



Groundwater Management Plan

Tanilba Northern Dune Projects



Name of Approval Holder	SIBELCO AUSTRALIA LIMITED PO Box 114 Tanilba Bay NSW 2319
Operations Manager	Peter Radzievic Operations Manager Sibelco Australia Limited Sibelco Salt Ash 8 Oakvale Road Salt Ash NSW 2318 Mob: +61 409 241 488 peter.radzievic@sibelco.com.au www.sibelco.com
Environmental Coordinator	Michael Lynch Quality, Safety and Environment Coordinator Sibelco Australia Limited Sibelco Salt Ash 8 Oakvale Road Salt Ash NSW 2318 Tel +61 2 4982 6399 M 0418 952 697 michael.lynch@sibelco.com.au www.sibelco.com

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1. INTRODUCTION

1.1 BACKGROUND

Sibelco Australia Limited (Sibelco) operate white silica sand projects on the Tanilba Northern Dune near Oyster Cove on the Tilligerry Peninsula, NSW (see Figure 1). This Groundwater Management Plan (GWMP) manages groundwater impacts relating to both the Northern Dune (Original) site, and the Northern Dune Extension site (together, the 'Northern Dune Projects').

Historically, Sand has been extracted at the Northern Dune Projects as a rolling west to east cycle in approved zones of clearing native vegetation, extracting sand, reforming a new surface and planting of native vegetation. Extraction has now ceased at both the Northern Dunes (Original) and Northern Dunes Extension sites and both are in rehabilitation phase. The transition from extraction phase to rehabilitation phase has resulted in this revision of the GWMP to provide appropriate monitoring procedures given the reduced risk of impact from rehabilitation activities only.

The operations across the Northern Dunes area are subject to the approvals granted by the NSW Land and Environment Court (Northern Dune Original) and a Court approved Environmental Management Plan (Northern Dune Extension), which has been amended and updated as required since project commencement. Relevant approvals are detailed in section 1.4.

