ENVIRONMENTAL MANAGEMENT PLAN

Surface Water Monitoring and Remedial Programme

Voyager II Quarry, The Lakes, Shire of Northam.

BGC (Australia) Pty Ltd
18 Mount Street
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Revision 2 October 2011

Rev No.	Date	Author	Approved by
1	Feb 2007	G Bakesi, URS	I Le Provost, URS.
2	Oct 2011	R Holmes, Holmes Environmental	P.Yates, BGC Quarries.

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1.1 Introduction to Revision 2

The proposal for the Voyager II Quarry was approved by the Minister for the Environment with the signing of Ministerial Statement 706 on 16 December 2005. Relevant to this management plan is Condition 13 reproduced in Section 1.5 below.

Further to a submission by BGC under Section 46 of the EP Act in October 2010– Statement 872 was issued in August 2011 replacing Condition 706:M6.1 with a new condition that extends the use of the tertiary crushers to 1900 hours on Saturdays.

Revision 1 of this Management Plan was prepared by URS (Australia) Pty Ltd on behalf of BGC (Australia) Pty Ltd (BGC) in compliance with Ministerial Statement 706 Condition 13.1 (706:M13.1). Revision 2 of this Management Plan has been prepared in compliance with 706:M13.6 that requires the Management Plan be reviewed and updated on an annual basis.

Ministerial Statement 706 set conditions on the construction and operation of a new quarry that has now replaced the original Voyager Quarry - now nominated Voyager I. With the expiry of the licence agreement between the BGC and the landowner, the Operating Licence L5356 for crushing and screening at Voyager I was not renewed and was allowed to expire on 3 October 2010. Quarrying operations were translocated to Voyager II Quarry that was located on adjacent land to the west that was purchased by BGC. Voyager II was commissioned in October 2010 under Operating Licence L8415.

Voyager II Quarry management meetings all include a segment discussion on safety and environmental issues under the guidance of the Health, Safety & Environment Officer. In these meetings, environmental issues arising are discussed in terms of current management system adequacy. Decisions that may improve environmental performance are implemented and are referred forward to the annual review meeting for consideration of their effectiveness. Clearly, Management Plan Documents are subject to ongoing review, but not necessarily "updates" in every year of operation when the review does not find adequate cause for an update of the document – in such circumstances the annual review outcome of quarry operations would be that environmental issues are adequately managed using the current management plan.

Development of the Voyager II Quarry will ultimately entail excavation of up to 2 million tonnes of gravel and approximately 12 million tonnes of clay from the quarry footprint. These excavations will allow approximately 60 million tonnes of granite to be quarried from the site over an estimated 50-year period.

1.2 Current Status

At the time of this first update (Revision 2) Voyager II Quarry has been through commissioning, start-up and gradual ramping up of operations to the designed production rate; consequently, an update is now appropriate as the plant has now been in operation for one year since commissioning. The ownership of Voyager I has now passed to the landowner and the original design strategy for managing Voyager II has now been updated in regard to design and operational experience.

The planning for Voyager II as outlined in EIA documents (URS, 2004) and in Revision 1 of this document indicated that water courses to the north of Voyager II would be impacted by surface water discharges from the quarry. However, with the development of the quarry and continued drying of the regional climate, Voyager II has been now been constructed so as to contain all surface water derived both from rainfall and groundwater seepage.

Surface water discharges from the decommissioned Voyager I operational areas are now under the control of the landowner who has requested that the surface water flows to the Voyager I Dam be maintained so as to provide for stock watering. All surface water flows within the catchment of Voyager I are either to the sump within the Voyager I void or are directed via sediment traps to the Voyager I Dam. Pumping water from the Voyager quarry pit to the dam on the eastern boundary was discontinued with the decommissioning of Voyager I.

Potential impacts on watercourses and surface water environments downstream of the Voyager II Quarry, as envisaged in earlier planning (Revision 1), will not occur as water is not intended to be released from Voyager II. However, provision has been made for the managing any erosional impacts should Voyager II be required to release water under exceptional circumstances (see Section 4)

1.3 Changes to the Management Plan

The following are noted as changes from Revision 1 to Revision 2 of this Management Plan

- With the expiry of the licence agreement between BGC and the landowner, Voyager I Quarry was decommissioned in October 2010 and ownership of the land occupied by both the void and the operational areas were passed to the control of the landowner.
- Voyager II Quarry was commissioned on 24th September 2010 and is now in full operation.
    - Areas 1 and 2 have been excavated to a level platform 30 m below the original ground level for the quarry operational area;
    - Areas 3 and 4 have been cleared, overburden has been removed and is now mined as a source of ROM for the operational area
    - Areas 5 and 6 have been cleared of vegetation in preparation for overburden removal at a future time.

The Revision 2 of the monitoring regime requires the following to be taken into account:

- Voyager II Quarry has been designed and constructed to hold all catchment and seepage water. Water will only be released in exceptional circumstances – in the event that high rainfall exceeds the storage capacity of the two storage dams and the quarry pit.

The revised monitoring plan is shown in Table 4.

1.4 Aspect of the Environment to be Protected

The Voyager II Quarry is on the north side of the Great Southern Highway, about 3.5 km east of the intersection of the Great Eastern and Southern Highways (Figure 1), on Lot 14 Horton Road, The Lakes

(Avon Location 1881), Shire of Northam and is located immediately to the west of the now decommissioned Voyager I Quarry.

Voyager II Quarry is located on privately owned land near the top of the local catchment divide (see Figure 2, Voyager II Groundwater Management Plan, 2011), on the western side of a small valley, in the south-east portion of the Wooroloo Brook Catchment, which in turn forms part of the Swan-Avon Catchment.

