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Surface Water Management

APPROVED
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Description of Change

APPROVAL RECORD			
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DEPARTMENT OF ENVIRONMENT & CONSERVATION
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Corporate Information Section ATRIUM

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1. INTRODUCTION

1.1 OBJECTIVES

The objectives of the Surface Water Management Plan are to take all reasonable and practicable measures to minimise detrimental impacts on the hydraulic function of drainage systems and on downstream water quality.

RNO are committed to the delivery of best practice surface water management through planning and development. The Surface Water Management Plan has been prepared to:

- minimise the risk of negative impacts on receiving environments and mine assets as a result of surface water management associated with the project;
- minimise the risk of flooding, erosion or surface water inundation impacting upon the projects operations; and
- preserve, as far as practically possible, pre-mining surface water flow rates, volumes and quality at points of discharge from the project area.

This Management Plan was developed to fulfil Commitment 6 of Ministerial Statement 633, and thereby addresses:

- *integrity of the water supply pipeline;*
- *diversions of the Bandalup and Burlabup creeks;*
- *runoff and water shadow effects for the project earthworks;*
- *stormwater runoff from the processing plant; and*
- *storage and handling of chemicals and reagents.*

This document supersedes previous Surface Water Management Plans (SKM, 2001 and URS, 2006) and incorporates issues raised by the DEC in correspondence 28 March 2006.

1.2 OVERVIEW

The location of the Project is approximately 35 km east of the town of Ravensthorpe and 155 km west of Esperance along the South Coast Highway. The Project is located within the Shire of Ravensthorpe in Mineral Field 74 and the Phillips River District, 571 km by road from Perth. The site layout is shown in Figure 1.

The Project involves the development of a mine, treatment plant and associated facilities to produce a mixed nickel-cobalt hydroxide intermediate over an approximate 25 year period. The Project consists of three nickel laterite deposits, Halleys, Hale-Bopp and Shoemaker-Levy, which will be mined by conventional open cut methods. The nickel content in the ore will be upgraded through a beneficiation process and followed by a series of treatments utilising pressure and atmospheric acid leach technology and solution purification techniques. The Project will produce up to 220,000 tpa of intermediate mixed nickel-cobalt hydroxide. The mixed hydroxide product will be containerised and transported by road to the Port of Esperance before being shipped to the Yabulu Refinery in Townsville, Queensland.

The Project is located in the Bandalup and Burlabup Creek catchments and occupies a small part of the Jerdacuttup River Catchment. Key receiving environments for surface water runoff from the project area are the Jerdacuttup River, pools and local watercourses, bushland in the Bandalup Corridor and farmland to the south of the project. The mine pits will be located in bushland on Bandalup Hill. Most of the infrastructure will be located on farmland to the east of Halleys Pit.

The three catchments associated with the Halleys Pit drain into Bandalup Creek, approximately 8 km south-west of the Project site. Farmland to the south of Bandalup Hill has surface runoff flowing south into an ill-defined, ephemeral drainage channel referred to as Burlabup Creek, which eventually enters the Jerdacuttup River, 30 km south-east. The layout of the site within the catchment boundaries and drainage lines are shown in Figure 2

SKM (2001) and URS (2006) have previously described the hydrology of the project area. Relevant hydrological information as described in these reports is summarised below:

- variable, but intense rainfall and runoff events;
- a dense network of minor watercourses, particularly around Bandalup Hill and the Shoemaker- Levy Pit Figure 2;
- naturally shallow, duplex soils that may be highly erodible;
- a combination of native bushland and cleared agricultural land;
- generally saline groundwater;
- saline seepage in the unnamed creek, north of the processing area;
- generally low turbidity water in streams and ponds, except during larger runoff events; and

- water quality and stream flow has been changed as a result of other activities in the broader catchment, including clearing for agriculture, old mines and urban activities.

1.3 RECEIVING ENVIRONMENTS

The Ravensthorpe Nickel Project is an area that has bushland, streamlines and pools as a receiving environment from the western and northern parts of the project area and farmland from eastern areas. Much of the receiving environment is protected by significant buffer distances and is considered to be at low risk form project activities. Bushland areas close to the project, however, are more at risk from low-level impacts, such as from erosion on site and salt wash-off from roads watered with saline water.

Non RNO-owned farmland that receives surface water from the project area is located south of Jerdacuttup North Road, extending along the Burlabup Creek flood plain to the west to the Jerdacuttup River. The receiving farmland is a productive agricultural area, supporting sheep grazing on annual pastures and cropping of cereals, legumes and oilseed grains. The receiving farmland is some 10 km from the processing area and 2 km from the southern edges of the tailings storage facility (TSF) and evaporation ponds at maximum extent. Land slope downstream of the storage facilities is low and this distance provides a considerable buffer between project activities and the receiving environment.

The mine pits are located in bushland on Bandalup Hill and hence in immediate proximity to the west of the project area is the bushland. The Bandalup Corridor generally follows Bandalup Creek and includes Bandalup Hill, it provides a buffer zone and vegetation corridor within the Fitzgerald Biosphere Reserve.

A number of permanent pools exist in the area including those located in the Jerdacuttup River and in Jerdacuttup Lakes. In addition, Bandalup Pools are located in Bandalup Creek near the outlet to the Jerdacuttup River and Bandalup Rockhole is located on one of the upper branches of Bandalup Creek, north of the South Coast Highway and close to the Shoemaker-Levy Pit.

The bushland, pools and Jerdacuttup River have important social, recreational, ecological and heritage values. The Jerdacuttup River is a priority river system because much of its foreshore vegetation is rated pristine. Jerdacuttup Lakes has been recommended for inclusion on the register of the National Estate.

Whilst water bodies in the lower Bandalup Creek and the Jerdacuttup River are some distance from the project area, the Shoemaker-Levy Pit includes parts of Bandalup Creek and hence stream flow in these areas will be diverted.

1.4 SOURCES AND IMPACTS

The main activities associated with the project that could affect surface water quality are listed below:

- seawater pipeline from Mason Point;
- mining (Halleys, Hale-Bopp and Shoemaker-Levy Pits, ROM and ore stockpiles and waste dumps);
- the process plant;
- the tailings storage facility and evaporation ponds;
- chemical storage and handling; and
- accommodation areas and other infrastructure.

Environmental management of these activities is detailed in Section 2.

1.5 APPLICABLE LEGISLATION

The tracking of legislation changes is being managed by LandAssist, an integrated web served application managing Mineral Titles, Operating Licences, and Leasehold Land and Agreements. These documents can be readily viewed on line and reminders and emails can be generated for key events such as reports, expiry and renewals. A summary of the legislative process and approvals obtained is summarised below.

Part III Environmental Protection Act 1986, Environmental Protection Policies

Project implementation is aligned with the intents of the Environmental Protection Authority (EPA) Position Statement Number 7: Principles of Environmental Protection (2004).

Part IV Environmental Protection Act 1986, Environmental Impact Assessment.

The original proponent, Comet Resources NL, submitted a Consultative Environmental Review (CER), which was assessed under Part IV of the *Environmental Protection Act 1986*. Ministerial Approval for the original Project was granted 4 June 1999.

Subsequent amendments to the original mine plan and proposed treatment process resulted in the requirement to obtain amendments to the original environmental approval. The changes to the project were outlined through the submission (June 2002) of an Environmental Review document under Section 46 (1).

The EPA issued Bulletin 1093 (April 2003) which provides recommendations of conditions to manage the impacts of project activities on the environment. The Minister for the Environment issued Statement No. 633 (5 September 2003) which stated that the project may be implemented subject to commitments.

