	22.5	21.2	18.5	18.0	19.7
Alkalinity (mg/L as $CaCO^3$)	1	520	42	3	162	3	7	<1	3	386	3	253	12	3	410	44
Chloride Sulfate Ratio (CL:SO_4)	0.71	1.21	3.36	5.89	12.70	8.00	1.43	2.33	1.14	3.67	2.00	3.68	0.94	0.79	1.03	1.03
Dissolved Aluminium (mg/L)	0.46	<0.01	0.09	1.18	0.06	0.30	0.49	1.39	0.20	0.22	0.13	0.06	0.08	0.14	<0.01	<0.01
Dissolved Iron (mg/L)	7.34	0.01	0.13	7.17	10.80	1.08	2.03	44.60	5.42	1.37	1.82	0.12	8.83	3.67	<0.01	20.70
Dissolved Manganese (mg/L)	0.084	0.0405	0.034	0.052	0.582	0.003	0.008	0.300	0.076	0.092	0.011	0.014	0.100	0.031	0.152	0.184
Dissolved arsenic (mg/L)	<0.001	<0.001	<0.001	0.006	<0.001	0.002	<0.001	<0.001	0.001	<0.001	0.001	0.002	<0.001	0.002	<0.001	0.009
Calcium (mg/L)	5	109	1	39	66	3	<1	12	6	36	2	13	10	3	107	17
Magnesium (mg/L)	2	55	7	86	107	4	<1	23	4	80	1	2	7	<1	42	18
Sodium (mg/L)	20	301	19	801	1190	46	33	165	20	815	20	150	17	10	162	79
Potassium (mg/L)	2	18	2	37	54	<1	2	10	1	45	1	4	2	4	15	10

Table 3-3 Surface water quality

Location	Date	Tide	Water level (m AHD)	Redox (mV)	E.C. (mS/cm)	Turbidity (NTU)	pH	Temp. (C^o)	DO (mg/L)	TSS (mg/L)	N (mg/L)	P (mg/L)
SW1	17/12/04	Incoming Mid tide	NA	NA	2.85	NA	NA	24.1	4.55	NA	NA	NA
SW2	17/12/04	Incoming Mid tide	NA	NA	4.19	NA	NA	23.0	6.49	NA	NA	NA
SW3	17/12/04	Incoming Mid tide	NA	NA	1.73	NA	NA	24.3	5.79	NA	NA	NA
SW4	17/12/04	Incoming Mid tide	NA	NA	5.95	NA	NA	23.3	9.22	NA	NA	NA
SW5	24/01/05	Outgoing High tide	0.566	244	39.5	5	8.07	28.9	6.23	24	0.3	0.11
SW6	24/01/05	Outgoing High tide	0.636	254	24.3	19	7.53	30.2	6.06	NA	NA	NA
SW7	24/01/05	Outgoing High tide	0.507	221	9.32	11	7.44	29.7	4.76	NA	NA	NA
SW8	24/01/05	Outgoing High tide	0.076	194	0.73	10	7.30	34.8	6.90	8	1.5	0.05
SW9	24/01/05	Outgoing High tide	0.354	240	18.8	15	7.50	31.6	5.47	22	0.4	0.04
SW10	24/01/05	Outgoing High tide	0.433	207	3.19	8	7.17	32.8	5.12	2	0.8	0.02
SW11	24/01/05	Outgoing High tide	NA	212	27.8	1	7.81	30.8	6.04	NA	NA	NA
SW12	24/01/05	Outgoing High tide	0.497	189	8.50	10	7.42	31.7	5.60	NA	NA	NA

3.6 Impacts

Potential negative impacts on soil, groundwater and surface water from the proposal include:

3.6.1 Soils

- Short term erosion of stockpiles and exposed soils relating to vehicle movements, stockpiled materials and vegetation removal.
- Compaction of the deeper soil structure from the movement of large machinery.
- Transportation of soil onto nearby sealed roads resulting from offsite vehicle movements.
- Dust generation from excavation works and vehicle movement over exposed soils.
- Contamination from oil or chemical spills.
- Exposure of potential acid sulfate soils to the atmosphere which is likely to create acidic conditions that may have a detrimental impact on the local environment.

3.6.2 Groundwater

- Drawdown of the surrounding water table.
- Exposure of acid sulfate soils due to drawdown of the water table.
- Contamination via accidental spillage of chemicals or changes to the water quality of the ponds.

3.6.3 Surface water

- The proposed quarry would alter the local topography at the site, which would affect the drainage of surface water. This could lead to a concentration and discharge of flows leading to increased risk of erosion and sedimentation.
- Surface water discharging from the quarry area could entrain sediment from disturbed areas causing decreased water quality in waterways.
- Contamination via chemicals, hydrocarbons or other contaminates from accidental spillage.
- Flooding of the site which may result in flood risk to staff, result in off-site flood impacts, erode stockpiles and entrain sediment and damage equipment.

4. Water balance

The following sections summarise the water balance, based on the information provided in the EMS (Planit 2018).

4.1 Introduction

The Dunloe Sand Quarry is situated within the Sheens Creek catchment, which is an ephemeral, stream that eventually discharges into Mooball Creek. Water is required at the quarry for use in the wash plant and for dust suppression, the majority of which will be drawn from the extraction area itself.

Water is also lost through evaporation from the extraction area and within the processing of extracted sands.

There are three main sources of water for the quarry, namely: groundwater seepage into the pit; rainfall falling directly into the pit; and lastly and of least importance, off-site runoff that enters the Quarry Site.

4.2 Site water use

4.2.1 Sand washing and retention of water in materials

Approximately 8,000 L of process water is required to produce one tonne of sand product. A maximum of 300,000 tonnes of washed sand will be produced annually in accordance with the development consent.

With the exception of the following, the majority of this process water will be continuously recycled and available for reuse:

- The washed sand product will have a moisture content of approximately 8%. As a consequence, up to 24 ML/year will exit the Quarry Site as water retained in the sand products.
- Water used in the placement of fines within the re-internment ponds will remain within the water cycle.

4.2.2 Dust suppression

Water is used for dust suppression on the roads, stockpiles and other exposed surfaces around the Quarry Site. Given that all roads will be sealed, water used in dust suppression is considered likely to be relatively low. In this regard it is estimated that the maximum rate of water application will be an average of 3 KL/day.

Based on an application time of 3 hours/day (or 1 KL per day) for 100 days/year, this equates too approximately 1 ML/year. It is pertinent to note that in the initial stages of the extraction (dry excavation), dust suppression demands are likely to be more onerous, although it is reasonable to assume that in certain conditions no suppression will be required.