Figure 1. Aerial Photograph of Voyager I and Voyager II Quarries *(from NearMap)*

1.5 Protection of Surface Water Environments

The use of surface water and groundwater is controlled by the *Rights in Water and Irrigation Act 1914* and applies to the management of water resources. However, the Voyager I and II Quarries are not located within a proclaimed surface water area.

The quality of surface water should be maintained or improved to ensure that existing and potential uses, including ecosystem maintenance, are protected, consistent with the *Australian and New Zealand Water Quality Guidelines* (ANZECC, 2000). These guidelines provide a framework for water quality management and the development of appropriate Surface Water Monitoring and Remedial Programmes.

Legislation and guidelines that apply to the Surface Water Monitoring and Remedial Programme are outlined in Table 1 below.

Table 1: Statutory and Policy Guidelines for Surface Water Monitoring and Remedial Programmes

Agency	Statute/Guideline	Applicability
State Legislation.	*Environmental Protection Act 1986*	Ministerial Statement 706 was issued under Part IV of the Act.
Department of Environment and Conservation (DEC).	*Draft Guideline: Preparing Environmental Management Plans.*	This document has been prepared in compliance with the draft document.
	Rights in Water and Irrigation Act 1914.	Management of water resources.
Department of Environment and Heritage.	*Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000..*	Use of Groundwater and Surface Water.

Relevant to this Surface Water Monitoring and Remedial Programme is the Ministerial Statement 706, Condition 13 which is reproduced below.

13-1 Prior to clearing of vegetation or excavation of soil or rock, whichever is the sooner, the proponent shall prepare a Groundwater[1] and Surface Water Monitoring and Remedial Programme, to the requirements of the Minister for the Environment.

The objective of this Programme is to monitor groundwater levels adjacent to the quarry, and the quantity and quality of surface water leaving the site to ensure that the operations are not resulting in a reduction of water levels of existing bores of neighbours or any significant decline in the

[1] The Groundwater Programme is presented in a separate document.

quality of waters downstream of the quarry, and to define management actions and contingency measures to be implemented in the event of adverse impacts on the water levels of bores or salinity in downstream waters caused by quarry and associated operations.

This Programme shall:

1. be designed and implemented in a manner which is capable of identifying any adverse impacts from quarrying and associated activities on surface and groundwater in the vicinity of the proposal;

2. incorporate separate monitoring for surface water and groundwater;

3. identify key monitoring locations;

4. identify water quality criteria and limits to be met;

5. identify baseline levels for groundwater supplies on adjacent properties;

6. include a monitoring schedule;

7. include a reporting schedule; and

8. define management actions and contingency measures to be implemented in the event of adverse impacts on the water levels of bores or water quality in downstream waters caused by quarry and associated operations.

13-2 The proponent shall implement the Groundwater and Surface Water Monitoring and Remedial Programme required by condition 13-1 and any subsequent updates as required by condition 13-6.

13-3 The proponent shall ensure that water quality criteria and limits identified within the Groundwater and Surface Water Monitoring and Remedial Programme are not exceeded.

13-4 The proponent shall report any exceedance of the limits identified within the Groundwater and Surface Water Monitoring and Remedial Programme to the Department of Environment within 24 hours of being observed.

13-5 The proponent shall provide a report to the Department of Environment relating to the exceedances referred to in condition 13-4 within seven days of being recorded, identifying the sources of the exceedance within the proposal area and indicating remedial action undertaken to prevent further such exceedances.

13-6 The proponent shall review and update the Groundwater and Surface Water Monitoring and Remedial Programme required by condition 13-1 annually.

13-7 The proponent shall make the Groundwater and Surface Water Monitoring and Remedial Programme required by condition 13-1 publicly available.