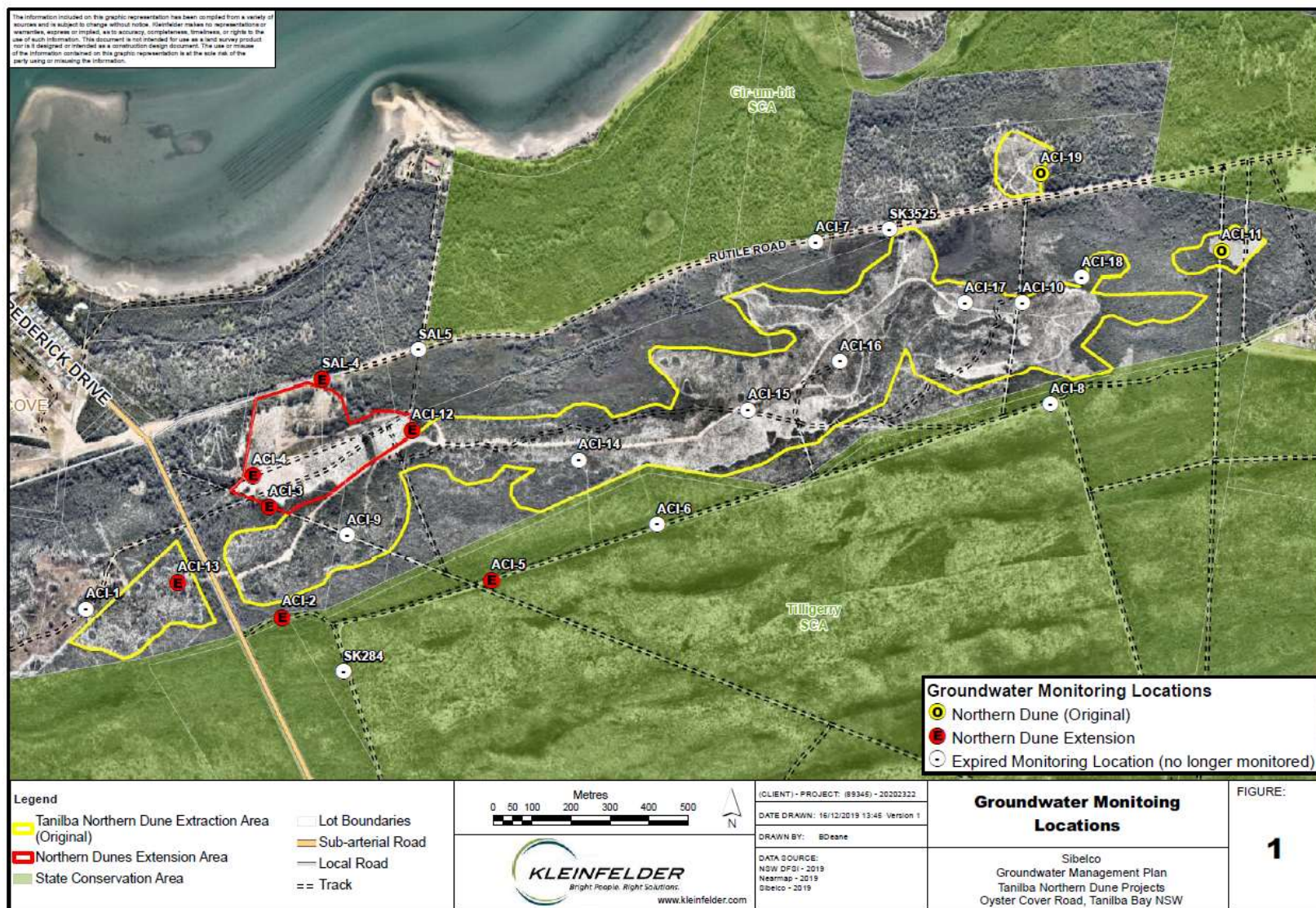


Figure 1 Location of the Tanilba Northern Dune Projects and Associated Monitoring Locations

1.2 GROUNDWATER MANAGEMENT PLAN

This Groundwater Management Plan (GMP) has been developed at Northern Dune to ensure compliance with the conditions of consent and licensing requirements stipulated by the relevant regulatory authorities during development and operation at the silica sand sites. Table 2 details the relevant regulatory authority to each project and the associated monitoring requirements.

1.2.1 History of the GWMP

CM Jewel and Associates (2003) developed the initial GWMP prior to the commencement of sand extraction at the Northern Dune Original site. In 2011 the GWMP was updated for planned extraction at Extraction Zone 4.

In 2014 a GWMP was developed for planned extraction at Lots 11-13 Extraction Zone (the Northern Dune Extension area). The 2014 version of the GWMP was revised in 2017 and focussed on monitoring ongoing extraction at the Northern Dunes Extension site, and rehabilitation at the Northern Dunes (Original) site.

1.3 PURPOSE AND SCOPE

This GWMP revision (2020) provides both Northern Dune projects groundwater management arrangements for the rehabilitation phase now that sand extraction has ceased from both the Northern Dune original area, and the Northern Dune Extension area.

The broad primary objectives of this GWMP are to provide an implementable management plan regarding the potential impact of:

- Recent extraction activities (less than 4 years) on groundwater level and quality
- Contaminated groundwater on Groundwater Dependent Ecosystems
- Acid sulphate and potentially acid sulphate soils

This GWMP has been developed to provide a formal framework for ongoing monitoring of groundwater across the Northern Dunes Projects. As such, this GWMP will provide sufficient data of adequate quality to achieve the following specific objectives:

- Monitor groundwater levels and quality in the vicinity of recent extraction (less than 4 years), and refine knowledge of the current depth to groundwater and natural fluctuations in groundwater level.
- Demonstrate that recent sand extraction (less than 4 years) has not resulted in the release of contaminants that might impact upon groundwater resources
- Demonstrate that recent sand extraction (less than 4 years) has not significantly altered the groundwater flow regime within the aquifer
- Demonstrate that recent sand extraction (less than 4 years) has not impacted on Groundwater Dependent Ecosystems
- Provide a contingency plan to manage any acid sulphate soils and potentially acid sulphate soils encountered during quarrying operations

1.4 STATUTORY REQUIREMENTS (PROJECT APPROVALS)

This GWMP is required to manage the requirements of approvals received from two statutory authorities, those being Hunter Water Corporation (HWC) and Department of Planning, Industry and Environment (DPIE). The relevant project areas and the requirements of the associated approvals are detailed in Table 1, which also identifies where in this GWMP they are managed, and demonstrated in Figure 1.

It should be noted that monitoring locations and frequencies of the Northern Dune Extension area are also dictated by the requirements of EPL 11633. Should the requirements of this EPL change then the GWMP would be revised to reflect those changes.