4.2.3 Evaporation/groundwater

An evaporation assessment was undertaken using rainfall and evaporation figures for typical dry (1982) and wet (1976) rainfall years. The rainfall would be variable throughout any recording period with monthly totals above or below the median value even within annual percentile bands. The total for the reporting period used in the calculation (annual values) is the critical factor. This analysis in Table 4-1 demonstrates that typically precipitation exceeds evaporation over a 12 month period.

Table 4-1 Net monthly water balance statistics

Month	Dry (mm)	Median (mm)	Wet (mm)
January	+84.2	+87.9	+24.9
February	+36.1	-29.2	+252.1
March	+7.5	+18.9	+606.7
April	+29.3	+293.4	+45.0
May	+39.9	+22.7	+158.1
June	-34.0	+82.8	+55.8
July	-7.1	+79.0	+34.7
August	-30.3	+71.1	-77.5
September	+145.8	+17.9	-31.0
October	+8.9	-57.7	-29.9
November	-108.4	+18.0	+67.1
December	-83.9	91.8	-31.6
Balance	+87.8	+554.4	+1074.3

Table 4-1 shows that on average there is a 554.4 mm excess of water when cross referencing purely evaporation and precipitation.

Given a surface area of 56.7 ha, this equates to a surplus of 314.18 ML.

Given that rainfall distribution is largely variable and precipitation generally exceeds evaporation for most months of the year, it is unlikely that excavation will result in the formation of any significant cone of depression around the extraction areas. However, it is possible during extended dry periods, some localised drawdown may occur on a temporary basis.

4.2.4 Total water use

Based on the calculations above, the estimated water use for the quarry is as follows:

- A maximum of 24 ML/year of water lost through the retention of water in exported sand.
- 1 ML/year of water used for dust suppression.

Potable water and water utilised in on site amenities will be harvested on site by way of rainwater tank.

4.2.5 Total water availability/usage

Given an extraction area of 56.7 ha and an annual rainfall of 1720.10 mm, a total precipitation input of 975.24 ML can be demonstrated. Evaporation accounts for 661.06 ML, leaving a surplus of 314.18 ML.

Given water usage associated with sand production and export loss (24 ML) and dust suppression (1 ML), total net surplus of water is in the order of 289.18 ML.

All surface water runoff will be diverted to existing drains in the vicinity and therefore no surface water inflows are likely or necessary.

In the event that the amount of on-site water storage declines over time, Holcim will need to take action to increase the available water or reduce the water consumption. The following options would be considered:

- Sourcing water from existing dams on adjoining lands, which is normally close to or at capacity. This would include the Maximum Harvestable Right Dam Capacity (max. 10% runoff) for the site.
- Modify the clean water diversion channel to discharge 100% of this flow into the quarry.
- Increase the proportion of sand that is sold unwashed to reduce the amount consumed in the washing process.
- Decrease the rate sand production to reduce the amount consumed in the washing process.

5. Environmental control measures

Environmental requirements and control measures are identified in the Conditions of Approval and the EIS. Specific measures and requirements to address soil and water quality impacts are outlined in Table 5-1 below.

Table 5-1 Environmental control measures

Ref	Environmental Management Measure	Timing	Responsibility
Soil			
SW01	Induct all site staff so they are aware of their responsibilities in relation to soil and water management, in particular: • Sediment and erosion control • Blue Green Algae management • Acid sulfate soil management • Use of spill kits • Flooding	Operation	Quarry Manager
SW02	Erosion and sediment control devices will be installed prior to the commencement of extraction works in accordance with Drawing Nos GJ05554.ESCP.1 and GJ0554.ESCP.2 as presented in Appendix B.	Pre-operation	Quarry Manager
SW03	The perimeter bund/catch drain will be seeded (consistent with visual buffering) upon completion of its construction. This will ensure the integrity of the catch drain is maintained and will avoid potential slips and sediment run-off post construction of the perimeter bund.	Pre-operation	Quarry Manager
SW04	Additional erosion and sediment control devices including silt fences, catch drains, perimeter banks and diversion channels will be installed on an 'as required' basis. Such measures will be installed in accordance with the "Soils and Construction guidelines – Managing Urban Stormwater" (Landcom, 2004).	Operation	Quarry Manager
SW05	Erosion and sediment control devices will be installed onsite prior to extraction if potential for sheet and/or gully erosion exists.	Pre-operation and operation	Quarry Manager
SW06	Stormwater runoff will be directed away from disturbed areas.	Pre-operation and operation	Quarry Manager
SW07	Discharge velocity and configuration will be controlled to ensure erosive flows do not occur	Operation	Quarry Manager
SW08	Grass cover will be maintained around the perimeter of the extraction areas and adjacent to the haul roads.	Operation	Quarry Manager
SW09	Where practicable, surface waters from undisturbed areas will be diverted away from extraction/work areas.	Operation	Quarry Manager
Acid sulfate soils			
SW10	The extraction areas will be assessed for the presence of acid sulfate soils, in accordance with the Acid Sulfate Soils Management Plan in Appendix C.	Pre-operation and operation	Quarry Manager
SW11	If acid sulfate soils are present, the excavated material will be treated, in accordance with the Acid Sulfate Soils Management Plan in Appendix C.	Operation	Quarry Manager

Ref	Environmental Management Measure	Timing	Responsibility
SW12	All extracted materials will be hydraulically separated through a cyclone (or equivalent hydraulic separation device) to remove pyretic fines from the sand. The hydraulically separated fines will be strategically reburied (re-interred) below the water surface within the nominated on-site fines internment pond(s). The fines must be deposited, as soon as possible on the same day as extracted, at a depth no less than 3 m from the water surface.	Operation	Quarry Manager
SW13	All on-site surface water from disturbed areas will drain into the pond so that any acidic reactions will be detected and the extraction process modified to avoid a continuance of the problem.	Operation	Quarry Manager
SW14	All drainage from the cyclone/wash plant will be negatively graded back to the internment pond to ensure that any leachate from the sand stockpiles, returns water or any hydraulically suspended pyritic material drains towards the on-site fines internment pond.	Operation	Quarry Manager
SW15	If the returns water is not transported in a pipeline, the velocity will be sufficient to ensure that no precipitation of pyritic fines occurs during movement of these waters towards the on-site fines internment pond.	Operation	Quarry Manager
SW16	The returns water flow path will be directed away from any stockpiled sand.	Operation	Quarry Manager
Blue Green Algae			
SW17	During the dredging phase of the operations the formed lakes will be signed to ensure it is clear to all that the waters are not for drinking or swimming.	Operation	Quarry Manager
SW18	Warning signs including current alert levels (refer to Table 5-2) will be kept within the quarry office and each likely access point to the lake indefinitely.	Operation	Quarry Manager
SW19	Vegetated visual buffers are to be planted surrounding both extraction areas (refer to Landscape Management Plan) and these will assist in reducing nutrient loads which will assist in reducing the potential for blue-green algae outbreaks.	Operation	Quarry Manager
SW20	Following the termination of dredging at the end of the lifespan of each extraction pond planting of additional appropriate wetland vegetation species will be implemented as a part of the rehabilitation of the site (refer to Landscape Management Plan). This action will further reduce the level of nutrient flow over land by being taken up by the increased level of vegetation present.	Operation	Quarry Manager
SW21	Any visiting contractors or other visitors likely to come into contact with the lake water or be exposed to aerosols, will be asked whether they have a history of allergenic dermal reaction and or asthma and if so provided information regarding the risk. An information sheet would be provided detailing the correct response if a rash or asthma attack does occur.	Operation	Quarry Manager
SW22	If any personnel are required to dip their hands into the lake for operational or sampling purposes they will have a suitable length rubber glove to avoid skin exposure.	Operation	Quarry Manager