Part V Environmental Protection Act 1986, Environmental Management

RNO was issued with Works Approval 3911 (5 April 2004) for the construction of the Project. In accordance with the provisions of the Works Approval staged commissioning and operation of parts of the plant was undertaken as required, prior to expiry of the Works Approval (5 April 2007).

RNO was issued Licence 8008/1 (4 May 2005) for the commissioning and operation of the sewage facility. A number of prescribed activities have since been added to the license through the DEC amendment process, such that the Environmental Operating License was reissued 26 October 2006. An amendment is in progress and the anticipated licence categories are as follows:

CATEGORY	DESCRIPTION	CAPACITY
31	Chemical manufacturing	1,606,000 tonnes per year
5	Processing or beneficiation of metallic or non metallic ore	13,900,000 tonnes per year
12	Screening, etc. of material	300,000 tonnes per year
52	Electric power generation	54 MW
54	Sewage facility	300 cubic metres per day
89	Putrescible landfill site	20 – 5000 tonnes per year

Other Legislation

Mining Act 1978 administered by The Department of Industry and Resources

Explosives and Dangerous Goods Act 1961 administrated by the Department of Consumer and Employee Protection. RNO has received a Dangerous Goods Licence (License Number DGS020591) to cover the storage of specified dangerous goods on site

Environment Protection and Biodiversity Act 1999 administrated by the Federal Department of Environment and Heritage

Rights in Water and Irrigation Act 1914

RNO has extraction bores on the project site but as the area is within an unproclaimed area they are not required to hold a Section 5C licence to take water under the *Rights in Water and Irrigation Act 1914.*

- Obtain a licence to take surface water, 5C, if surface water is to be utilised in the project.
- Obtain a clearing permit for all native vegetation clearing activities.
- Obtain a bed and banks permit for all prescribed creek crossings.
- A site obligation register will be developed and maintained to ensure all licence conditions are captured and adhered to.

1.6 STANDARDS AND PERFORMANCE CRITERIA

RNO licence (8088/1) requires all water samples to be:

- collected and preserved in accordance with the requirements of Australian Standard 5667.1:1998.
- submitted to a NATA certified laboratory, accredited for the analyses specified, in accordance with the current *Standard methods for Examination of Water and Wastewater-APHA-AWWA-WEF*

Standards of relevance to chemical storage and handling include AS1940 The storage and handling of flammable and combustible liquids and AS3780 *Australian Standard for The Storage and Handling of Corrosive Substances.*

The seawater pipeline will be constructed in compliance with AS 2033, *Installation of Polyethylene pipe system* and AS 2566, *Buried Flexible Pipes – Structural Design.*

The Department of Industry and Resources produce a number of Mining Environmental Management Guidelines relevant to this project and they include:

- Water Quality Protection Guidelines for Mining and Mineral Processing
- Safe Design and Operating Standards for Tailings Storage
- Development of an Operating Manual for Tailings Storage
- Mine Rehabilitation
- Mining Environmental Management Guidelines – Mining Proposals in WA

1.7 ROLES AND RESPONSIBILITY

Key management Actions have been assigned in Table 1 and Monitoring Actions in Table 2. General roles and responsibilities are described in the relevant procedures. Contractor responsibilities will be outlined within contract documents.

1.8 INSPECTIONS AND AUDITS

RNO personnel and contractors shall conduct environmental inspections within an agreed timeframe. An annual compliance audit will be carried out against the key management actions (Table 1). This compliance audit will address license conditions and the commitments in Ministerial Statement 633:

- evidence of compliance with the conditions and commitments; and
- the performance of the environmental management plans and programs.

Operational inspections will assess effectiveness of surface water diversion structures, washdown stations, sediment build-up, areas requiring maintenance, downstream vegetation health and opportunities for improvement.

In the event that monitoring and / or inspections identify adverse impacts RNO will implement management contingencies as documented in Procedures, for example RNO-HSE-PRO-0083 Spill Response RNO-HSE-PRO-0003 Incident Reporting.

1.9 TRAINING AND AWARENESS

RNO will ensure an environmental induction is presented to all employees and contractors. The environmental induction will include a component on the Surface Water Management Plan. The induction will draw attention to the importance of reporting incidents, such as hydrocarbon spills, notification of pipeline leakages, procedures on water truck operations and surface water overflow.

1.10 REPORTING

An annual environmental report is to be provided to the Department of Environmental and Conservation, for the report period of 1 July to 30 June of the next year, and within 30 days from the end of the reporting period (Licence Condition 9)

Compliance audit reports are required according to the Ministerial Commitments in addition to a performance review report every five years after the start of the operations phase.

The Department of Industry and Resources also requires the preparation of an Annual Environmental Report in October (Mining Environmental Management Guidelines – Preparation of an Annual Environmental Report, April 1996).

BHP Billiton requires all sites to provide information on waste management within the Monthly HSEC Reports and the BHP Billiton Half Yearly reports.

1.11 REVIEW

This management plan will be reviewed every 12 months or at such time as the project scope changes. The revision status will be recorded as directed by the RNO Document Control Procedure.

The review will seek to incorporate any new investigations, information and new working techniques.

1.12 STAKEHOLDER CONSULTATION

Consultation with relevant stakeholders was required as part of the environmental approval process for the Project and is ongoing. Immediate neighbour and community concerns are being addressed through the RNP Community Liaison Committee (RCLC), the Jerdacuttup RNO Working Group (JRWG) and one-on-one discussions. RNO has committed to actively facilitate the continuation of both the Community Liaison Committee and the JRWG for as long as the community requires them.

2. ENVIRONMENTAL MANAGEMENT

The objectives of this Surface Water Management Plan were presented in Section 1.1 and Section 1.4 identified the main activities associated with the project that could affect surface water quality as listed below:

- seawater pipeline from Mason Point;
- mining (Halleys, Hale-Bopp and Shoemaker-Levy Pits, ROM and ore stockpiles and waste dumps);
- the process plant;
- the tailings storage facility and evaporation ponds;
- chemical storage and handling; and
- accommodation areas and other infrastructure.

The purpose of this section is to identify the potential impacts, performance indicators and implementation strategy for each of these activities. Monitoring requirements are detailed in Section 3.

An analysis of key threats, potential impacts and likelihood of occurrence, has been submitted (URS, 2006). Hydrological information has been submitted in reports including Surface Water Management Plan (SKM, 2001), Baseline Hydrogeology Report (Aquaterra, December 2003) and Surface Hydrology Baseline Study (URS, 4 August 2005) and will not be reproduced in this document.

The Department of Environment had reviewed the previous Surface Water Management Plan (letter from James Treloar, 28 March 2006) and responded that further information was required specifically to address Commitment 6 (Ministerial Statement 633) as follows:

- *integrity of the water supply pipeline;*
- *diversions of the Bandalup and Burlabup creeks;*
- *runoff and water shadow effects for the project earthworks;*
- *stormwater runoff from the processing plant; and*
- *storage and handling of chemicals and reagents.*

Information pertinent to Commitment 6 has been available in reports, which have been submitted by RNO as part of both the Part IV and Part V approval processes. Additional information has been included in this section and in Section 3 Monitoring to specifically address issues raised in the DoE letter (28 March 2006).

Significant diversion of Bandalup Creek will be required to enable mining of the Shoemaker Levy deposit. Further information on the environmental management of this impact will be supplied as part of the future application process as mining is not likely to commence for at least five years. The creek diversions required for Halleys is relatively minor and will be fully rehabilitated in the short term. This will reduce the land areas disturbed during the construction phase.