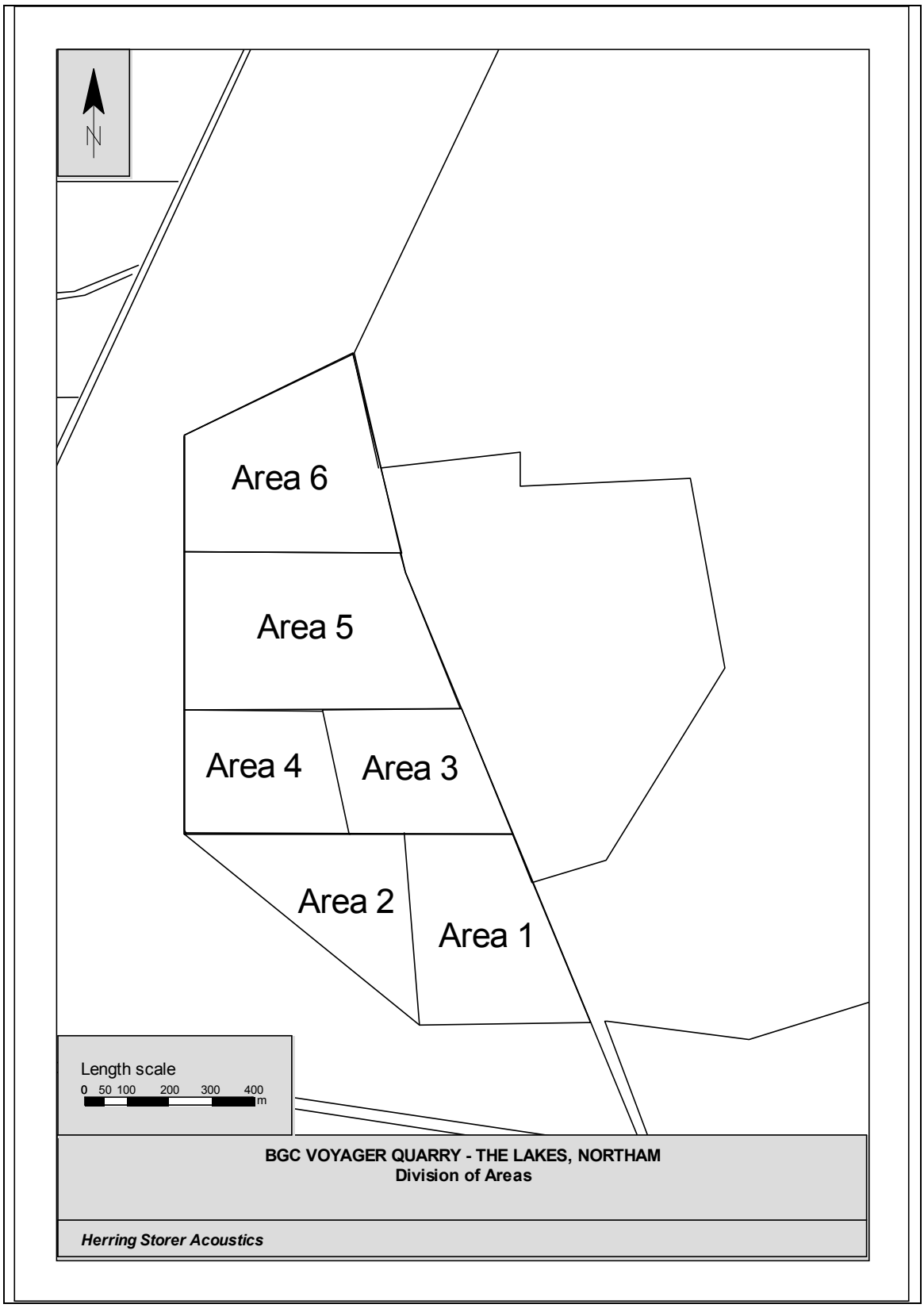

Figure 2: Division of Areas within Voyager II Quarry *(from Herring Storer Acoustics)*