Ref	Environmental Management Measure	Timing	Responsibility
SW23	For people required to submerge into the water at any time (diving for equipment servicing etc.), diving suits are not recommended as they tend to trap and disrupt cells thereby gaining greater exposure to toxin. Instead, loose fitting swimwear should be worn, and any contact with the lake water should be followed by a thorough shower from a clean water supply.	Operation	Quarry Manager
SW24	On-site sewage will be managed to comply with the requirements of the Environment and Health Protection Guidelines – On-site Sewage Management for Single Households (1998).	Operation	Quarry Manager
SW25	Potential nutrient sources will be managed to minimise the likelihood of algal blooms in the onsite lakes.	Operation	Quarry Manager
Surface water			
SW26	Surface water monitoring will be undertaken in accordance with Section 6.2.	Operation	Quarry Manager
SW27	Sampling locations EPA Point 1 and EPA Point 2 are provided and maintained in an appropriate condition to permit: • The clear identification of each monitoring location • The collection of representative samples • Access to the sampling points at all times by an authorised officer of the EPA	Operation	Quarry Manager
SW28	Existing surface water conditions will be maintained outside the excavation area.	Operation	Quarry Manager
SW29	Where sediment problems are identified, settling in the dredge pond will be aided by dosing with a flocculant such as gypsum or an agreed alternative.	Operation	Quarry Manager
SW30	During clearing and topsoil stripping operations, surface water flows will be directed towards the on-site lakes. Sediment and erosion control measures will be installed during this stage as per the plans in Appendix B.	Operation	Quarry Manager
SW31	Dewatering from on-site water bodies, excluding the extraction ponds, will not be undertaken without prior approval from DPI&E.	Operation	Quarry Manager
SW32	No discharge will occur from the dredge ponds unless discharge criteria have been met.	Operation	Quarry Manager
SW33	Discharge velocity and configuration will be controlled to ensure erosive flows do not occur.	Operation	Quarry Manager
SW34	Existing surveyed height pegs in watercourses/drains will be inspected and replaced as required.	Operation	Quarry Manager
SW35	Streambank and bed profile and condition to be recorded at approved locations.	Operation	Quarry Manager
SW36	Designated, impervious, bunded facilities with oil and water separator system will be provided for cleaning and/or maintenance of vehicles, plant or equipment.	Operation	Quarry Manager
SW37	All chemicals, fuels and oils stored at the premises must be contained within appropriately designed bunded areas that meet the following requirements: a) comply with any relevant Australian Standards for the liquids being stored b) have impervious flooring and walls c) have a minimum capacity of 110% of the volume of the largest container stored within the bund.	Operation	Quarry Manager

Ref	Environmental Management Measure	Timing	Responsibility
SW38	Spill kits will be provided at all chemical storage facilities/compound sites and staff trained in their use	Operation	Quarry Manager
SW39	Where refuelling on site is required, the following management practices will be implemented: • Refuelling will be undertaken on level ground, within the designated refuelling areas with appropriate bunding and/or absorbent material, at least 20 metres from drainage lines, waterways and/or environmentally sensitive areas. • Spill kits will be readily available and personnel trained in their use. • Hand tools will be refuelled within lined trays of site vehicles wherever possible. Any contaminated material will be disposed at an appropriately licensed facility and used spill kit materials replaced.	Operation	Quarry Manager
SW40	Regular checks of vehicles working at the quarry will be conducted to ensure that no oils or fuels are leaking.	Operation	Quarry Manager
Groundwater			
SW41	All ground-water related site activities will be undertaken in accordance with the DPI – Office of Water groundwater licence.	Operation	Quarry Manager
SW42	Groundwater monitoring will be undertaken in accordance with Section 6.2.	Operation	Quarry Manager
Flooding			
SW43	The site is to be bunded to provide protection from flooding up to 300 mm in height above natural ground level, to a maximum height of 2.0 m AHD, unless otherwise approved by the Secretary. The bunding is to be contained wholly within the site.	Operation	Quarry Manager
SW44	Holcim must provide perimeter drainage prior to the construction of bunding or the placement of fill on-site.	Operation	Quarry Manager
SW45	No dredging or processing will occur when the dredge ponds are overflowing or within 24 hours prior to them overflowing.	Operation	Quarry Manager
SW46	Holcim will ensure that that the flood storage capacity of the site is no less than the pre-existing storage capacity at all stages of the operations. Details of the available flood storage capacity will be reported in the AEMR.	Operation	Quarry Manager
SW47	Plant, equipment and machinery that is at risk from flood waters to be moved to higher ground.	Operation	Quarry Manager
SW48	Evacuate staff as required.	Operation	Quarry Manager
SW49	Where flood waters overlap the bund, appropriate water testing to be carried out to measure that water quality returns to base levels.	Operation	Quarry Manager

Table 5-2 Blue green algae alert levels

Guideline	Recommended actions
Green Level Surveillance Mode The total bio volume of all potentially toxic (only) cyanobacteria does not exceed 1.0 mm^3/L and biovolume of all cyanobacteria <4 mm^3/L.	• Monthly samples from lake
Amber Level Alert Mode The total biovolume of all potentially toxic (only) cyanobacteria and biovolume of all cyanobacteria >1.0 mm^3/L <1.0 mm^3/L.	• Fortnightly samples from lake • Screen samples for genetic capacity to produce toxin (CyanoDtec test) If genetic testing determines not toxic; revert back to monthly surveillance monitoring.
Action level Red Mode The total biovolume of all actual toxic cyanobacteria >1.0 mm^3/L (confirmed genetically) or biovolume of all cyanobacteria >4 mm^3/L.	• Signage alerting to potential danger for staff, contractors, clients and visitors; • Use of PPE for people coming into contact with lake water if aerosols present. • Fortnightly sampling until back to surveillance levels.