Monitoring requirements are detailed in Section 3 and Monitoring Actions in Table 2.

2.1 SEAWATER PIPELINE

Seawater will be sourced from Mason Point, 41 km to the south, and transported to the plant via a 600 mm diameter high density polyethylene (HDPE) buried pipeline. The pipeline corridor is within the Mason Bay Road right of way. The road is managed by the Ravensthorpe Shire.

Potential impacts associated with the seawater pipeline are:

- potential for pipeline rupture, resulting in seawater entering the environment;
- erosion, leading to sediment deposition in nearby watercourses or vegetated areas and/or increased turbidity of stream water;
- interruption of surface water drainage, with potential impacts on rivers, floodplains, sheet flow, marshes and springs; including alteration of systems due to redirection or ponding increase flooding characteristics; and
- changes to the downstream vegetation health from alteration of surface flows.

Performance Indicators:

- The pipeline is constructed to the standards set out in the NOI Seawater Pipeline April 2005, Supplementary NOI Seawater Pipeline and Powerline – Part B September 2005 and Amendment to NOI Seawater Pipeline and Pipeline – Part B March 2007.
- No physical damage to the pipeline, including no breaches (leaks) of the pipeline.
- No interruption to the surface water flow during pipeline construction.
- No seawater spills from the pipeline.

Implementation Strategy:

- A Pipeline Management Plan has been developed that outlines the minimum construction standards for pipeline construction and operation activities (Outback Ecology, March 2005 attachment to Supplementary Pipeline NOI September 2005).
- All management actions of the Pipeline Management Plan will be complied with.
- Natural drainage lines that are intersected by the pipeline route will be contoured such that the final soil surface above the trench will be level with the original

surface, to ensure that the natural flow of water will not be obstructed once construction has been completed.

- Erosion control measures will be put in place to minimise and where possible prevent potential erosion. Erosion control measures will be site assessed and include revegetation of disturbed sites or rip rap pads associated with culverts.
- All pipeline access roads being engineered to prevent erosion and exposure of the pipeline caused by stormwater runoff (Mining Lease L74/21 Condition 16).
- Surface water in wetlands that are to be traversed by the pipeline, or those that are within 500 m downstream of the pipeline, will be sampled and analysed for its chemical properties as a baseline measure, including EC and pH.
- To minimise the risk of spills or leaks, all items used for the pipeline and the transfer facility will be constructed from materials, and to standards, that are appropriate for pumping sea-water at the intended pressures. The standards (AS 2033, 'Installation of Polyethylene pipe systems' and AS 2566, 'Buried Flexible Pipes – Structural Design') will be used in the design, fabrication and installation to ensure that the pipeline will operate safely throughout its lifecycle.
- The seawater intake and transfer pipeline will be operated and monitored from the central control room of the RNO Processing Plant. The flow rate through the pipeline will be monitored and alarms will be activated by decreased pressure, allowing a remote shutdown of the system if required.
- The intake and seawater transfer facilities will be subjected to regular inspection.
- The intake and pump stations will be continuously monitored using CCTV technology, for failures and leaks.
- Booster stations, high point vents and low point drains will be installed along the pipeline as appropriate. The vents and drains will be isolated using locked valves. The booster stations and drainage points will have HDPE lined catchment facilities to contain any discharged seawater.
- The ground surrounding the pipeline will he visually inspected for evidence of failure at least one per day whilst in operation (Mining Lease L74/21 Condition 14).
- The pipeline will be subject to a hydrostatic test, set at a pressure 1.5 times the design figure.
- Contingency response in the event of a seawater spill has been documented as Reference 6.8 in the Environmental Plan for Construction of a Seawater Supply System (Outback Ecology, March 2005). This information will be included in Site Procedures.

2.2 MINING (MINE PITS, ROM, ORE STOCKPILES AND WASTE DUMPS)

Mining operations consist of three shallow open pits (Halleys, Hale-Bopp and Shoemaker-Levy), Run of Mine (ROM) ore stockpile and a designated waste dump located east of the Halleys ore body, north of the process plant.

A number of watercourses and overland flow pathways will be diverted or disturbed during the construction and operation of the project. Surface water flows will need to be

controlled in a drainage network to protect operational assets and receiving environments. Runoff in the area is intermittent but rates can be very high during periods of high rainfall.

Runoff from rainfall initially drains down gradient as overland flow before concentrating in a defined flow channel. In this process surface detention, vegetation, seepage and other mechanisms absorb water from the runoff stream. To reduce environmental impacts, such as water shadow effects, provision for drainage needs to be provided where there is interruption to surface water flows. Mine infrastructure has the potential to block the surface water pathways causing water to collect along the upstream side. With inappropriate management, areas with dependent downstream vegetation will potentially be impacted.

The main water quality issues in the ROM and ore stockpile areas relate to erosion from disturbed areas, stockpiles, roads and drains leading to elevated sediment loads in stormwater and to salt wash-off from areas watered with saline water.

Potential impacts associated with mining activities include:

- excavation of the pits could potentially alter existing natural drainage surface water drainage patterns including inundation of upstream areas and water starvation to downstream areas (water shadow effects).
- interruption of surface water drainage, with potential impacts on rivers, floodplains, sheet flow, marshes and springs; including alteration of systems due to increase flooding characteristics and water shadow effects. Of particular importance is the diversion of Bandalup and Burlabup creeks;
- on-site erosion, leading to sediment deposition in nearby watercourses or vegetated areas and/or increased turbidity of stream flow;
- localised flooding;
- increased salt input into the environment from dust suppression measures;
- increased turbidity through uncontrolled surface water runoff;
- the potential for pollution of surface waters from spills and inappropriate disposal of waste; and
- changes to the downstream vegetation health from alteration of surface flows.

Performance Indicators:

- No onsite flooding.
- All structures will be constructed to the minimum specifications as stated in the Works Approval and/or Notice of Intent e.g. Halleys Pits (2006) for diversion structure for Bandalup and Burlabup Creeks.
- Erosion, sedimentation and turbidity downstream of the Bandalup and Burlabup Creeks diversions are maintained at pre-mining levels.
- Vegetation health is not impacted.
- No erosion, pooling of water or other effects of changes in water flow.
- Turbidity levels in waterways are unchanged by infrastructure.

- No discharge of water from site to exceed licence limits.
- Compliance with the Department of Industry and Resources guidelines on waste dump construction.

Implementation Strategy:

Stormwater from nearby catchments that are not disturbed by mining activities will be redirected to the nearest drainage line using diversion drains and bunds.

Small diversion drains will be used to divert and control overland flow around Halleys and Hale-Bopp Pits. Several upper branches of Bandalup Creek currently flow through the Shoemaker-Levy pit and waste dump areas. These watercourses will be diverted around the east and west pits using two diversion channels with associated bunds. The pits will also be protected by a series of diversion drains and bunds.

A series of diversion drains and smaller conveyance drains will be used to control stormwater around the ROM, west of the processing plant, and around the ore stockpiles, south of the ROM. Stormwater from the stockpiles drains to the south, into a tributary of Burlabup Creek. A sediment basin downstream of the stockpiles will be used to control sediment levels in water re-entering the natural drainage system. Stormwater from the ROM area drains toward the north and a tributary of Bandalup Creek.

Runoff from the waste dumps will be controlled by contour banks and re-establishing vegetation as soon as practicable. Runoff will be collected in drains at the base of the dumps and directed to a sedimentation basin prior to release of clean water to the natural drainage network.