Table 1 Groundwater Related Project Approval Conditions by Project Area

Project Area	Section / Clause	Requirement	GWMP Section
Hunter Water Corporation Approval under Clause 13(1) of the Hunter Water (Special Areas) Regulation 1997 for engaging in extractive industry in the Tomago Sandbeds Catchment Area.			
Northern Dune Original	9 (1)	<i>[Groundwater Management Plan] Prior to the commencement of Extractive Operations, the Approval Holder must develop a program, to the satisfaction of HWC and the Department, to operate concurrently with the Extractive Operations in order to prevent or minimise to the extent possible any unreasonably adverse impact on the quality or stored quantity of the</i>	All

Project Area	Section / Clause	Requirement	GWMP Section
		<i>groundwater in the Tomago Sandbeds Catchment Area (Groundwater Management Plan).</i>	
	9 (2)	[Requirements of GMP] <i>The Groundwater Management Plan must include, but is not limited to:</i>	2.2.1
		<i>a) the Release Criteria applicable to the objectives of the Groundwater Management Plan;</i>	
		<i>b) locations of monitoring bores and piezometers distributed such that the monitoring program covers the Operational Area;</i>	Table 2
		<i>c) pre-extraction and post-extraction monitoring across the Extraction Area of watertable levels and water quality;</i>	2.4, 2.4, 2.5
		<i>d) analytes to be monitored;</i>	2.5.1
		<i>e) procedures for sampling and testing;</i>	2.4, 2.5
		<i>f) frequency of readings in relation to all specified parameters;</i>	Table 2 2.4.3 2.5.3
		<i>g) levels of readings indicating contamination of the groundwater; and</i>	2.5.1
		<i>h) procedures for investigation of detected contamination.</i>	2.5.4
	9 (3)	a) [Review of groundwater level plan]	4.4
		b) The Benchmark Maximum Predicted Groundwater Level Plan, and any subsequent Applicable Maximum Predicted Groundwater Level Plan, may be reviewed by HWC, the Department, and the Approval Holder, taking into account: <i>a. the monitoring results obtained under the Groundwater Management Plan; and</i> <i>b. groundwater level monitoring by HWC in the performance of its functions.</i>	4.4
		c) If no agreement can be reached pursuant to subparagraph (3)(b), the Director-General may amend the Applicable Maximum Predicted Groundwater Level Plan if reasonably satisfied that such amendment is supported by the data available.	N/A
		d) The Applicable Maximum Predicted Groundwater Level Plan may be amended	4.4

Project Area	Section / Clause	Requirement	GWMP Section
		<i>from time to time by the agreement of the HWC, Department and the Approval Holder based on the review conducted in accordance with subparagraph (3)(a).</i>	
		e) <i>On an amendment to the Applicable Maximum Predicted Groundwater Level Plan pursuant to subparagraphs (3)(b) or (3)(c), the Approval Holder must lodge with HWC and the Department a plan and associated data depicting that amended maximum predicted groundwater level for the Extraction Area (Maximum Predicted Groundwater Level Plan Amendment No. [X], where "X" is the number of the amendment).</i>	N/A
	9 (4)	[Continued monitoring] <i>The Approval Holder must continue to monitor the groundwater level and groundwater quality in accordance with the Groundwater Management Plan for four years after the extraction of sand has ceased in any particular Extraction Zone or such earlier time at which the Director-General is reasonably satisfied that the condition of the Extraction Zone satisfies the Release Criteria.</i>	2.2.1
Department of Planning, Industry and Environment Approval 09_0091 under Section 75J of the <i>Environmental Planning and Assessment Act 1979</i> .			
Northern Dune Extension	14. <i>The Ground Water Monitoring Program shall include:</i>	a) <i>detailed baseline data on groundwater levels and quality, based on statistical analysis;</i>	2.4.1, 2.5.1
		b) <i>groundwater impact assessment criteria;</i>	2.4.1, 2.5, Appendix 2
		c) <i>a program to monitor groundwater levels and quality;</i>	2.4, 2.5
		d) <i>a protocol for the investigation, notification and mitigation of any identified exceedances of the groundwater impact assessment criteria;</i>	2.4.4, 2.4.5, 2.5.4, 2.5.5
		e) <i>the outcome of groundwater modelling to establish the predicted maximum groundwater elevation for the site;</i>	2.4.2, 3.1
		f) <i>a program to monitor any impacts of the project on groundwater dependent ecosystems, and</i>	3.2
		g) <i>a contingency plan to manage any acid sulfate soils and potentially acid sulfate soils encountered during quarrying operations.</i>	3.3