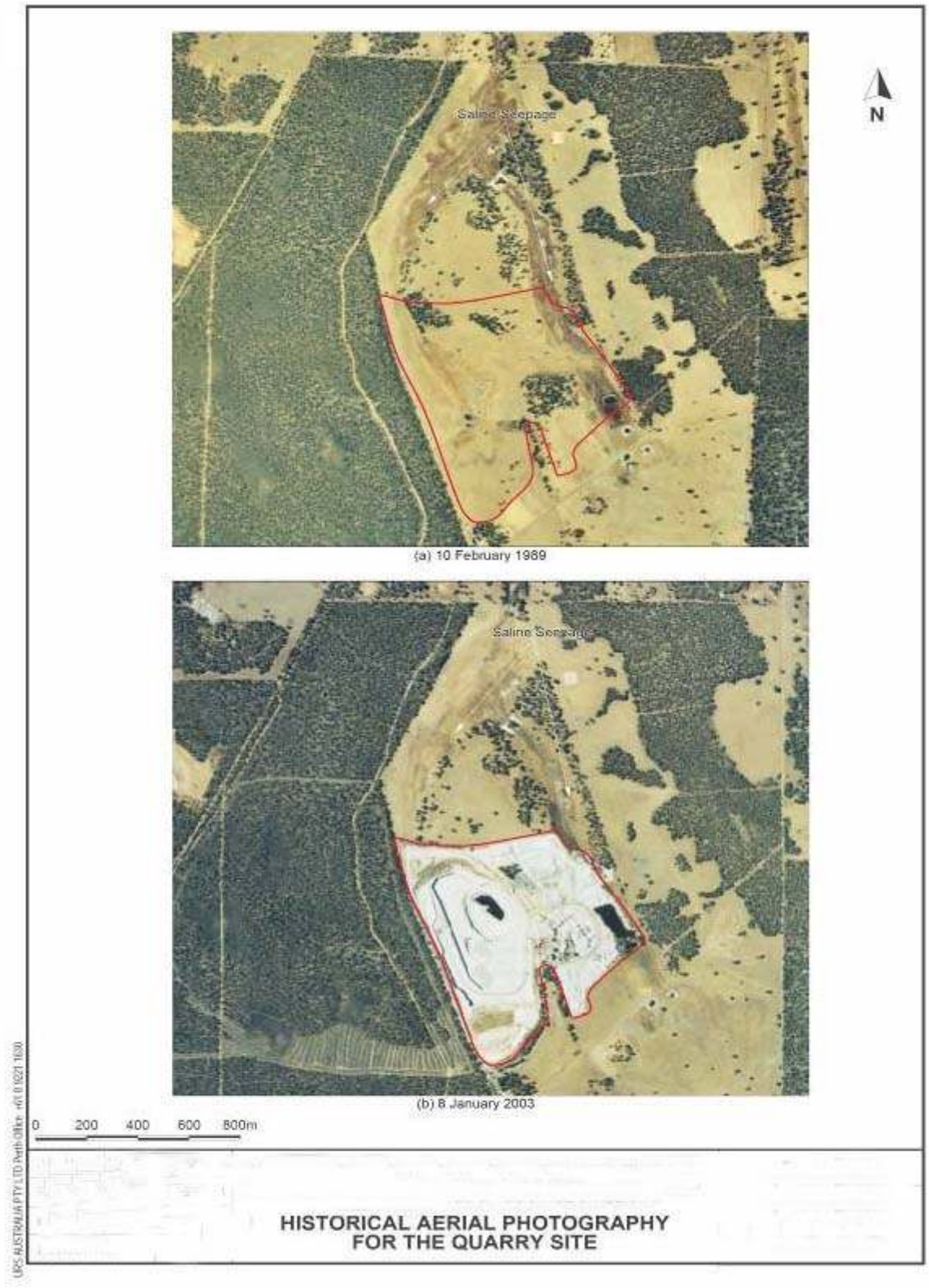

Figure 3. Historical Salinisation Impacts due to Clearing ***(from URS 2007)***

2.1 Characterisation of the Surface Water Environs

Drainage in the vicinity of the Voyager Quarries is from the south to the north predominantly in two small tributaries termed the Eastern and Western Streams that can be seen to the north of Voyager I in Figure 1. The catchment divide lies immediately to the south of the Voyager II Quarry (see Figure 2, BGC Groundwater MP). There are, however, no substantial drainage lines, wetlands or sensitive watercourses in the area that have been disturbed by either Voyager I or II quarries. Slope on the original site of Voyager I was around 7% and the general direction of flow is to the north-east. Elevation in the original ground surface area varied from 300 to 350 m AHD. The local streams just north of the quarry are small, flowing mainly in winter as a result of overland flow and seepage from the surrounding slopes. The soils along the streamlines are sandy clay (weathered granite) overlying granite. The Voyager I Quarry Dam can be seen on the eastern boundary of the Voyager I Quarry (Figure 1). During the operational life of the Voyager I Quarry, all surface water discharged from the quarry was directed through the dam via sediment traps. The dam will continue to operate as a catchment overflow from the decommissioned Voyager I operational area, now under the control of the landowner.

The main watercourse near the quarry merges with another tributary about 2 km to the north, then with Chinganning Gully about 4 km further north. From there a series of tributaries join Wooroloo Brook before it flows into the Avon River, some 30 km northwest of the quarry.

The catchment in which the quarry is located is influenced by salinisation, interpreted to be caused by rising groundwater as a result of land clearing. The extent and causes of salinity were discussed in Appendix G of the Public Environmental Review (PER) documents (URS 2003). The extent of salinity in the local catchment is also indicated by historical aerial photography (Figure 3). The Figure 3 photo taken on 10 February 1989, before the quarry operations began, shows clear evidence of salinisation and salt scalds. The photograph taken in January 2003 shows the Voyager I Quarry in place.

There are several obvious areas of salinisation in the pastures downstream of the Voyager I and II quarries (Figure 3). Vegetation in these areas is sparse, runoff rates are high and soils may be erosionally unstable. Grazing and trampling by stock exacerbate erosion. Observations of salinity in the streams, water storages and bores over time clearly show that seepage from surrounding agricultural land is the main source of salt load in the local catchment. This seepage is the result of a rising watertable caused by land clearing for agriculture. Salinisation is not related to the previous operations of the Voyager I Quarry. Controlled discharges from the Voyager I Quarry, when under BGC control, increased stream flows, and due to the low salinity of discharged water, resulted in an overall lowering of salinity levels in the streams near the quarry.

The characterisation of the local surface water environments has been undertaken using site inspections, review of maps, and evaluation of stream flow data (from the several stream flow sites on Wooroloo Brook operated by the Department of Water [DoW]). Flows and water qualities in streams in the vicinity of the quarry were characterised during site visits in January and April 2004, building on data from previous site visits and observations presented in Appendix G of the PER.

A number of transects along the streams north of the Voyager Quarry were taken between 2002 and 2004 (Figure 4). Transects were made along the Eastern and Western Streams, commencing on the northern limits of the quarry and extended further north to the boundary with Lot 13. Issues related to erosion, baseflow contributions, concentration of salts and impacts on dams and farmland were investigated.

The transect taken on 9 July 2002 illustrates the cumulative impact of seepage flows from salt scalds north of the quarry. These data are discussed in Appendix G of the PER and indicate that the main source of seepage and salt in the streams north of the quarry is a result of a rising groundwater levels due to clearing.

The transect taken in January and April 2004 show a decline in stream flow and steady increase in salinity with distance downstream. In these cases, the stream flow was sourced from the area near the north eastern corner of the quarry. Stream flow declined with distance downstream because of losses to evaporation, particularly from a small farm dam (D2) north of the quarry. No infiltration into or seepage was evident from the stream bed and banks north of the quarry. The Western Stream at the time of the March 2002 and January and April 2004 samplings was dry.