The operation will experience stormwater run-off water from two different sources namely from road surfaces where saline water (primary water source estimated to have 8,000 ppm salt) has been used for dust suppression and from disturbed mining areas.

The run-off from the haul roads, waste dump and the low grade stockpiles will be collected in suitably sized drains and directed to three sediment ponds. These drains and sediment ponds have been designed for a 1 in 100 year ARI storm event over 72 hours, using run-off coefficients of 90% for roads and 50% for other disturbed areas. Run-off from the balance of the eastern portion of the pit will be channelled to a fourth sediment pond which has been designed for a 1:20 ARI storm event using run-off coefficients of 45% on disturbed areas and 25% on undisturbed areas.

The location of the four sediment ponds has been dictated by topography and lease boundaries. The northern pond is sited to collect run-off from the northern section of the Eastern haul road, the waste dump and seepage water that may emerge from the base of the waste dump. The central pond collects run-off from the central section of the Eastern haul road, the southern section of the waste dump and the ROM pad. Run-off from the southern section of the Eastern haul road, the workshop road and the low grade stockpiles drains into the southern pond. The fourth pond is located within the top soil and vegetation storage area, north of the process plant and east of the waste dump.

General:

- Areas of major erosion hazard will be identified and avoided where practicable. If unavoidable, specific management measures will be implemented to reduce the

erosion risk.

- Areas of disturbance will be minimised.
- Clearing of areas will comply with Vegetation and Topsoil Management Procedure, RNO-HSE-PRO-0029.
- Construction on or near natural drainage pathways will be planned for the dry season where practicable.
- Infrastructure will be situated to avoid or minimize the potential for surface water interruptions. Where unavoidable, upstream runoff will be diverted around disturbed areas and infrastructure to minimise erosion and consider the need for water of the adjacent area.
- Stormwater diversion structures will be constructed to control erosion and sedimentation downstream through the use of sedimentation ponds, riprap pads and maintenance excavation work to keep channels free flowing.
- Diversion channels will be constructed to convey a 100-year ARI event for 72 hours duration. Maintain a 0.3 m freeboard. Have a flow velocity of <1.2 m/s and where possible mimic the hydraulic characteristics of the original streamline; this may include meanders, riffles, pools and habitat reconstruction.
- Infrastructure that has the potential for interfering with creeks and natural flow systems will incorporate bridges, culverts and diversions into the design. Bridges, culverts and diversions will minimise the hydrodynamic changes and ensure adequate flushing of the areas. Each site will be assessed on the number and design of bridge or culverts or divisions to allow best drainage.
- Bridges will be designed to withstand a 50 year ARI flood event and the culverts designed to withstand a 20 year ARI flood event.
- Culverts will be designed in association with small interceptor banks and appropriate erosion protection work, e.g. riprap pads.
- Obtain a bed and banks permit for all river crossings of a prescribed creek.
- Temporary stabilisation measures will be used in high erosion risk zones, such as creek beds and embankments.
- Where appropriate rip-rap pads will be installed in key areas along edges of the diversion bunding to slow and redistribute runoff.
- Sediment control devices such as ponds, traps and filters will be utilized as appropriate to the specific location.
- Mine Services Area- Stormwater drainage containment will be based on the 1 in 100 year ARI, 72-hour storm event. A HDPE lined, stormwater collection sump will be located at the south-eastern corner of the mine services area to collect all potentially contaminated runoff. Ponds will have an oil skimming bar and an overflow weir discharging into the adjacent watercourse for clean water.
- Rehabilitation will occur as soon as practicable and within 6 months of decommissioning of a site.

Pits:

- Clearing will be staged to minimise the disturbance footprint.
- Pit bottoms will be above the regional water table and not require pump out of seepage.
- Any rainfall collecting in the pit will be collected and used for dust suppression.
- Where possible, pits and borrow pits will be located behind physical terrain and/or vegetation belts or otherwise in areas that would reduce its visual impact.
- Where possible, pits and borrow pits will not be located in areas where their presence would impact on surface drainage patterns.
- Vehicle movement will be confined to approved roads and tracks.
- Pits situated on a sloping area will employ water control measures. Diversions, such as windrows will be placed upstream to divert water around pit.
- Drainage and erosion control structures will be developed around the pit to control the impact of substantial rainfall events.
- All constructed slopes will be maintained at a 3:1 horizontal:vertical ratio to reduce erosion rates.
- A buffer zone of at least 50 m will be left between any road and mine pits and 150 m between borrow pits.
- Borrow pit depth should not exceed 2 m.

Waste Dumps, ROM Pads and Stockpiles

- A management plan for waste dumps, ROM pads and stockpiles will be prepared prior to construction, these will take into account the final mine closure plan.
- Waste dumps located near drainage channels will be rock armored, if necessary, to prevent scouring and erosion and monitored for such impact.
- Where required creeks and tributaries will be diverted around structures via diversion channels. Diversion channels will incorporate sediment traps.
- Where required, windrows will be used along the toe and crest of slopes to prevent erosion of the face from surface water run-off. Bottom windrows will help contain eroded material.
- Where practicable, waste dumps will be constructed with a rounded footprint and blended into existing hill slopes.
- Structures will include bunds and progressive revegetation to reduce erosion
- Acid forming or other adverse (e.g. saline/sodic) materials that are present in excavated material will be managed in accordance with DoIR requirements

Diversions of the Bandalup and Burlabup Creeks

- Obtain bed and banks permit for all river crossings of a prescribed creek.
- Diversion structures will be compliant with the relevant statements in the Halleys Pit Notice of Intent and include:

Structure	Design Criteria
Catch drains (to direct non-contaminated stormwater from the project area to sediment traps).	• Convey a 20-year ARI event of 72 hours. • Freeboard of 0.3 m. • Flow velocity < 1.2 m/s.
Culverts and road crossings.	• Generally to pass a 20-year ARI event. • Erosion protection downstream.
Diversion drains (to divert stream flow around structures).	• Convey a 100-year ARI event. • Freeboard of 0.3 m. • Flow velocity < 1.2 m/s. • Use compensating basins as required to regulate flow prior to discharge to the environment. • For temporary stream diversions: – remove the diversion drain and reinstate the original watercourse; and – hydraulic and ecologic characteristics, as far as practicable. • For permanent stream diversions: – mimic the hydraulic characteristics of the original streamline; this may include meanders, riffles, pools and habitat reconstruction; and – reproduce, as far as practicable, the ecological values of the original streamline.
Sediment traps.	• Use where required to remove sediment from stormwater prior to release to the environment. • Average flow velocity though the structure of 0.3 m/s • Length to width ratio of 3:1; maximum 0.5 m deep.

Roads

- Vehicle movements will be kept to a minimum and only approved tracks.
- Roads will be constructed to Local Government standards.
- Construct tracks with a crown or cross-road drainage to shed water to a table drain and turn out drains to prevent water flow along road alignment and scouring the road surface.
- Table drains will be vegetated or graveled to decrease the velocity of water flow.
- Linear structures, such as roads and pipelines, will have measures in place to prevent water flowing preferentially along the structure. Such measures will include culverts and diversion drains.
- Tracks, will be situated in areas least prone to erosion or inundation with water.

- Where saline water is used for dust suppression all reasonable measures will be taken to avoid any detrimental effects to surrounding vegetation and all topsoil stockpiles.

2.3 PROCESS PLANT

Within the Surface Water Management Plan the Process Pant refers to the ore crusher, limestone crusher, beneficiation plant, hydrometallurgical circuit and sulphuric acid plant.