Project Area	Section / Clause	Requirement	GWMP Section
Hunter Water Corporation Approval under Clause 10(1) of the Hunter Water Regulation 2010 for engaging in extractive industry in the Tomago Sandbeds Catchment Area.			
Northern Dune Extension	2	<i>To ensure that there is no adverse impact on the supply or quality of groundwater located within the Tomago Sandbeds Catchment Area, the Approval Holder must operate and manage the Extractive Operations:</i> a) <i>In accordance with the terms and conditions of this approval and the Environmental Management Plans; and</i>	This GWMP -All
		b) <i>Having regard to the importance of the groundwater and its surrounding environment for potable water supply purposes.</i>	This GWMP -All

2. MONITORING PLAN

2.1 GROUNDWATER MONITORING ESTABLISHMENT

Groundwater monitoring was initiated at Northern Dune in 2002, prior to the commencement of sand extraction in 2003. The groundwater monitoring network expanded over time with the installation of new piezometers as extraction expanded into planned zones and reached a maximum of twenty-three piezometers during the most intensive extraction operations.

Due to the cessation of extraction and progression of the projects into a rehabilitation activity, this GWMP includes monitoring at a reduced number of bores. Nine bores are monitored across both the Northern Dune (original) and Northern Dune Extension sites as detailed in Table 2.

Groundwater monitoring is required:

- Prior to sand extraction to benchmark (baseline) natural conditions and develop groundwater level and quality trigger values
- During sand extraction (operation) to monitor the potential impact of sand extraction against the groundwater level and quality trigger values
- During Rehabilitation to determine post and extraction conditions for comparison against natural conditions

Baseline groundwater level and quality monitoring is undertaken within a planned zone prior to commencing sand extraction. Baseline groundwater level monitoring is used to create a predicted maximum of groundwater (PMGE) which is then used for determining depth of extraction and final landform. Baseline groundwater quality samples are collected to create Trigger Values for comparison against sample concentrations during extraction operations and post-extraction operations to assist in detecting any changes in groundwater level and quality at the site.

Since a GWMP is approved prior to the commencement of operations baseline monitoring is incomplete and trigger values determined from the incomplete monitoring are provisional until sand extraction commences. Groundwater monitoring of rehabilitated Extraction Zones is continued until release has been secured from the relevant regulatory authorities. Groundwater monitoring data is collected and analysed by suitably trained personnel in accordance with Sibelco Groundwater Monitoring Guidelines.

2.2 GROUNDWATER MONITORING LOCATIONS

Groundwater monitoring locations are provided in Table 2 and demonstrated in Figure 1.

2.2.1 Groundwater Monitoring Locations Release Criteria

Extractive operations have ceased at both the Northern Dune and Northern Dune Extension Area and are in the rehabilitation phase and as such associated activities pose a significantly reduced risk of groundwater impacts.

Accordingly, groundwater quality monitoring frequency following cessation of extraction is performed annually for all monitoring locations with the exception of four monitoring location required by EPL 11633 which relates to the Northern Dune Extension area only. Monitoring locations and frequencies are detailed in Table 2.

While monitoring is planned to continue for 4 years following cessation of extraction, monitoring may be ended sooner if the Director-General is reasonably satisfied that the condition of the Extraction Zone satisfies the Release Criteria, with the release criteria being no exceedances experienced in the previous two groundwater quality monitoring events, or previous 12 months groundwater level monitoring events. Meeting of the release criteria will be evidenced to DPIE and HWC via the Annual Report (see section 4.2).

2.3 MONITORING LOCATIONS AND PROJECT APPROVAL BOUNDARIES

Project approvals (DPIE and HWC) require a GWMP (this plan) to the satisfaction of the Director General. The EPA has also issued an EPL which currently requires specific monitoring locations. See section 1.4 and Table 1 for further detail on individual Project approval requirements and the areas to which they apply.

The GWMP is required to manage the monitoring requirements of separately approved Projects across the Tanilba Dune operations. As such not all bores within the monitoring network are applicable to all Projects. Table 2 demonstrates which monitoring locations are related to which Projects and Approvals.