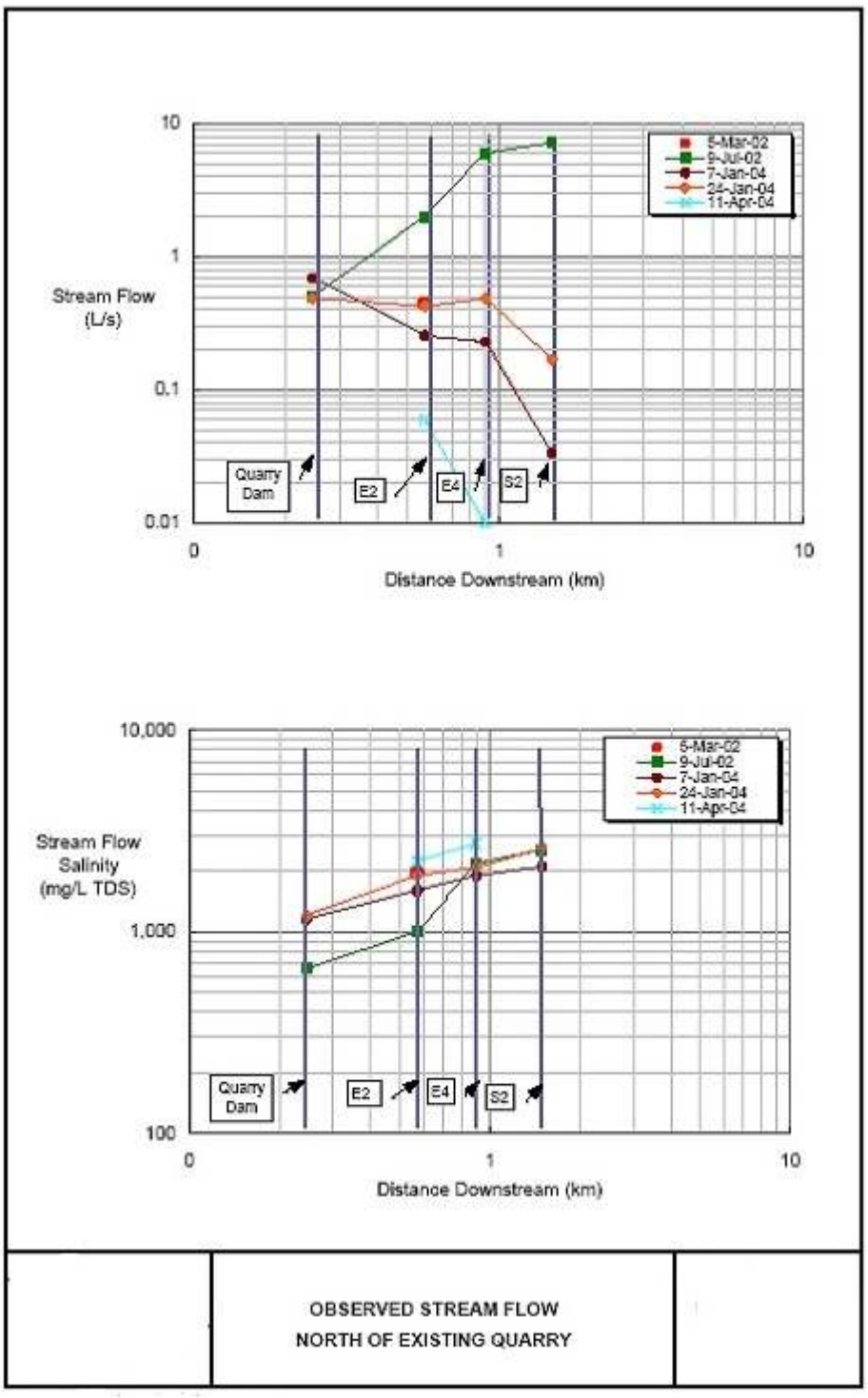

Figure 4. Transects That Characterise Local Stream Flow *(from URS 2007)*

2.2 Characterisation of Existing Quarry Operations

2.2.1 Voyager I

With the decommissioning of Voyager I Quarry in October 2010, the control of the land surrounding the void is now in the ownership of the landowner. Terrain shaping up to the time of decommissioning ensured that all stormwater drainage flowed either to the Voyager I void or via silt traps to the dam on the eastern boundary of the Voyager I Quarry. Previously, seepage water was pumped to the dam, but this has been discontinued since decommissioning. The landowner has requested that this arrangement stay in place so as to provide stock watering capability from the Voyager I dam.

As was the case prior to decommissioning, runoff from rehabilitated soil bunds on the north of the Voyager I void continue to flow to the Western Stream.

2.2.2 Voyager II

Revision 1 of this Management Plan indicated that surface water runoff from Voyager II would be directed to the western Stream (see Figure 5 below). However, the intention of the ongoing design and development of the new quarry is to ensure, if at all possible, that there will be no discharge of surface water from Voyager II Quarry. Figure 1 shows the location of the Voyager II North and South Dams and a sump within the quarrying area for collecting rainfall and seepage from current Voyager II quarrying operations. Water from the sump is pumped to the South Dam for operational needs. A bund has been constructed along the length of the eastern boundary of Voyager II that ensures all surface water flows either of the dams or to the sump.

Any seepage from the bund on the eastern boundary of Voyager II is directed to the Voyager I sump.

A water balance for Voyager II Quarry is included in Table 2 below based on Voyager Quarry rainfall records collected since 2004 and Class A pan evaporation data for Northam (Luke et al, 1987). The estimates provided in Table 2 indicate a positive water balance over the year of approximately 94 KL where the total storage capacity is 270 KL. The quarry has only been in operation for one year; consequently, data for Annual Water Use, Annual Runoff to Storage and Annual Net Seepage have not yet been able to be quantified. At this time, an estimated positive gain over the year is encouraging due to the possibility of a further drying climate. At the time of preparing Revision 2 in September 2011, the Southern Dam was full and the Northern Dam still had a freeboard of 5 metres. The total depth of the Northern Dam is approximately 12 metres where the major storage volume is at the top end of the freeboard due to the V-shape of the dam. Water monitoring data will provide an improved estimate of surface water balance by 2013 and will be included in the review for 2013.