Water quality issues through the process plant area relate to the presence of a range of contaminants, including fuels and oils, waste water, saline water, sulphuric acid, and other chemicals.

Potential impacts associated with the process plant include:

- on-site erosion, leading to sediment deposition in nearby watercourses or vegetated areas and/or increased turbidity of stream flow;
- increased turbidity through uncontrolled surface water runoff;
- the potential for pollution of surface waters from spills and inappropriate disposal of waste;
- interruption of surface water drainage, with potential impacts on rivers, floodplains, sheet flow, marshes and springs; including alteration of systems due to increase flooding characteristics; and
- changes to the downstream vegetation health from alteration of surface flows.

Performance Indicators:

- No onsite flooding.
- All structures will be constructed to the minimum specifications as stated in the Works Approval and/or Notice of Intent.
- No erosion, pooling of water or other effects of changes in water flow.
- Turbidity levels in waterways are unchanged by infrastructure.
- No discharge of water from site above the Licence limits.
- Compliance with the Department of Industry and Resources guidelines on waste dump construction.

Implementation Strategy:

- Stormwater catchment drains and containment ponds will be constructed as part of the plant site bulk earth works, and therefore will be operational prior to the commencement of the main construction activities.
- Stormwater will be managed in accordance with the provisions of the Water Quality Protection Guidelines for Mining and Mineral Processing.

- Design and management criteria and principles that have been adopted for the plant site include the following:
  - The process plant has been designed on the basis of no discharge of stormwater from within the plant site directly to the surrounding environment;
  - HDPE lined stormwater collection ponds will be provided;
  - Stormwater drains have been designed to cater for a 1 in 20 year average recurrence interval (ARI) flow and the combined roadway and stormwater drain system has been designed to cater for a 1 in 100 year ARI flow to prevent flooding of the process plant areas in extreme weather events; and
  - Design rainfall intensities for the different drainage systems will be based on values equal to or exceeding the recommendations of Australian Rainfall and Runoff, an Institution of Engineers Australia publication.
  - Where saline water is used for dust suppression, all reasonable measures being taken to avoid any detrimental effects to surrounding vegetation (Mining Lease M74/144 Condition 14).
  - All pipeline access roads being engineered to prevent erosion and exposure of the pipeline caused by stormwater runoff (Mining Lease M74/144 Condition 21).
- The process plant rainfall catchment areas fall into the four categories described below:
  - Concrete and earth-bunded Areas – around dangerous good storage tanks. Water will collect in sumps within the containment bunds and be pumped out to the stormwater containment ponds or to the hypersaline water pond, according to the water quality. Bunds will accommodate the incident rainfall from a 72-hour, 1 in 20 years storm event. In addition to the above provisions (Bureau of Meteorology data for the Project site estimates the 1 in 20 year 72-hour rainfall to be 115.9 mm) in accordance with the Water Quality Protection Guidelines. In concrete bunded areas around process tanks, process spills and rainwater will be collected in sumps within each process area, and sump pumps will generally discharge this material into the adjacent process tanks.
  - Potentially Contaminated Areas - All roads, hardstands and untreated ground surfaces within process areas of the plant that represent risk of contamination, rainfall will be captured by unlined stormwater drains gravitating to one of two HDPE lined stormwater containment ponds at the north west and south east end of the plant site. The ponds shall be sized on a 1 in 100 year ARI, 72-hour storm event with a pond freeboard of 800 mm. The location and orientation of the plant site will be such that about two thirds of the storm water flow will discharge to the north-west pond and one third will discharge to the south east pond. A discharge pump station will be located at each pond. Depending on the water quality contained in the ponds at any one time, the discharge from the ponds will be pumped back to the process plant. If the water is highly contaminated and unsuitable for such use, it will be pumped to the evaporation ponds.
  - Uncontaminated Areas - All roads, hardstands and untreated ground surfaces within areas that represent minimal or no risk of contamination (eg. administration buildings, water storage ponds, beneficiation areas, limestone and ore stockpile

areas, crushing and plant access roadways), rainfall will be captured by unlined stormwater drains Each drain will discharge into a small unlined storm water retention basin to allow silt gathered in storm water runoff from the hardstand areas to settle out, prior to discharging into downstream watercourses.

- Plant Access Roads - Culverts across roadways will be corrugated steel pipe with a minimum of 600mm cover over the pipe. Rip rap erosion protection will be installed both upstream and downstream at major creek crossings to prevent scouring during peak flows. Road table drains on either side of the road will collect stormwater from both the road and from the adjacent land. Table drains will be unlined and will be V-shaped.

2.4 TAILING STORAGE FACILITY AND EVAPORATION PONDS

The tailings storage facility (TSF) will be used for disposal of tailings material from the process plant. Three cells will be constructed sequentially during the life of the project, with full cells progressively capped and rehabilitated. Design capacity of the TSF is 87.81 Mt with an estimated 3.51 Mtpa (Sup. NOI Contruction of Tailings and Evaporation Ponds (September 2005).

A series of evaporation ponds will be constructed south of the main processing area to dispose of supernatant from the TSF and surplus wash water from the process plant (1.51 Mtpa). The ponds will contain saline materials and salinity will increase over time with evaporative concentration.

The TSF and evaporation ponds were located so that the water flow in the two main creek in the area (Burlabup and Gnamma Creek) is unimpeded. Surface water diversion channels will be constructed around the perimeters of the TSF and evaporation ponds to divert water away form the facilities.

Potential impacts associated with the TSF and evaporation ponds include:

- seepage to impact upon groundwater;
- overflow of contaminated waters either from overfilling or rain event;
- interruption of surface water drainage, with potential impacts on rivers, floodplains, sheet flow, marshes and springs; including alteration of systems due to increase flooding characteristics; and
- changes to the downstream vegetation health from alteration of surface flows.

Performance Indicators:

- Constructed according to specifications
- Provide long term and safe containment of all solid waste materials
- Rapid and effective rehabilitation enabled
- No seepage to groundwater
- No overflow

Implementation Strategy:

- Pipelines carrying dewatering effluent, saline groundwater from borefields, or process waters to and from tailings impoundments being fitted with automatic shutoff devices to prevent flow of effluent and waters to the environment in the event of systems failure (Tenement Condition for M74/175).

Tailings Storage Facility:

- Cells will be constructed (sequentially) in a series adjacent one another. Construction will be staggered, starting from the north and moving toward the south, following drainage direction.
- Cells will be constructed above ground surface.
- Cells will accommodate a 72 h, 100-year ARI rainfall event and maintain 0.3 m freeboard at all times.
- The TSF will be in accordance with the approved design, construction and management document (NOI Supplementary Notice of Intent of the Construction of Tailings and Evaporation Ponds, September 2005).
- The construction of any tailings impoundment embankment shall be supervised by an engineering or Geotechnical specialist (Tenement Condition 20 for M74/175).
- The construction details of any tailings storage embankment shall be documented by an engineering or geotechnical specialist and confirm that the construction satisfies the design intent. The construction document shall include the records of all construction quality control testing, the basis of any method specification adopted, and any significant modifications to the original design together with the reasons why the modifications were necessary. The construction document shall also present as-built drawings for the embankment earthworks and pipework. A copy of the construction document shall be submitted to Department of Industry and Resources for its records (Tenement Condition 21 for M74/175).
- The tailings storage facility shall be checked on a routine daily basis by site personnel during periods of deposition to ensure that the facility is functioning as per the design intent (Tenement Condition 22 for M74/175).
- Stormwater and stream flow outside the facility will be diverted around the facility.
- Pipelines carrying tailings to the facility are buried underground.
- Pipelines will be fitted with automatic shutoffs to prevent flow of water into the environment in the case of failure.
- Excess water will be returned promptly for processing.