Table 2 Groundwater Monitoring Locations by Project / Jurisdiction

Project	Agency / Approval Jurisdiction	Monitoring Location Name	Easting	Northing	End of Mining Activity	Groundwater quality Monitoring Frequency	Groundwater Level Monitoring Frequency
Northern Dune	HWC	ACI-11	404951	6377742	Ceased Jan 2017	Annually	Monthly
	HWC	ACI-19	404487	6377941	Ceased Jul 2016	Annually	Monthly
Northern Dune Extension	DPIE / HWC / EPA	ACI-2	402538	6376802	Ceased Jan 2006 (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC / EPA	ACI-5	403076	6376897	Outside of extraction zone (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC / EPA	ACI-13	402270	6376891	Ceased Jun 2005 (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC / EPA	SAL-4	402641	6377413	Outside of extraction zone (monitoring required until EPL surrendered / varied)	6 Monthly	Monthly
	DPIE / HWC	ACI-3	402505	6377085	July 2019	Annually	Monthly
	DPIE / HWC	ACI-4	402463	6377166	July 2019	Annually	Monthly
	DPIE / HWC	ACI-12	402872	6377282	July 2018	Annually	Monthly

2.4 GROUNDWATER LEVEL MONITORING

2.4.1 Predicted Maximum Groundwater Elevation - from Baseline level monitoring

Baseline Groundwater level monitoring was used to construct a PMGE surface as described in sections 2.4.1.1 (Northern Dune) 2.4.1.2 (Northern Dune Extension). These levels were used to manage the extraction phase operations. Now that the project is in rehabilitation phase and extraction is no longer occurring, PMGE are provided as background to inform ongoing monitoring of groundwater levels.

2.4.1.1 Northern Dune

The original PMGE for the Northern Dune area derived by Jewel (2003) was a purely statistical based prediction of future groundwater behaviour using baseline groundwater. In 2008 the PMGE was exceeded which led to AECOM (2010) developing a similar statistically based estimate for Northern Dune.

Sibelco (2011) reviewed the AECOM estimate and identified deficiencies with this approach which led to the development of a more hydrogeological focused methodology. Sibelco developed a PMGE based on an analysis of local and regional groundwater data from 1950- 2011 against the 100 year rainfall record. Based on this analysis, Sibelco established a maximum groundwater elevation at the Tanilba Northern Dune operation and is provided in Appendix 1 and **Error! Reference source not found.**

2.4.1.2 Northern Dune Extension

Sibelco (2014) used a similar methodology for deriving the PMGE for the Northern Dune Extension area based on observed piezometer levels coupled with hand auger testing of groundwater. The Sibelco PMGE is 0.3-0.5 metres more elevated than the Jewel PMGE described in section 2.4.1.1.

2.4.2 PMGE Results

The PMGE Surface with piezometer PGME is presented in Appendix 1 and the piezometer PMGE are tabled in Appendix 2.

2.4.3 Groundwater Level Monitoring Schedule

The NOW (now DPI-Water) and HWC require that groundwater levels in all monitoring wells are to be measured monthly, but that this frequency be increased to weekly for a period of four weeks following any period when rainfall at Williamstown equals or exceeds 100 millimetres over a seven day rolling period, or when water levels are within 100 millimetres of the maximum predicted groundwater levels.

Since extraction of sand has ceased within the project areas and all are in rehabilitation phase, the projects present negligible risks to groundwater levels in the region. On that basis, groundwater level monitoring will continue at the monitoring locations and frequency specified in Table 2 for a further 12 months following endorsement of this Plan to confirm no ongoing groundwater level impact from the project activities unless an alternative duration is specified by DPI-Water and HWC.

2.4.4 Groundwater Level Exceedance Investigation

If initial analysis of groundwater level monitoring sample shows anomalous levels significantly different to other monitoring results and the regional groundwater table then groundwater in the effected monitoring well will be retested within fourteen days to confirm the results.