	Table 2. Voyager II Catchment Analysis												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep[	Oct	Nov	Dec	Total
2004	0.0	1.5	1.0	7.0	91.8	106.0	62.5	114.5	29.5	17.5	34.5	0.0	465.8 mm
2005	0.0	4.0	0.0	0.0	154.0	153.0	46.0	112.5	76.0	33.0	7.0	5.0	590.5 mm
2006	70.0	13.5	3.0	22.0	22.0	34.5	77.0	118.0	45.5	11.0	6.0	2.0	424.5 mm
2007	15.0	0.0	12.0	45.0	14.0	45.0	178.0	100.0	55.0	3.0	5.0	22.0	494.0 mm
2008	0.0	35.0	39.0	57.0	59.0	71.5	130.0	9.0	37.0	50.0	39.0	14.0	540.5 mm
2009	0.0	0.0	10.0	25.0	50.0	93.0	129.0	108.0	70.0	0.0	36.0	0.0	521.0 mm
2010	0.0	0.0	25.0	12.0	40.0	0.0	58.0	7.0	0.0	0.0	9.0	22.0	173.0 mm
Average monthly rainfall mm	12.1	7.7	12.9	24.0	61.5	71.9	97.2	81.3	44.7	16.4	19.5	9.3	458.5 mm
Surface water catchment KL	10.2	6.4	10.7	20.1	51.4	60.1	81.3	68.0	37.4	13.7	16.3	7.8	383.3 KL
Avg. Class A pan evap. mm	366.0	311.0	263.0	150.0	91.0	56.0	57.0	69.0	110.0	167.0	236.0	329.0	2205.0 mm
Evaporation KL/month from surface storage	7.3	6.2	5.2	3.0	1.8	1.1	1.1	1.4	2.2	3.3	4.7	6.6	43.9 KL
Net Storage Gain KL assume no losses	2.9	0.3	5.5	17.1	49.6	59.0	80.1	66.6	35.2	10.3	11.6	1.2	339.4 KL
Reduced catchment runoff – evap & seepage for V1 > 50%	1.4	0.1	2.8	8.5	24.8	29.5	40.1	33.3	17.6	5.2	5.8	0.6	169.7 KL
Annual Usage ~ V1 use + 10%													75.0 KL
Annual Balance													94.7 KL

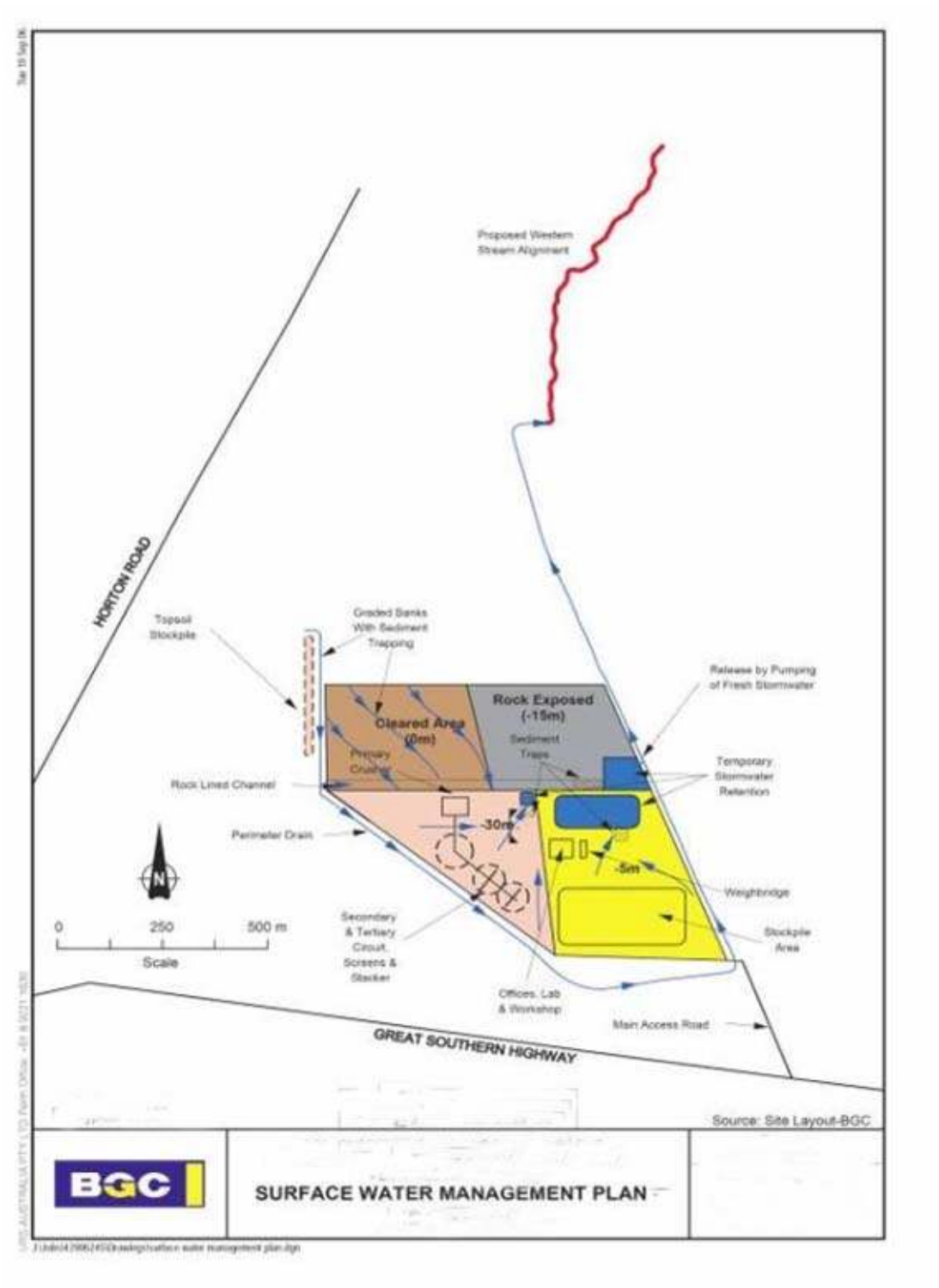

Figure 5. Initially Proposed Surface Water Management for Voyager II Quarry *(from URS 2007)*

Potential Quarry Impacts on Surface Water

SECTION 3

The following issues were raised in Revision 1 due to the proposal to release quarry surface water to the Western Stream.