6. Monitoring and reporting

6.1 Environmental inspections

Routine weekly inspections by the Quarry Manager (or delegate) will occur throughout the operational lifetime of the quarry to identify any ad-hoc soil or water related issues such as erosion, oil spill, poor water quality, algae outbreak, using the *Environmental Inspection Checklist* in the Environmental Monitoring and Management Plan.

6.2 Monitoring

Inspections, monitoring and reporting specific to the management of soil and water that will be implemented during operation of the quarry are listed below in Table 6-1, along with who is responsible.

The interim trigger values in Table 6-1 are based on 80th and/or 20th percentile values of eight rounds of monthly monitoring undertaken in the period September 2006-August 2007. Some values have been varied to reflect Condition 9 of Schedule 3.

Target criteria to be used throughout the life of the quarry will be established upon completion of a minimum twenty rounds of monthly monitoring for the parameters presented in the following tables. Concentration limits are to be established from calculating the 80th and/or 20th percentile values for each parameter sampled at each monitoring location. Outliers would be statistically removed for accuracy.

Table 6-1 Soil and water monitoring program

Aspect	Frequency	Details	Analysis and interim trigger values	Responsibility
Weather	Daily	Weather forecasts will be monitored to inform quarry operations, for example: • If rain is forecast, sediment and erosion controls will be checked and maintained. • If dry weather and winds are forecast, dust controls will be implemented.	-	Quarry Manager
Rainfall	Daily	Rainfall at the premises must be measured and recorded in millimetres per 24 hour period, at the same time each day.	-	Quarry Manager
Erosion and sediment controls	Weekly and following rain (>10 mm in 24 hr)	Erosion and sediment controls are to be monitored and maintained, as required.	-	Quarry Manager
Blue Green Algae monitoring within the extraction area	October to April – fortnightly May to September - monthly	A sample will be collected from the extraction ponds and analysed for blue green algae. If results indicate cell growth to a level exceeding 500 cells/mL, weekly sampling will be implemented until such time as the results of the testing indicate <500 cells/mL for a period of greater than 3 months	<50,000 cells/mL (M.aeruginosa) <4 mm 3/L (total biovolume)	Quarry Manager
	Quarterly	Chlorophyll a	2-10 µg/L	Quarry Manager
Surface water monitoring within the extraction area	Monthly	Water quality monitoring at Pond 1 and Pond 2 locations on Figure 6-1.	pH - 5.0 – 8.5 Electrical conductivity - <5.50 mS/cm Dissolved oxygen - >4.00 mg/L Turbidity - <20 NTU Oil and grease - <10 mg/L	Quarry Manager
	Quarterly	Water quality monitoring at Pond 1 and Pond 2 locations on Figure 6-1.	As above monthly monitoring, plus: Manganese - 0.15mg/L Magnesium - 40mg/L Sodium - 280 mg/L Potassium – 17.5 mg/L Bicarbonate - 400 mg/CaCO3 Chloride - 285 mg/L Sulfate - 175 mg/L Aluminium - 0.75 mg/L Arsenic - <0.005 mg/L Iron - <7.5 µg/L Chlorophyll a – 2-10 µg/L	Quarry Manager

Aspect	Frequency	Details	Analysis and interim trigger values	Responsibility
	Quarterly	Vertical profile monitoring at one-metre intervals will be undertaken in the active extraction area.	pH - 5.0 – 8.5 Electrical conductivity - <5.50 mS/cm Dissolved oxygen - >4.00 mg/L Turbidity - <20 NTU Oil and grease - <10 mg/L	Quarry Manager
	When discharging either naturally (i.e. solely as a result of rainfall at the premises less than 82.5 millimetres over any consecutive five day period) or manually (i.e. pumped) but not if reused on site (e.g. dust suppression, wash plant)	Sampling at EPA Point 1 and EPA Point 2, as shown in Figure 6-1. Sampling is to be done once <24 hours prior to; and, sampling the discharge daily during, each discharge event arising from rainfall of **less than** 82.5 mm in total over a period of up to five days duration. If the concentration limits are not achieved, the water will need to be treated and resampled.	Oil and grease – Nil visible pH – 6.5-8.5 TSS – 50 mg/L	Quarry Manager
Surface water	Rainfall/event based and quarterly	Water quality monitoring at the locations SW3, SW4, SW9 and SW10 on Figure 6-1 would be conducted monthly and during large rainfall events. DPI&E acknowledges that short term exceedances of these objectives may occur during natural events such as flooding. DPI&E acknowledges that pre-existing water quality may not meet the objectives for some analytes, including salinity. Holcim must strive to meet the water quality objectives through implementation of the Soil and Water Management Plan, as far as is reasonable and feasible and within the Proponent's control, to the satisfaction of the Secretary.	pH – 5.5-7.5 EC – 1800-2400 µS/cm Suspended solids - <25 mg/L Dissolved oxygen - >6 mg/L Total nitrogen - <1 mg/L Total phosphorus - <0.08 mg/L	Quarry Manager
Streambank and bed profile	Rainfall/event based and quarterly	Streambank and bed profile and conditions at the locations SW3, SW4, SW9 and SW10 on Figure 6-1 will be visually inspected during surface water sampling events.	Any changes due to site operations are identified and repaired.	Quarry Manager
Spill kit	Monthly and following use	The spill kit is to be checked and any missing materials to be replaced.		Quarry Manager
Groundwater	Monthly	The groundwater monitoring well locations are shown on Figure 6-1. DLP1, DLP3, DLP5, DLP6 and DLP7 are to be monitored during Stage 1 of the extraction. DLP5, DLP6 DLP7, DLP8, and DLP10 are to be monitored during Stage 2 of the extraction.	pH – 4.2 – 7.0 EC – <2.0 mS/cm Dissolved oxygen - >1.50 mg/L Level - <20% change from historical levels	Quarry Manager

Aspect	Frequency	Details	Analysis and interim trigger values	Responsibility
	Quarterly	DPI&E acknowledges that short term exceedances of these objectives may occur during natural events such as flooding. DPI&E acknowledges that pre-existing water quality may not meet the objectives for some analytes, including salinity. Holcim must strive to meet the water quality objectives through implementation of the Soil and Water Management Plan, as far as is reasonable and feasible and within the Proponent's control, to the satisfaction of the Secretary.	As monthly monitoring, plus: Ammonia - NA Calcium – 55 mg/L Magnesium – 0.40 mg/L Sodium - 280 mg/L Potassium – 17.5 mg/L Bicarbonate - 400 mg/L Sulfate - 175 mg/L Chloride - 285 mg/L Dissolved iron – 7.5 mg/L Dissolved aluminium – 0.75 mg/L Dissolved arsenic – 0.005 mg/L Oil and grease - NA	Quarry Manager