2.4.5 Groundwater Level Exceedance Notification

If retesting confirms the anomaly, DPI-Water and HWC will be notified as soon as practicable in writing, and an investigation will be initiated and results reported which will:

- Establish the spatial and temporal variability of groundwater level
- Determine whether the anomaly is natural variability (background) or potentially related to a site activity
- Provide an assessment of the potential impact upon the groundwater resource

2.5 GROUNDWATER QUALITY MONITORING

2.5.1 Analytes to be Monitored

The following analytes are monitored under the groundwater quality monitoring program:

- pH
- Electrical Conductivity
- Iron
- Arsenic
- Manganese
- Total Petroleum Hydrocarbons

2.5.2 Groundwater Quality Trigger Values

Baseline groundwater quality monitoring was undertaken prior to conducting any sand extraction within a planned zone. This data was used to create Trigger Values for comparison against sample

concentrations during extraction and post-extraction operations to assist in detecting any changes in groundwater quality within the zone. Trigger values are available in Appendix 2.

2.5.2.1 Development of Groundwater Quality Trigger Values

Groundwater quality at Northern Dune is driven by the nature of rainfall and properties of the unsaturated zone. Rainfall entering the soil zone undergoes significant changes in chemical composition and pH by processes such as root respiration and decomposition of organic matter via chemical reactions such as sorption and redox. The chemical constituency of infiltrating water in turn modifies groundwater chemistry by processes such as leaching, dilution but not concentration (which is protected against by licence conditions limiting depth to groundwater) as well as dissolution/precipitation. The effect of multiple processes on groundwater quality parameters and therefore setting Trigger Values is that water quality data is often multiple-modal (non-normal distribution) and so simple statistical analysis using mean and standard deviation may not adequately represent processes leading to water quality change.

The original trigger values derived by Jewel (2003) were from double the mean of the baseline concentrations encountered prior to extraction. In 2010 AECOM updated the trigger value calculation to mean plus two standard deviations. Sibelco derived trigger values for Extraction Zone Lots 11-13 (Northern Dune Extension) based on observed maximum and minimum rather than mean plus two standard deviations because the metals arsenic, manganese and iron demonstrate non-normal distribution and also because the mean plus two standard deviations exceeds the maximum for these water quality parameters.

2.5.2.2 Groundwater Quality Trigger Value Results

Groundwater quality Trigger values are tabled in Appendix 2.

2.5.3 Groundwater Quality Monitoring Schedule

Across the Northern Dune operations, operational groundwater quality monitoring is undertaken six monthly once mining commences in a zone, and continues at a lower frequency for four years after mining ceases.

Groundwater quality monitoring ceases from 4 years following cessation of extraction at a monitoring location if monitoring indicates no ongoing groundwater quality issues related to the extractive operations.

Extractive operations have ceased at both the Northern Dune and Northern Dune Extension Area and both are in the rehabilitation phase and as such associated activities pose a significantly reduced risk of groundwater impacts.

Accordingly, monitoring frequency will now be annually for all monitoring locations with the exception of four monitoring location required by EPL 11633 (Table 2) which relates to the Northern Dune Extension area only and requires 6 monthly monitoring . Should EPL 11633 be surrendered, the four associated monitoring locations referenced in Table 2 will reduce to an annual monitoring frequency also. Further, monitoring locations where extraction ceased four years ago or greater are removed from the groundwater quality monitoring program.

Using this approach, current groundwater quality monitoring locations and frequencies are listed in Table 2.

2.5.4 Groundwater Quality Exceedance Investigation

If analysis of water quality monitoring sample shows anomalous concentrations of any water quality parameter above Trigger Values, then groundwater in the effected monitoring location will be resampled and tested again within fourteen days to confirm the results.

2.5.5 Groundwater Quality Exceedance Notification

If resampling confirms the anomaly, DPI-Water and HWC will be notified as soon as practicable via email and an investigation will be initiated and results reported which will:

- Identify the specific groundwater quality parameters
- Establish the spatial and temporal variability of the water quality parameters
- Determine whether the anomaly is natural variability (background) or potentially related to a site activity
- Provide an assessment of the potential impact upon the groundwater resource

3. OTHER REQUIREMENTS

At the request of the Department of Planning this section of the GMP outlines how the PMGE surface was derived; demonstrates that sand extraction does not impact on Groundwater Dependent Ecosystems, and provides a contingency plan to manage acid-sulphate soils.

3.1 PMGE DERIVATION

Planned sand extraction is based on a PMGE. The PMGE surface has been constructed from the predicted maximum groundwater elevations of piezometers, which at Northern Dune are the observed maximum groundwater elevations, complimented by auger testing of groundwater. The PMGE surface was created in MAPINFO using an Inverse Distance Weighting method with a 3rd Power weight model, 50m cell size and the maximum calculated value of coincident points. The PMGE surface does not represent an actual surface but is an artificial surface created from groundwater levels at different dates. The prediction is therefore cautionary because it overstates actual maximum groundwater elevation which occurred from other sample points at the time of peak measurement. See Appendix 1.