> Issues have been raised about the impact of the release of water from the Voyager II Quarry on downstream flows, salinity, erosion, and local groundwater levels. The community indicated a need to characterise how far downstream the water from the quarry is likely to have an impact, to place the volume of water and salt released in the context of the wider Wooroloo Brook catchments, and to characterise any potential impact of the additional water on groundwater levels along the streamlines.
>
> Clearing for agriculture has substantially increased stream flows and salinity along the whole length of Woorooloo Brook. The impact of clearing is much greater than the impact for either Voyager I or Voyager II Quarries because the extent of clearing is much greater than the disturbance from quarrying.
>
> The main potential surface water issues linked to the Voyager II Quarry may be directly inferred from the Voyager I operations and these include:
>
> - The water balance of the Voyager I Quarry and what impact the it is having on downstream flows and salinity.
> - Release of water from the Voyager II Quarry, particularly how far downstream impacts might occur and what the impacts will be on stream flow, salinity, erosion, and local water-table elevations as a result of infiltration from the stream beds.
> - Management of sediment and erosion on-site during the life of the quarry.
> - Accuracy of the water balance for the Voyager II Quarry, particularly relating to the amount of seepage into and out of the pit during the life of the project.
> - The scope and frequency of surface water monitoring at Voyager I Quarry.

Surface water management for Voyager II now requires all catchment and seepage to be retained within Voyager II surface storage dams. Now that the quarry is fully operational, monitoring over the next twelve months will provide a firmer data set that is currently available (Table 2).

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Management Performance Indicators/Criteria

SECTION 4

4.1 Principal Objectives

The objectives outlined below were a consequence of the original proposal to release surface water from Voyager II (Figure 5) to the Western Stream. Thus:

- Salinity, turbidity and erosion issues will now not arise in that all surface water will be retained within Voyager II Quarry.
- In regard to pollution, the design and construction of the maintenance and repair workshops ensures that all surface water discharged from these areas are treated for hydrocarbon removal prior to release to the operational area of the quarry. Hydrocarbon management is also managed under the DEC Operational Licence issued to Voyager II Quarry.
- It is anticipated that catchment and net seepage will provide sufficient water for Voyager II operational needs.

However, contingency planning is in place for the possibility that surface water has to be released under exception circumstances. In such circumstances any release would be of short duration and the water quality would meet the requirements of Table 3 because such a release would be during or after a high rainfall event.

The EPA objectives for surface water management and conservation as stated in Ministerial Statement 706:M13.1 are:

- Monitor the quantity and quality of surface water leaving the site to ensure the quarry operations are not resulting in a reduction of water quality downstream of the quarry.

Furthermore the management objectives of this management plan are to:

- Minimising the risk of erosion by appropriate management of surface runoff volumes and quality.
- Implement appropriate pollution management measures on-site.
- Ensure adequate water supply for the quarry operations.

The Surface Water Monitoring and Remedial Programme applies to all areas under consideration for the Voyager II Quarry.

The EPA's objectives as stated in Bulletin 1169 (EPA 2005) are to

- Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected.

The requirements of Condition 706:M13.1 are

1. The management plan be designed and implemented in a manner which is capable of identifying any adverse impacts from quarrying and associated activities on surface and groundwater in the vicinity of the proposal.
2. Incorporate separate monitoring for surface water.

3. Identify key monitoring locations.
4. Identify water quality criteria and limits to be met.
5. Include a monitoring schedule.
6. Include a reporting schedule.
7. Define management actions and contingency measures to be implemented in the event of adverse impacts water quality in downstream waters caused by quarry and associated operations.

The above items are satisfied by the requirements of Table 4.

4.2 Performance Indicators/Criteria

The criteria of a Management Plan are generally used to track progress in achieving objectives and targets. These indicators should be specific, objective, achievable, relevant and time-framed, and therefore verifiable and reproducible.

Possible indicators and criteria may include ANZECC water quality criteria, site-specific criteria, regulatory standards, plant density/diversity measures and Australian Standards. measurable performance criteria are crucial elements of a Management Plan, allowing the proponent and regulatory bodies, to confirm the effectiveness of management strategies and for proponents to demonstrate compliance with environmental regulation. They are also an important tool for monitoring continuous improvement.

The Project was designed to comply with the requirements of the EPA Guidance Statement No. 26 which are presented in Table 3 below.

To ensure water released from the quarry meets release criteria (Table 3), water storage (the Quarry Sump or plant storage) will be sampled for TDS, TSS and EC.

The water quality and erosion criteria are listed in Table 3, and are based on current water quality in the local catchment and potential impacts on the downstream environment. It is possible that these criteria will be modified in the DEC licence for the site. BGC will ensure that these criteria are met before release of water (URS 2003).

Table 3: EPA Criteria for Water Release

Measurement	Measurement Method	Acceptable Criteria	Comments
Salinity	Manual sample as required, analysed at accredited laboratory or recorded using portable equipment.	TDS < 1,000 mg/L or EC < 1,800 (µS/cm)	Based on background stream salinity
Turbidity	Manual sample as required	TSS< 80 mg/L	Based on background stream conditions and licence conditions for the Voyager II Quarry
Downstream stability	Visual observation of downstream channels as required.	No obvious stream bank erosion, rilling or sediment fans that can be attributed to releases from the quarry.	Based on the need for a flexible, rapid assessment of gross pollution potential

5.1 Monitoring and Management Plan

A Surface Water Monitoring and Remedial Plan was prepared based on best-practice erosion management techniques and conforming with relevant guidelines.