Legend

- Project boundary
- Sand extraction areas
- Incoming haul road
- Outgoing haul road
- Site office
- Washplant
- Existing dwelling house
- Watercourse (LPI 2015)
- Pond Monitoring Location
- EPA Monitoring Point
- Surface water
- Groundwater

Paper Size A4

0 150 300 600

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Holcim (Australia) Pty Ltd
Dunloe Sand Modification

Job Number	22-20056
Revision	A
Date	03 May 2019

Site location and layout

Figure 6-1

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

N:\AU\Coffs Harbour\Projects\22\20056\GIS\Maps\Deliverables\22_20056_MonitoringLocations.mxd

Data source: Aerial Imagery: Sixmaps (2017 - NSW LPI), LPI DCDB: Cadastre, 2012; LPI DTDB: Topo base data, 2012. Created by:sross2

6.3 Contingency plan

If the above monitoring detects an impact, a contingency plan or trigger and response plan is to be implemented, as shown in Table 6-2.

Table 6-2 Contingency plan

Trigger	Response
Soils	
Erosion, sedimentation, damaged controls or turbid water observed	• Identify the source of the problem and take the necessary steps required to prevent a recurrence.
Acid sulfate soils	
Signs acid sulfate soil and water management has not been effective: • Yellow efflorescence on soil surface • Iron staining of soils or water • Sulphurous odour • Low pH soils or water	• Contain the material and runoff. • Sample and treat the material in accordance with the procedure in Appendix C. • Review procedures to ensure management is effective.
Fish kills associated with acid sulfate soil impacts	• Stop works immediately and implement the EMS incident procedure.
Blue Green Algae	
Algal blooms observed	• Increase inspections of the extraction pond to twice daily and water monitoring to weekly. • Ensure no public access to water body. • Should phosphorous levels be recorded higher than the criteria, dosing of the ponds could be undertaken. A mixture of alum and gypsum should be used. The quantity of each will be determined by the volume of water in the lakes. This action is more appropriate and successful at the beginning of summer and prior to a bloom developing. • Engage consultant to advise on the appropriate mitigation.
Surface water	
Water quality results exceed the relevant trigger value	• Undertake a detailed inspection of all controls and address any issue identified. • DPI&EIf a significant variation in lake water pH or EC occurs as a result of on-site activities, investigate the cause of the problem and identify measures to resolve. • Review procedures to avoid the issue in future. • If the issue persists, engage a consultant to advise on the appropriate mitigation.
Fuel/chemical spill on land	• Identify and stop the source of the leak or spill. • Apply the spill kit to clean up the spill. • Dispose of the used material at a licensed landfill. • Replace the materials used in the spill kit.
Fuel/chemical spill on water	• Dredging to cease and all equipment in vicinity turned off. • All ignition sources to be removed from the vicinity of the spill. • Fuel/oil absorbing products to be used to contain and soak up contaminants from the pond and contaminated sand from the edge of the pond to be removed. • Site manager to identify source of contamination and rectify problem.

Trigger	Response
Groundwater	
Monitoring results exceed the relevant trigger value	• Undertake a detailed inspection of all controls and address any issue identified. • If a significant variation in groundwater pH, EC or level occurs as a result of on-site activities, investigate the cause of the problem and identify measures to resolve. • Assess vegetation health and impact of groundwater supply on adjoining properties. • Review procedures to avoid the issue in future. • If problem persists, engage a consultant to advise on the appropriate mitigation.
Flooding	
Flooding damages equipment	• Review controls to avoid damage during floods in the future.
Flooding exceeds perimeter bunds	• Review the height of bunds to ensure they are the design height • Investigate increasing the height of the bund, in consultation with DPI&E.

6.4 Reporting

The general reporting requirements are described in Section 8.4 of the EMS. In relation to routine monitoring this will be recorded on the *Environmental Inspection Checklist* in the Environmental Monitoring and Management Plan.

In relation to water samples, the following would be recorded, as a minimum:

- The date(s) on which the sample was taken
- The time(s) at which the sample was collected
- The point at which the sample was taken
- The name of the person who collected the sample
- The activities occurring during the monitoring
- A comparison of the results with the adopted criteria

A report will be prepared by the Quarry Manager following every 12 months of monitoring and a summary of the monitoring results will be presented in the Annual Report (refer to the EMS).

If an exceedance of the criteria is recorded, the affected landowners and DPI&E will be notified in writing, as described in Section 6 of the EMS, and provided with quarterly monitoring results until the results show that the project is complying with the relevant criteria.

All records will be:

- Maintained in a legible form
- Kept for at least 4 years
- Produced to any authorised officer of the EPA and/or DPI&E upon request

7. Review and improvement

Continuous improvement of this SWMP will be achieved in accordance with the EMS, through the ongoing evaluation of environmental management performance against environmental policies, objectives and targets.

The continuous improvement process is designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement; and make comparisons with objectives and targets

Appendices

Appendix A – Agency Consultation

Ben Luffman

From: Ben Luffman
Sent: Thursday, 8 August 2019 12:50 PM
To: 'landuse.enquiries@dpi.nsw.gov.au'
Cc: 'Victoria Musgrove'
Subject: Dunloe Quarry Management Plan consultation

CompleteRepository: 2220056
Description: Dunloe EMP
JobNo: 20056
OperatingCentre: 22
RepoEmail: 2220056@ghd.com
RepoType: Job

Hi,

We have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06_0030 require a number of the plans to be prepared in consultation with the DoI. We have therefore provided a link below to the relevant plans for review.

https://ghd.sendthisfile.com/M3RFj9HigPcjj1ATu8LUMpEj

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

Ben Luffman | A GHD Associate
B.App.Sc. (Hons) | Grad.Dip. Urban and Regional Planning | Environmental Auditor
Technical Director - Environment

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Ben Luffman

From: Geff Cramb <Geff.Cramb@epa.nsw.gov.au>
Sent: Wednesday, 21 August 2019 11:20 AM
To: Ben Luffman
Subject: RE: Dunloe Quarry Management Plan consultation

CompleteRepository: 2220056
Description: Dunloe EMP
JobNo: 20056
OperatingCentre: 22
RepoEmail: 2220056@ghd.com
RepoType: Job

Dear Ben

The EPA do not intend to review and provide comment upon the management plans. The EPA are content with the scope. However, it is understood that EPA will undertake compliance reviews against the requirements of the Environment Protection Licence issued and the implementation of the management plan at our discretion.