Evaporation Ponds:

- Ponds will be HDPE lined.
- Ponds will accommodate a 72 h, 100-year ARI rainfall event.
- Pipelines will be fitted with automatic shutoffs to prevent flow of water into the

environment in the case of failure.

- Where required creeks and tributaries will be diverted around structures via diversion channels. Diversion channels will incorporate sediment traps, speed control structures and spreader systems as needs be.

2.5 CHEMICAL STORAGE AND HANDLING

RNO has prepared a Hazardous Material Operational Management Plan (February 2006) which satisfies the requirement of Commitment 33. The plan includes requirements for a hazardous materials register, risk assessments, purchasing and inventory control and environmental monitoring such as a checklist to assess spill containment.

Potential Impacts associated with chemical storage and handling include:

- Contamination of surface waters, including runoff in the event of a fire.
- Seepage to groundwater.
- Soil contamination.
- Damage to flora and fauna.

Performance Indicators:

- No evidence of spills on site (spills cleaned up on occurrence).
- Compliance with secondary containment and risk abatement procedures.
- Compliance with the Hazardous Materials Management Plan.
- Compliance with Australian Standards (AS1940 and AS 2430)

Implementation Strategy:

- All management actions stated within the Hazardous Materials Management Plan will be complied with.
- Only approved hydrocarbons and hazardous materials will be allowed on site.
- Contaminated stormwater will be contained on site and treated using settling ponds and/or oil traps, and/ or filters depending on the type of contamination.
- All hydrocarbons and hazardous materials will have a Materials Safety Data Sheet (MSDS) stored with the item and one copy to be stored with the HSE Representative.
- All contaminated stormwater will be retained on site for treatment. Storage ponds will maintain a 1 in 100 year storm event of 72 hours duration.
- All matter containing saline, alkaline, cyanide or other process chemical constituents being retained within holding facilities, such that there is no impairment of surface or

underground waters (Mining Lease Condition).

Bulk Storage Facilities

- Bulk hydrocarbons containers will be stored and managed in accordance with Australian Standard 1940 (2004) – The Storage and Handling of Flammable and Combustible Liquids.
- Containers which are self bunded (double skinned) shall be protected against collision by equipment and/or vehicles.
- Containers which are not self bunded shall be secondarily contained in facilities with impervious floors and bunds, with a capacity to contain 110 % of the volume of the largest tank or 25 % of the total volume stored in the compound.
- Containers will be appropriately labeled as required by the relevant legislation.
- Areas adjacent to secondary storage facilities will be graded to drain away from the facilities.
- Inspections of the containers will be carried out as outlined in license conditions.
- Water or other liquids that collect in the storage facilities will be removed and treated to appropriate standards.
- Compliance with Dangerous Goods licenses.

Minor Storage

- Small containers, including drums, of hydrocarbon products shall be stored upright with lids on, in secondarily container facilities.
- Storage facilities will have impermeable floors and bunds, with a capacity to contain 110 % of the volume of the largest container or 25 % of the total volume stored in the compound.
- Small containers, including drums, will be checked regularly for signs of corrosion and leaks.
- Containers will be appropriately labeled as required by the relevant legislation.

Spills

- Spill response equipment shall be readily accessible in each work area. As a minimum, spill response equipment shall be located at fuel storage and transfer facilities, work areas near the marine environment or open water bodies, and at maintenance workshop areas.
- Spills shall be controlled at the source, contained and cleaned up as soon as they occur. Contaminated material shall be disposed at a licensed facility.
- Personnel shall be competent in spill management with training to be provided where necessary.

2.6 ACCOMMODATION AND OTHER INFRASTUCTURE

The accommodation areas consist of a temporary camp for construction workers, and a semi-permanent village to house staff during the project's operational life. Drainage is toward a tributary of Bandalup Creek (the unnamed creek).

Two waste water treatment plants treat sewage from the village (WWTP1) and the mine site (WWTP2). Treated effluent from WWTP2 is pumped to WWTP1 prior to discharge to evaporation ponds and an irrigation system. Both WWTPs are package type treatment plant designed to suit the on-site construction population of around 2,000 persons and a treatment capacity of about 100 m^3/d, with the ability to be downgraded to suit a long-term operational work force of around 1,000 persons and a treatment capacity of around 50 m^3/d.

Potential impacts associated with the accommodation and other infrastructure includes:

- on-site erosion, leading to sediment deposition in nearby watercourses or vegetated areas and/or increased turbidity of stream flow;
- increased turbidity through uncontrolled surface water runoff;
- interruption of surface water drainage, with potential impacts on rivers, floodplains, sheet flow, marshes and springs; including alteration of systems due to increase flooding characteristics;
- changes to the downstream vegetation health from alteration of surface flows;
- licence non compliance, discharge of poor quality water;
- odour
- contamination of the WWTPs with chemical that inhibit appropriate treatment;
- groundwater contamination from sewage irrigation;
- human health impacts.

Performance Indicators:

- No onsite flooding.
- No erosion, pooling of water or other effects of changes in water flow.
- WWTP functions correctly without causing soil or water contamination or odour.
- Compliance with licence requirements for water quality.
- Compliance with the Hazardous Materials Management Plan.

Implementation Strategy:

- Sewage will be contained within HDPE-lined ponds that can withstand a 100-year

72 h duration event and screened by natural vegetation.

- Irrigation shall not occur during periods of rainfall or onto flooded areas.
- Stormwater will be managed through the accommodation area using a series of shallow conveyance drains.
- Upon completion of construction redundant evaporation pond cells will be in-filled and re-vegetated.
- At completion of construction, the bulk of the construction camp and associated services will be dismantled and removed.
- Where saline water is used for dust suppression, all reasonable measures being taken to avoid any detrimental effects to surrounding vegetation (Mining Lease M74/173 Condition 13).

3. MONITORING PLAN

A Surface Water Monitoring Program was developed by SKM (2001). This was updated by URS (2006) to account for changes in site layout including for example the positioning of the evaporation ponds (Figure 3) and submitted as Appendix D of the NOI Halleys Open Cut Pit, February 2006.

The objectives of the monitoring plan are to:

- characterise the quantity and quality of stream flow in major watercourses and permanent ponds that receive water from the project area;
- identify any major impacts of mining on the receiving environments;
- quantify the quality of water contained in storages throughout the project area;
- quantify the performance of the surface water drainage system throughout the project area; and
- store data recorded, and put in place resources and procedures to regularly review data and feedback to operational areas the need for any rectification actions required to address surface water management issues.

3.1 REGIONAL MONITORING DATA

The Department of Environment and Conservation is currently carrying out water quality testing of the Jerdacuttup Creek and Jerdacuttup Pools. Results of a 2000-2001 water quality survey (DoE 2004a), for stream flow and ponded water in the Jerdacuttup River, concluded that:

- the river is naturally saline. The electrical conductivity of river water varied between around 7.7 and 117 mS/cm (sea water is about 52 mS/cm). Salinity levels tend to be highest in summer when stream flow is low or ceases and ponds evaporate, and lowest in spring when stream flow is highest
- dissolved oxygen varies from 5-10 mg/L and tends to be lowest when stream flow is high as a result of an increase in organic matter;
- the water is always alkaline, varying between pH 7.5 and 9;
- turbidity levels are low, typically around 10 NTU, but may increase in summer with increased algal and phytoplankton growth and after stream flow events as a result of elevated sediment and organic matter levels;
- total nitrogen levels are high, varying from 1 to 10 mg/L during the snapshot period; and
- total phosphorus levels are generally high but are variable, ranging from 0.02 to 0.24 mg/L.