3.2 GROUNDWATER DEPENDENT ECOSYSTEMS

Groundwater Dependent Ecosystems (GDE) are “any system that uses groundwater at any time for any duration in order to maintain its composition and condition” (SKM, 2012). Non-dependent ecosystems occur mostly in recharge areas and have no connection to groundwater. The risk of Northern Dune projects impacting on a GDE is very low because:

- Extraction is no longer occurring (the projects are in rehabilitation phase)
- The sand dune is a recharge area
- A study by SKM in 2012 for the NSW Office of Water (NOW) on NSW Coastal GDE's did not identify a GDE at the site (NOW, 2012) and the site is not listed in the National Atlas of GDE's

3.3 ACID SULPHATE SOIL CONTINGENCY PLAN

Acid sulphate soils are naturally occurring soils, sediments or organic substrates that are formed under waterlogged conditions. These soils contain iron sulphide minerals which are benign in groundwater (saturated zone) but react with oxygen to form sulphuric acid in the unsaturated zone. The risk of encountering an acid sulphate soil during Northern Dunes Projects is low because:

- Sand extraction is no longer occurring.
- The underlying Coffee rock has potential for forming acid sulphate soils but sand extraction is complete and because it was limited to 1 metre above the predicted maximum groundwater elevation of groundwater in this sand aquifer sand extraction was at least 1 metre above the Coffee rock.

If an acid-sulphate soil was unearthed during rehabilitation activities, work will immediately cease and an Acid Sulphate Soil Contingency Plan be prepared to the satisfaction of DPI-Water and HWC which appropriately outlines how groundwater resources will be protected, and if required, will outline a method to remediate impacted groundwater.

4. REPORTING AND REVIEW

4.1 EXCEEDANCE INVESTIGATION REPORTING

Confirmed groundwater level and quality exceedances will be compiled in a summary report that will be submitted to DPI-Water and HWC following the procedure described in sections 2.4.4 and 2.5.4 .

4.2 ANNUAL GROUNDWATER LEVEL AND QUALITY REPORTING

The results of the groundwater level and quality monitoring will be compiled in a summary report which will be submitted to DPI-Water and HWC on an annual basis within the Annual Environmental Management Report (see section 4.3).