Regards
Geff

Geff Cramb
Operations Officer – Environment Management Unit
North Coast, NSW Environment Protection Authority
+61 2 6640 2510

Mon	Tues	Wed	Thurs	Fri
✓	✓	✓	✓	x

geff.cramb@epa.nsw.gov.au www.epa.nsw.gov.au @EPA_NSW
Report pollution and environmental incidents 131 555 (NSW only) or +61 2 9995 5555

From: Ben Luffman <Ben.Luffman@ghd.com>
Sent: Thursday, 8 August 2019 12:51 PM
To: Peter Lynch <Peter.Lynch@epa.nsw.gov.au>
Cc: Janelle Bancroft <Janelle.Bancroft@epa.nsw.gov.au>; Victoria Musgrove <victoria.musgrove@lafargeholcim.com>
Subject: Dunloe Quarry Management Plan consultation

Hi Peter,

Not sure if you are the correct person to contact but we have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06_0030 require a number of the plans to be prepared in consultation with the EPA. We have therefore attached the relevant plans for review.

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

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Connect

Appendix B – Erosion and sediment control plans

Site Layout/Clearing Limits

No site disturbance shall occur until appropriate approvals are obtained.
The area of disturbance shall be clearly identified.
Vegetation buffer zones shall be maintained where possible especially around high erosion risk areas.
No onsite maintenance of earthmoving equipment shall occur unless appropriate controls are in place.

Dust Management

Ground surfaces will be kept damp (not wet). An on-site water cart will be available at all times.
Surfaces shall be left in a rough cloddy condition to increase roughness and slow surface wind speed.
Temporary access roads and parking areas shall be sealed with a gravel layer.

Erosion Controls

Works programme shall be scheduled to minimise the potential for soil loss.
Sediment and erosion controls shall be installed prior to clearing and include:
* Diversion of stormwater around disturbed areas.
* Sediment control fences at the downslope perimeter of cleared and/or disturbed areas. These controls shall be functional prior to commencing upslope work.
* A negative grade towards the dredge ponds should be maintained for the area within the perimeter bund.
Stormwater runoff shall be directed away from construction entry/exit points.
Temporary erosion measures (silt fences, catch drains, perimeter banks and diversion channels) are to be employed onsite where reasonably deemed necessary.
Access is to be provided for maintenance and sediment removal works.
Perimeter bund is to be constructed prior to the commencement of resource extraction.
Upon its completion the perimeter bund is to be vegetated/seeded.

Surface water monitoring

All surface water tested to conform with the following criteria:

Parameter	Release Criteria	Criteria Type
pH	6. 0 - 8.5	Range
Dissolved Oxygen (field measured)	>6.5 mg/L	Minimum
Oil and Grease	No visible film, No detectable odour	

Sampling and analysis of dredge pond surface water should be undertaken monthly.

Acid sulfate soil identification

Soils recovered using dry excavation are to be tested in accordance with the ASSMAC guidelines.
A minimum of 10 samples per quarter are to be collected for CRS/TAA analysis from the resource recovered by dredging.

Acid sulfate soil treatment

Soils requiring lime treatment will be treated to neutralise their equivalent TPA or equivalent oxidisable sulfur, incorporating a mixing factor of safety of 1.5.
Materials used to construct the bunds will be free from acid sulfate soils or suitably treated.
Exposed sides of open drains are to be treated with lime immediately after excavation.

Pollution control

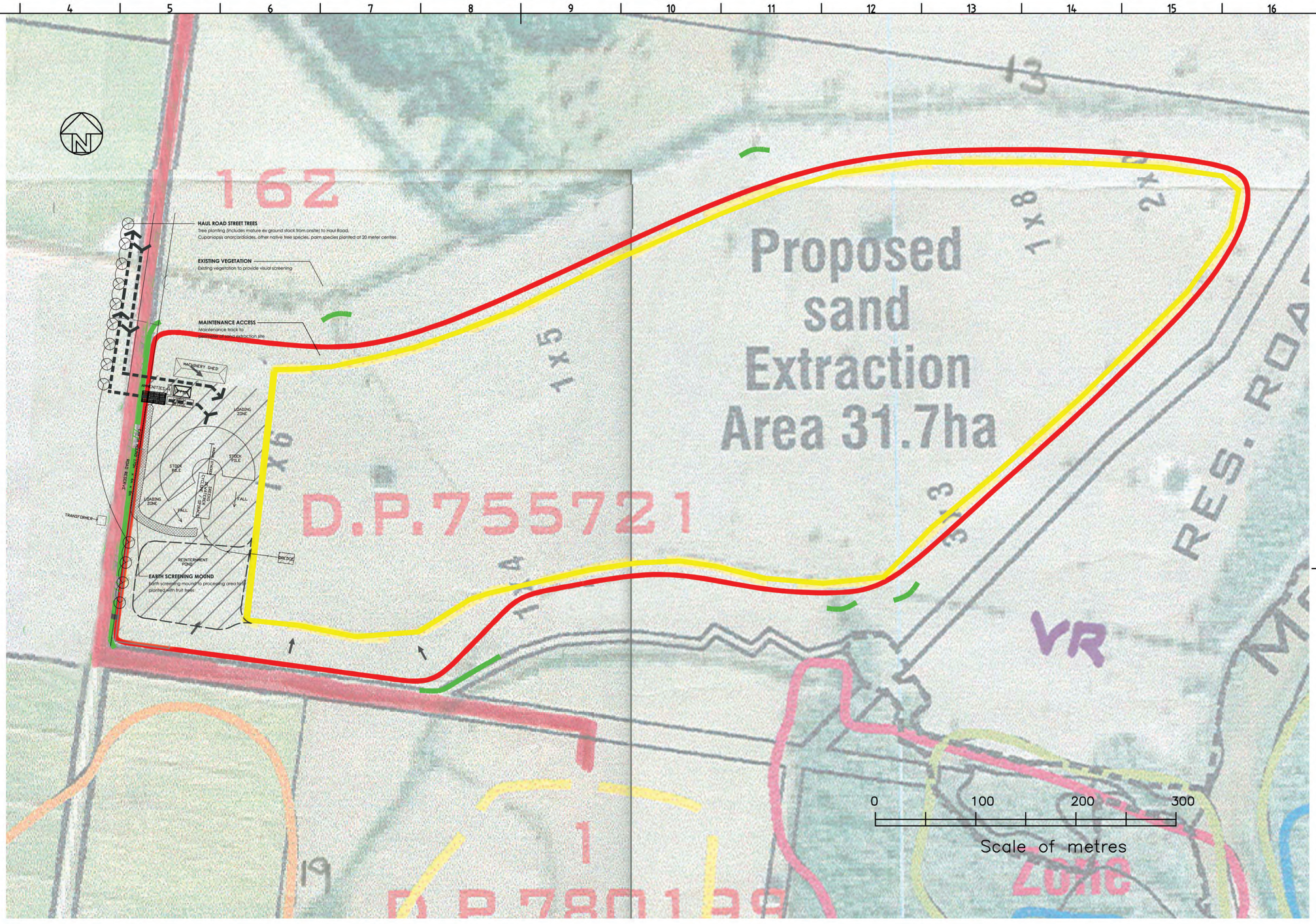
Petroleum and other chemical products shall be prevented from containing surface water and soil.
Any onsite fuel storage areas shall comply with Australian Standards.
Adequate trade waste and litter bins shall be provided onsite and service d regularly.
Concrete wastes and washouts shall not be deposited in any location where the wastes or washings can flow, or can be washed into any areas of retained vegetation or receiving waters.