3.2 WATER QUALITY MONITORING SITES

Monitoring locations were selected in order to best isolate the potential effects of the mining and processing operations and eliminate, as far as possible, the inclusion of potential effects of other activities, such as farming and other mining activities. Monitoring sites shall preferentially be located in a defined channel to promote mixing across the stream cross-section, thus reducing errors from unrepresentative samples. Placing the sites in a defined channel also enables an estimate of flow to be made when sampling the water quality. The monitoring sites must also be located in an area that is accessible during wet weather.

The selection of relevant water quality monitoring parameters is based on an assessment of the contaminants that could potentially emanate from the Project, the ability to detect these contaminants and the availability of guideline values against which to assess the appropriateness of the concentrations of these contaminants.

Protocols for field measurements, sample collection, laboratory analysis and data analysis have been documented and include the Environmental Monitoring Manual RNO-HSE-MAN-002.

Water quality monitoring will also be conducted following intensive or continued rainfall events. The objective will be to sample within 24 hours of a significant rainfall event, where sufficient water collects at the sampling points. Parameters to be analysed will include major metals and inorganics including Al, Fe, Mn, As, Ag, Cd, As, Cr, Co, Cu, Ni, Pb, Se, Zn, Hg, hydrocarbons, and physio-chemical qualities of the water such as, pH, salinity, TSS, and ions (NOI for the Construction of a Nickel Processing Plant and Project Infrastructure, February 2004). Additional analysis may include dissolved oxygen, total nitrogen, total phosphorous pesticides and other chemicals used in processing as appropriate (Supplementary NOI for Halleys, February 2006)

Guideline values for the Project will be defined from baseline water quality data in conjunction with the ANZECC (2000) recommendations and guidelines. As there are no consumptive water users downstream of the proposed sites, the guideline values for protection of aquatic ecosystems will be used in the setting of values, following the baseline monitoring.

Compliance monitoring will occur in addition to the above monitoring for the paramenters required by Licence.

All data recorded will be maintained in a water monitoring database maintained by RNO. The database will have a system in place for backup.

3.3 VEGETATION MONITORING

There is the potential to impact upon vegetation via contaminated surface water and water shadow effects. Vegetation monitoring is the subject of other management plans including the Dieback Management Plan which includes many commitments relevant to surface water management including DB2.4, DB2.5 and DB 2.14. In addition vegetation monitoring is also covered in environmental manuals (e.g. Environmental Monitoring RNO-SWE-PRO-0002) and Procedures (e.g. Dieback Control RNO-SWE-PRO-0028).

3.4 LICENCE MONITORING REQUIREMENTS

The RNO licence (8088/1) is being updated and the following information describes the anticipated monitoring requirements.

Monitoring conditions provide target and limit amounts for N, P and BOD for the irrigation of wastewater from WWTP 1. Monthly water sample analysis is required for TN, TP, pH, BOD, TSS and EC. In addition there is a requirement for quarterly monitoring (Jan, Apr, Jul and Oct) of two groundwater bores for TN, TP, pH, TSS, EC and standing water level (SWL). Soil sampling of four representative locations within each irrigation area is required at the soil surface, and at 30 and 40 cm below surface; collected twice per year (January and July). Soil analysis parameters include pH, salinity, and forms of N and P.

The licence requires all water samples to be:

- collected and preserved in accordance with the requirements of Australian Standard 5667.1:1998.
- submitted to a NATA certified laboratory, accredited for the analyses specified, in accordance with the current "standard methods for Examination of Water and Wastewater-APHA-AWWA-WEF

Licence amendments are currently under consideration to include monitoring of the Tailings Storage Facility, Evaporation Ponds and groundwater bores for parameters including pH, EC, TDS, SWL and screening for major ions and trace metals. The proposed frequency of monitoring is March, June, September and December each year.

Annual reporting of results is required by 31 July. The task of monitoring in accordance to the licence has been assigned (Table 2).

TABLE 1 KEY MANAGEMENT ACTIONS

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
General					
SW1	Where saline water is used for dust suppression, all reasonable measures being taken to avoid any detrimental effects to surrounding vegetation and all topsoil stockpiles.	Mining Leases Condition		Ongoing	Line Manager
SW2	All pipeline access roads being engineered to prevent erosion and exposure of the pipeline caused by stormwater runoff	Mining Leases Condition		Construction and ongoing	Line Manager
SW3	Clearing of areas will comply with Vegetation and Topsoil Management Procedure.		RNO-HSE-PRO-0029	Ongoing	Line Manager
SW4	Annual Licence Report to Department of Environment and Conservation.			July each year	Environmental Representative
SW5	Annual Report to Department of Industry and Resources.			October each year	Environmental Representative
SW6	Performance Review Report after start of operations required by Ministerial Commitments 633.			Every 5 years.	Environmental Representative
SW7	Environmental training and awareness packages delivered to all site personnel and contractors.			Employee Induction	Environmental Representative

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
SW8	Review of Surface Water Management Plan.			yearly or with project changes	Environmental Representative
Seawater Pipeline					
SW9	Constructed to Standard (AS2033 Installation of Polyethylene pipe systems and AS2566 Buried flexible pipes – Structural Design)	Construction EMP in Seawater Pipeline Sup. NOI Apr 05		Construction	RJV
SW10	Hydrostatic testing at 1.5 times design pressure.	Construction EMP in Seawater Pipeline Sup. NOI Apr 05		Construction	Line Manager
SW11	Scheduled maintenance program documented and implemented, to include pump stations, automatic air valves, manual air valves, drain pits, isolation valves and automatic air valve pits as per Section 4 NOI (April 2005).	Construction EMP in Seawater Pipeline Sup. NOI Apr 05		Ongoing	Line Manager
SW12	Pigging to remove any accumulated solids from the pipeline.	Construction EMP in Seawater Pipeline Sup. NOI Apr 05		3-4 times per year	Line Manager

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
SW13	Spare pipe lengths retained onsite.	Construction EMP in Seawater Pipeline Sup. NOI Apr 05		Ongoing	Line Manager
Mine					
SW14	Ensure mine development complies with construction details for catch drains, diversions, culverts, sediment traps, etc. to ensure minimisation of erosion and water shadow effects.	Supplementary NOI Halleys		Construction	RJV
SW15	Maintenance scheduled to ensure diversion and sediment control structures are functional.			Ongoing	Line Manager
SW16	Vehicle movement to be confined to approved roads and tracks which are constructed to at least comply with Local Government standards.			Ongoing	Line Manager
SW17	Rehabilitation to occur as soon as practicable and within 6 months of decommissioning			Closure	Environmental Representative
Bandalup & Burlabup Creeks					
SW18	Design of diversions according to specifications.	Halley's NOI.		Construction	Line Manager
SW19	Obtain a bed and banks permit for all river crossings of a prescribed creek			Construction	Line Manager