4.3 ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

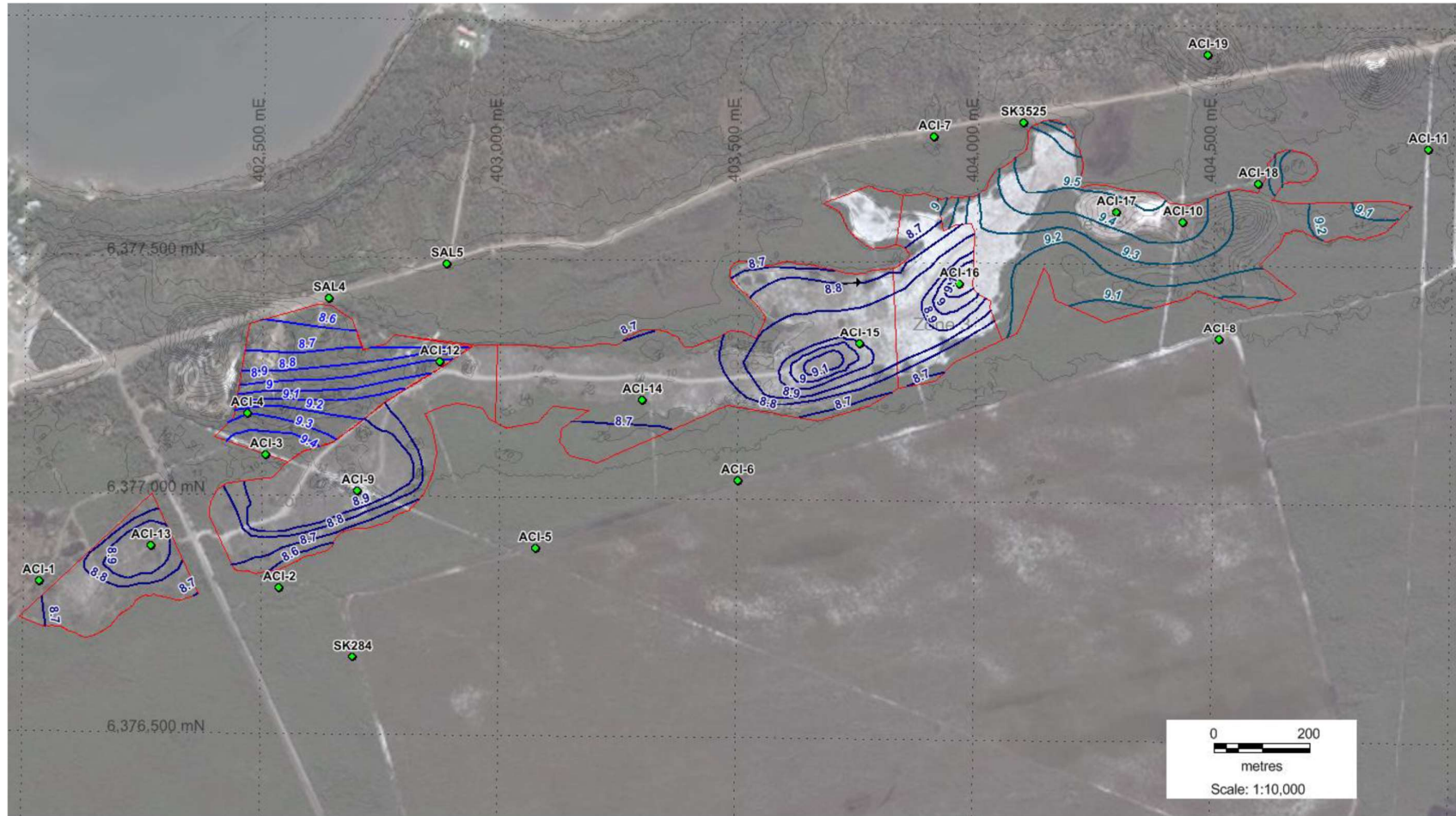
The results of the measured groundwater levels and quality analysis will be submitted to DPI-Water and HWC as part of the Annual Environmental Management Report (AEMR). Data will be validated against monitoring program QA objectives, and interpreted with reference to the overall monitoring program requirements (Table 1). The AEMR will also include rainfall data from Williamtown and descriptions of any environmental incidents that may relate to groundwater.

4.4 GROUNDWATER MANAGEMENT PLAN REVIEW

The GWMP will be reviewed annually and will assess the monitoring locations and frequencies included in the monitoring programs and the potential for more appropriate programs to be implemented.

If this review indicates more appropriate programs or procedures, then a submission informing of the changes and the need for them will be made to DPI-Water and HWC for endorsement.

Appendix 1: PMGE Surface with piezometer PGME



Jewel PMGE Extraction Zones 1-13 (dark blue), Sibelco PMGE Extraction Zone 4 (green) and Sibelco PMGE Lots 11-13 (bright blue)

Appendix 2: Groundwater Trigger Values and PMGE

Project Area	Bore	PMGE	GROUNDWATER QUALITY TRIGGER VALUES											
			pH	EC	Iron mg/L		Arsenic mg/L		Manganese mg/L		TPH mg/L			
					Dissolved	Total	Dissolved	Total	Dissolved	Total	C6-C9	C10-C14	C15-C28	C29-C40
Northern Dune	ACI-11	9.54	x	x	4.344	5.116	0.002	0.002	0.028	0.030	0.02	0.05	1	1
	ACI-19	9.06	x	x	x	x	x	x	x	x	x	x	x	x
Northern Dune Extension	ACI-2	8.44	x	x	3.058	3.623	0.001	0.010	0.015	0.014	0.02	0.05	1	1
	ACI-3	9.47	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-4	9.31	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-5	8.16	x	x	2.048	3.286	0.001	0.015	0.014	0.036	0.02	0.05	1	1
	ACI-12	9.28	x	x	x	x	x	x	x	x	x	x	x	x
	ACI-13	9.20	x	x	1.547	6.428	0.001	0.012	0.061	0.056	0.02	0.05	1	1
	SAL4	8.65	4.44-6.63	213	3.210	3.640	0.001	0.002	0.093	0.116	0.02	0.05	1	1