Rehabilitation and landscaping

Progressive stabilisation of areas where construction delays occur and revegetation of completed areas.
All landscaping and rehabilitation shall be completed so that a duration of less than 60 working days will elapse from final land shaping to permanent rehabilitation.
All temporary erosion and sediment control works are to be removed once works are complete and revegetation is successfully established in for merly disturbed areas.
Drainage channels are to be rehabilitated immediately after completion.

Contractor Management

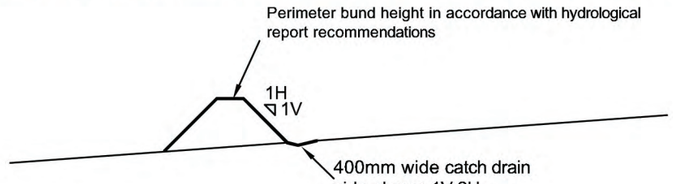
Review of the ESCP and the works contracts by the proponent.
Periodic checks to be made by an independent Environmental Consultant.
Training for construction staff in implementation of ESCP provisions.
Staff to be trained to implement dust minimisation measures.



Legend

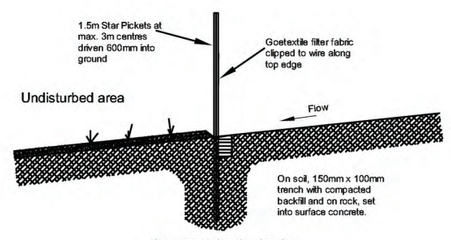
- Site office
- Perimeter bund
- Processing area
- Vehicular Shakedown
- Haul route
- Silt Fence
- Negative grade

Image source: N.C. White & Associates



PERIMETER BUND DETAIL

Not to Scale



SILT FENCE SECTION

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PLANIT CONSULTING

PROJECT

RAMTECH PTY LTD

DUNLOE PARK, MOOBALL

NORTHERN LAKE EROSION AND SEDIMENT CONTROLS

FIGURED DIMENSIONS TO BE READ IN PREFERENCE TO SCALING.	APPROVED	SCALE AS SHOWN	DRAWN C.M.A.	DRAWING No.
		DATE 9/11/06	CHECKED	GJ05554.ESCP.1.

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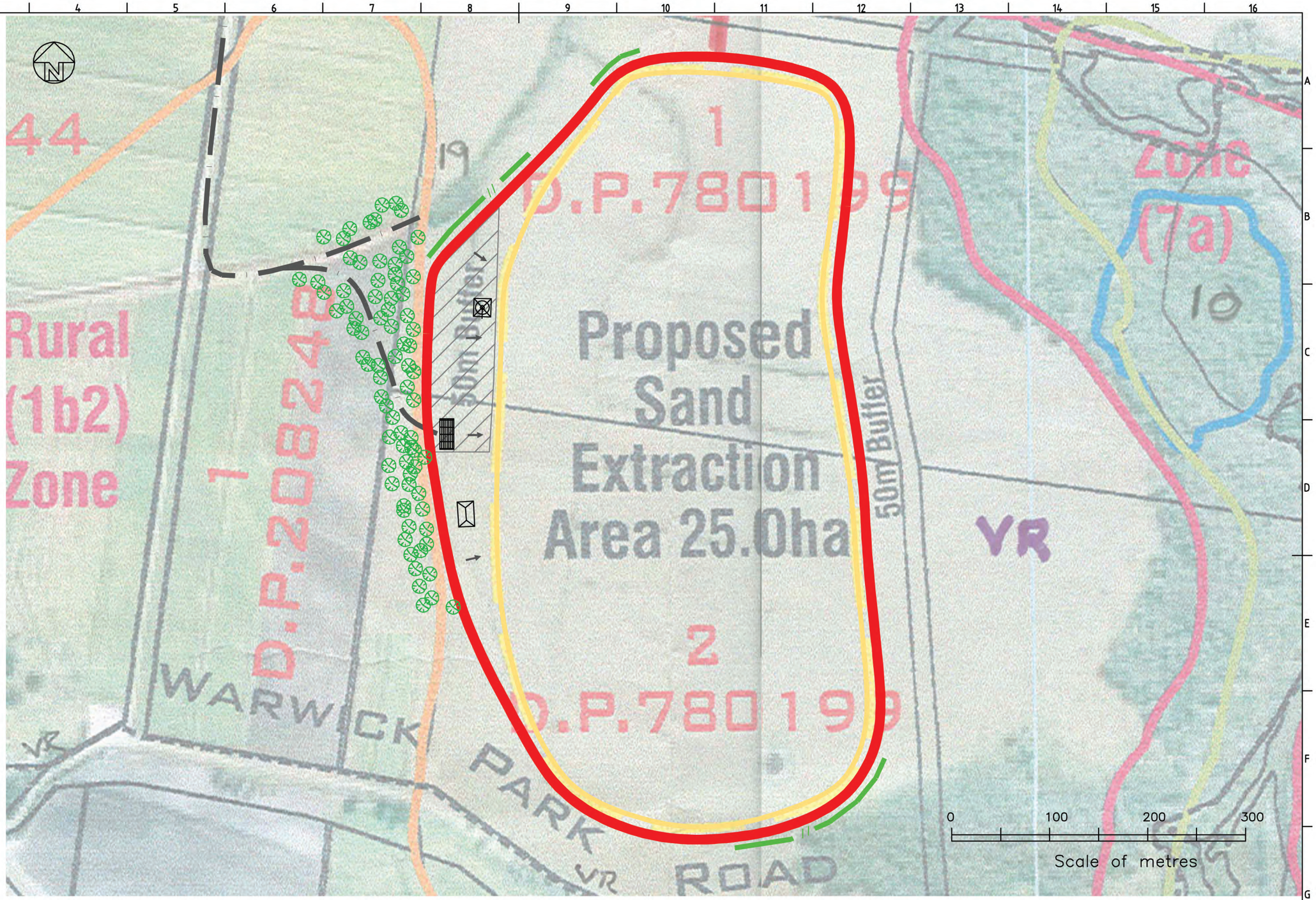
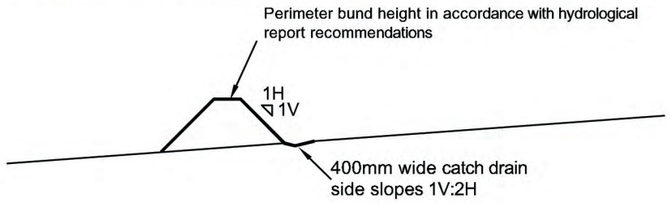
Staff to be trained to implement dust minimisation measures.