The monitoring and management plans are presented in Table 4. Samples will be collected in agreement with

- AS/NZS 5667.1:1998: *Water quality - Sampling - Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples.*

Table 4: Voyager II Surface Water Monitoring Program

Sample Location	Sample Method and Frequency	Analysis Required	Comments
Voyager II Quarry Sump.	Record weekly pumped volumes from sump to storage dams	Volume Kilolitres Pumped	All catchment and seepage water to be retained within the quarry if at all possible.
Quarry South Dam.	Manual sample for water quality, monthly.	TDS, TSS, pH	Required to characterise site water balance.
	Record depth of water from gauge board and water area, weekly.	Water depth.	
	Record volumes weekly for quarry use	Kilolitres	
Quarry North Dam	Manual sample for water quality, monthly.	TDS, TSS, pH.	
	Record depth of water from gauge board and water area, weekly.	Water Depth	
	Record volumes weekly for quarry use	Kilolitres	
Stream flow monitoring site on Western Stream	Prior to any surface water release to environment - manual sample if water is flowing in Western Stream	TDS, TSS, pH.	Monitoring location appropriate to terrain conditions at the time.
	In the event that water is released from Voyager II - Manual sample weekly released water during release	TDS, TSS, pH.	Required to characterise impacts of the quarry on stream flows.
	Record depth of water in stream using a ruler or gauge board at time of manual sampling.	Water depth.	
Western Stream.	Visual observation of erosion, water pollution and channel condition, monthly and after larger runoff events. Inspect safety bund walls for ponding and erosion.	Visual assessment.	Required for rapid assessment of gross pollution potential or any inadequacy of management systems.
Weather	Daily using a manual rain gauge or an automatic weather station.	Daily rainfall.	Required to characterise local rainfall conditions.
Operations	Record general water management operations	Diary notes as required	Required to characterise site water balance and general site operations.

In the event of a surface water release, the key management actions that will be triggered when monitoring indicates exceedances of the requirements of Table 3.

- Erosion,
- On-Site Runoff Management,
- On-Site Pollution Management,
- Water Release to the Environment,

The Key Management Actions are summarized in Table 5.

If the monitoring programme shows significant pH or TSS increase as specified in Table 5, the Quarry Manager is to inform OEPA within 24 hours of being aware of the exceedance and implement an appropriate survey of the causes of exceedance.

Depending on the criteria exceeded, different contingencies are available for the Quarry Manager. These contingencies include, but are not limited to:

- Decrease/cease water release to the environment,
- Further investigate/identify the cause,
- Use the quarry as temporary storage.

It is recommended that the Quarry Manager, in consultation with OEPA defines the most appropriate action within a week of exceedence being reported to OEPA.

Table 5: Key Management Actions

Issue	Management Action	Comment
Erosion Control	Undertake remedial action of erosion is observed	In the event of a requirement to release surface water
	Manage water release from Quarry to ensure erosion does not occur	Water to be carefully released subject to monitoring of water levels and weather forecasts so as to maintain even flow to minimise potential erosional impacts.
Pollution Management	Ensure runoff water from the offices, lab and workshop areas will pass through a triple oil separation trap before discharging into the process water dam to manage the impacts of storm water flows and potential transport of pollutants.	All runoff from all workshop and hardstands is directed via an oil separator prior to release to quarry operational area.
	Maintain fuel, hazardous chemical and machinery servicing areas on a concrete pad and bunded to capture any accidental spills.	All service areas located within bunded and hardstanded workshop areas.
	Ensure water quality release criteria are met by complying with the requirements of Table 3	Water only to be released in the event of dams near full followed by exceptional rainfall – in this eventuality released water quality is most likely to comply with Table 3.
Downstream Water Quality	Conduct a surface water monitoring program as required by Table 4.	A surface water monitoring program was instigated at the commencement of Voyager II development phase.
Contingency Actions	In case of exceedances of erosion or water quality criteria decrease or cease water release, further investigate or identify the causes of non-conformance, use the quarry for water storage.	BGC policy for Voyager II is only to release water in the event of a temporary excess beyond storage capacity.

7.1 Stakeholder Consultation

The following parties have been identified as stakeholders.

A Community Liaison Group has been established in accordance with the requirements of Condition 706:M19. The Liaison Group includes representation by Local Government, local residents and government agencies that have committed to attend . The Lakes Action Group and Woorooloo LCDC will be represented by local residents who have formed the Lakes Action Group.

8.1 Auditing

The Quarry Manager and Environmental Officer will be required to ensure that all management actions of this document are carried out.

The OEPA Environmental Audit Branch has a policy of conducting audits from time to time to verify compliance by proponents with Ministerial Conditions.

8.2 Review, Revision and Reporting

Review, and revision if required, of this EMP should be performed on an annual basis

As proposed by the ministerial statement, the proponent shall report any exceedance of the limits identified within the Ground and Surface Water Monitoring and Remedial Programme to the OEPA within 24 hours of becoming aware of the exceedance.

The proponent shall provide a report to the OEPA relating to the exceedances within seven days of becoming aware of the exceedance, identifying the sources of the exceedance within the proposal area and indicating remedial action undertaken to prevent further such exceedances.

References

SECTION 9

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Luke, G.J., Burke, K.L. & O'Brien, T.M. (1987). Evaporation Data for Western Australia. WA Department of Agriculture Resource Management Technical Report No. 65.

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Limitations

SECTION 10

Revision 2 of this report was prepared in accordance with the usual care and thoroughness of the consulting profession for the use of BGC (Australia) Pty Ltd. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The methodology adopted and sources of information are outlined in this report. No independent verification of this information beyond the agreed scope of works and the author assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to the author was false.

This report was revised in the month of September 2011 and is based on the conditions encountered and information reviewed at the time of preparation. The author disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.