Legend

- Site office
- Washplant
- Perimeter bund
- Processing area
- Vehicular Shakedown
- Haul route
- Silt Fence
- Negative grade

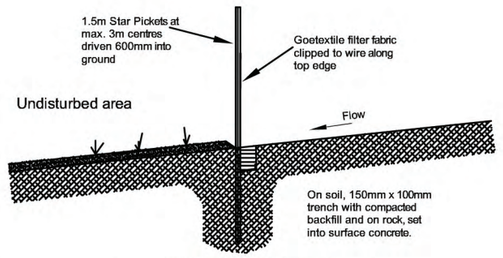
Image source: N.C. White & Associates





PERIMETER BUND DETAIL

Not to Scale



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SOUTHERN LAKE EROSION AND SEDIMENT CONTROLS

FIGURED DIMENSIONS TO BE READ IN PREFERENCE TO SCALING

APPROVED

SCALE AS SHOWN | DRAWN C.M.A.

DATE 9/1/06 | CHECKED

DRAWING No. GJ0554.ESCP.2.

Appendix C – Acid Sulfate Soil Management Plan

Acid Sulfate Soil Identification and Treatment

The Acid Sulfate Soil Management Plan has been separated into the following parts:

- Acid Sulfate Soil Identification
- Acid Sulfate Soil Treatment

Acid Sulfate Soil Identification

Dry excavated materials

All surface materials to be dry excavated will be sampled according to the following protocol on a staged basis prior to commencement of the excavation works.

Frequency – In accordance with the ASSMAC (1998) guidelines sampling frequency will be 2 boreholes per hectare over the excavation area with holes extending to the maximum depth of the builder's loam material.

Sampling – Soil samples approximately 0.3 kg each to be collected from each soil horizon or at least 0.5 m intervals down the soil profile. The soil profile description and depth of each sample is to be recorded.

Soil samples to be collected in sealed containers or geological sampling bags that exclude air. Samples are to be sent to the laboratory or frozen within 24 hours.

Analysis – Samples are to be screened for acid sulfate soil potential and undergo Chromium Reducible Sulphur (CRS) and Total Actual Acidity (TAA) analyses at an appropriate laboratory.

If the ASSMAC (1998) action criteria of 0.3%S equivalent sulphur or 18 mol H=/tonne of the equivalent acidity are exceeded, the material will require treatment as described below.

Hydraulically excavated material

Material extracted by hydraulic dredge will be sampled according to the following protocol:

Frequency – Ten samples per quarter.

Sampling – Samples will be collected following the washing process.

Soil samples to be collected in sealed containers or geological sampling bags that exclude air. Samples are to be sent to the laboratory or frozen within 24 hours.

Analysis - Samples are to be screened for acid sulfate soil potential and undergo CRS and TAA analyses at an appropriate laboratory.

If the ASSMAC (1998) action criteria of 0.3%S equivalent sulphur or 18 mol H=/tonne of the equivalent acidity are exceeded, the material will require treatment as described below.

Acid Sulfate Soil Treatment

Dry excavated materials

Dry excavation of soils exhibiting acid sulfate potential, based on the laboratory results, is to be treated in accordance with the following procedures:

- Soils requiring treatment will be treated with lime or a suitable neutralising agent to neutralise their equivalent TPA or equivalent oxidisable sulfur. In calculating the amount of lime or neutralising agent to be added, a mixing factor of safety of 1.5 will be used. If it can be demonstrated that this safety factor is not needed, a 1:1 ratio will be implemented.
- The calculated amount of lime or neutralising agent is to be spread over the extraction prior to commencement of excavation. Mixing of the materials will occur as the soils are excavated.
- All treated materials will be placed in spatially tracked areas within the perimeter bund and undergo verification testing at a rate of a minimum of 10 samples of the processed sand over a quarterly period for analysis by the CRS/TAA method. One sample should be collected from each on-site processing unit.
- Soils will not be transported off site until verification testing indicates acceptable oxidisable sulphur concentrations in accordance with the ASSMAC guidelines i.e., the equivalent sulphur is less than 0.3%S and the equivalent acidity 18 mol H=/tonne.
- If verification testing indicates continual failure to meet specified oxidisable sulfur concentrations additional lime and more thorough mixing of materials may be required. In this case, additional lime would be spread across the excavation area and mixed into the soil using a rotary hoe or disc plough prior to excavation.

Hydraulically excavated material

Hydraulically excavation material exhibiting acid sulfate potential, based on the laboratory results, is to be treated in accordance with the following procedure:

- Lime is to be mixed with water at the rate indicated by the laboratory results. In calculating the amount of lime or neutralising agent to be added, a mixing factor of safety of 1.5 will be used. If it can be demonstrated that this safety factor is not needed, a 1:1 ratio will be implemented.
- The lime and water mixture is to be sprayed onto the washed sand.
- All treated materials will be placed in spatially tracked areas within the perimeter bund and undergo verification testing at a rate of a minimum of 10 samples of the processed sand over a quarterly period for analysis by the CRS/TAA method. One sample should be collected from each on-site processing unit.
- The sand will not be transported off site until verification testing indicates acceptable oxidisable sulphur concentrations in accordance with the ASSMAC guidelines i.e., the equivalent sulphur is less than 0.3%S and the equivalent acidity is less than 18 mol H=/tonne.
- If verification testing indicates continual failure to meet specified oxidisable sulfur concentrations additional lime and more thorough mixing of materials may be required.

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22-SO-976847825-8/https://projects.ghd.com/oc/Newcastle3/holcimdunloesandquar/Delivery/Documents/2220056_RPT_Dunloe Soil and Water Management Plan.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	B Luffman	S Lawer		S Lawer		20/09/2019
1	B Luffman	S Lawer		S Lawer		21/10/2020

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