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
Process Plant					
SW20	No discharge of stormwater from within the plant site directly to the surrounding environment.			Ongoing	Line Manager
SW21	Pipelines carrying dewatering effluent, saline groundwater from borefields, or process waters to and from tailings impoundments being fitted with automatic shutoff devices to prevent flow of effluent and waters to the environment in the event of systems failure.	Mining Lease M74/144 Condition 27		Construction and ongoing	Line Manager
TSF and Evaporation Ponds					
SW22	Tailings dam to be constructed above ground and as per design specifications.	NOI Tailings and Evap. Ponds		Construction	RJV
SW23	The construction of any tailings impoundment embankment shall be supervised by an engineering or Geotechnical specialist.	Mining Lease M74/175 Condition 20		Construction	RJV
SW24	The construction details of any tailings storage embankment shall be documented by an engineering or geotechnical specialist and confirm that the construction satisfies the design intent. The construction document shall include the records of all construction quality control testing, the basis of any method specification adopted, and any significant modifications to the original	Mining Lease M74/175 Condition 21		Construction	RJV

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
	design together with the reasons why the modifications were necessary. The construction document shall also present as-built drawings for the embankment earthworks and pipe work. A copy of the construction document shall be submitted to Department of Industry and Resources for its records				
SW25	At the time of decommissioning of the tailings storage facility and prior to rehabilitation, a further review report by a geotechnical or engineering specialist will be required by the State Mining Engineer. This report should review the status of the structure and its contained tailings, examine and address the implications of the physical and chemical characteristics of the materials, and present and review the results of all environmental monitoring. The rehabilitation stabilisation works proposed and any on-going remedial requirements should also be addressed	Mining Lease M74/175 Condition 24		Decommissioning	Environmental Representative
Chemical Storage					
SW26	Ensure that all matter containing saline, alkaline, cyanide or other process chemical constituents being retained within holding facilities, such that there is no impairment of surface or underground waters	Mining Lease Conditions L74/20,21; M74/145; M74/175		Ongoing	Line Manager

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
SW27	Cleanup kits appropriately positioned and maintained.		RNO-HSE-PRO-0083 Spill Response	Monthly	Line Manager
SW28	Spill response is managed according to procedures		RNO-HSE-PRO-0083 Spill Response	Ongoing	Line Manager
Not Applicable*	Bunding and storage constructed to comply with Australian Standards including AS1940.	Hazardous Material MP	RNO-HSE-PRO-XXX Hydrocarbon Management	Construction	Line Manager
Not Applicable*	Non-destructive testing of tanks to be conducted according to Australian Standard.	Hazardous Material MP		Ongoing	Line Manager
Not Applicable*	Incidents, including hydrocarbon and chemical spills, to be tracked through the incident reporting procedures.	Hazardous Material MP	RNO-HSE-PRO-0083 Spill Response	Ongoing	Line Manager
Not Applicable*	Complete Hazardous Material Survey Checklist.	Hazardous Material MP		Ongoing	Hazardous Material Coordinator
Accommodation & Other Infrastructure					
SW29	Manage application of treated wastewater in accordance with "Ravensthorpe Nickel Operation Wastewater Treatment Plant No. 1 Nutrient and Irrigation Management Plan" February 2005	Licence 8008/1		Ongoing	Line Manager

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
SW30	Maintenance program documented and implemented, to ensure efficient operation of WWTP and irrigation equipment.			Ongoing	Line Manager
SW31	Inspection of irrigation equipment to check for appropriate dispersion, runoff, odours etc.			Ongoing	Line Manager

Not Applicable* – Action numbers assigned in previous Management Plans

TABLE 2 MONITORING ACTIONS

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
General					
MON1	Continuous logged recording of water quality and depth for natural watercourses.	Halleys Sup NOI Feb 06 and DoE letter 28 Mar 06		Continuous	HSEC representative
MON2	Hand sampling of stream flow opportunistically during runoff events and ponds monthly. Test for sediment, pH, salt, metals, oil and grease and other potential contaminants (e.g. nutrients, pesticides, chemicals used in processing) as appropriate, for Watercourse sites A to E (Figure 3).	Halleys Sup NOI Feb 06		Rain events and ponds monthly.	HSEC representative
MON3	Photographic records, GPS logged with time and date, of visual inspections of: - drainage network and below outfalls - on-site storm water and effluent containment ponds including sedimentation dams, TSF and evaporation ponds, and - erosion prone areas.	Halleys Sup NOI Feb 06		Significant rain events	HSEC representative
Not Applicable*	Vegetation and dieback monitoring (including unnamed creek north of the processing area, downstream to the extent of saline seepage).	Dieback MP		Ongoing	HSEC representative
MON4	The lessee visually inspecting for evidence of pipeline failure the ground surrounding the pipelines whilst in operation.	Mining Lease Condition		Daily during commissioning; minimum of	Line Manager

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
				weekly during operations.	
MON5	Should a failure in an inspected seawater pipeline be discovered, the discharge being ceased immediately and not resuming until the pipeline has been repaired. The Environmental Officer, DoIR being notified within one week of the failure and provided with an estimate of total effluent volume lost due to the failure and a program of corrective action.	Mining Lease Condition		Immediately cease discharge and notify DoIR within one week.	Line Manager
MON6	Conduct wastewater, groundwater, irrigation and soil monitoring according to licence conditions.	DEC Licence 8008/1	RNO-HSE-MAN-0002	Ongoing	HSEC representative
MON7	Record local daily rainfall and evaporation from reliable source	Halleys Sup NOI Feb 06		Continuous	HSEC representative
Seawater Pipeline					
MON8	Surface water in wetlands that are to be traversed by the seawater pipeline, or those that are within 500 m downstream of the pipeline, will be sampled and analysed for its chemical properties as a baseline measure, including EC and pH.	Construction EMP Mar 05 in Seawater Pipeline Sup. NOI Apr 05		Within 6mths of completion.	HSEC representative
MON9	The seawater intake and pump stations will be monitored using close circuit TV monitored for failures and leaks.	Construction EMP Mar 05 in Seawater Pipeline Sup. NOI Apr 05		Continuous	Line Manager
MON10	Flow rate along seawater pipeline monitored and	Construction		Continuous	Line Manager

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
	alarmed via Central Control Room.	EMP Mar 05 in Seawater Pipeline Sup. NOI Apr 05			
Mine					
MON11	Visual inspections of the waste dumps, stockpiles, ROM, collection ponds and diversion structures			Weekly	Line Manager
Bandalup & Burlabup Creeks				Annual	
MON12	Photographic record of diversion erosion including bank condition from defined sampling locations and logged by GPS with time and date.	DoE letter 28 Mar 06		Annual	HSEC representative
Process Plant					
MON13	Inspection of sediment traps, bunds, ponds and oil interceptors.			Ongoing	Line Manager
TSF, Evaporation and Effluents Ponds					
MON14	Monitoring to ensure adequate freeboard and check for presence of oil contamination.			Ongoing	Line Manager
MON15	The tailings storage facility shall be checked on a routine daily basis by site personnel during periods of deposition to ensure that the facility is functioning as per the design intent.	Mining Lease M74/175 Condition 22		Daily	Line Manager
MON16	An engineering or geotechnical specialist shall audit and review the active tailings storage facility on biennial basis. The specialist shall review past	Mining Lease M74/175 Condition 23		Biennial audit and reported in annual	Line Manager

Reference	Action	Commitment Source	Related Procedures	Timing	Responsibility
	performance, validate the design, examine tailings management and review the results of monitoring. Any deficiencies not in the review report shall be submitted to the Department of Industry with the annual environmental review, and should be accompanied by a recent survey pick-up of the facility and an updated tailings storage data sheet.			environmental review.	
Chemical Storage					
MON17	Bund inspections to check for presence of stormwater and/or contamination, to be recorded and signed off via checklist or equivalent.			Weekly	Line Manager

Not Applicable* – Action numbers assigned in previous Management Plans

FIGURE 1 RAVENSTHORPE NICKEL OPERATIONS LAYOUT

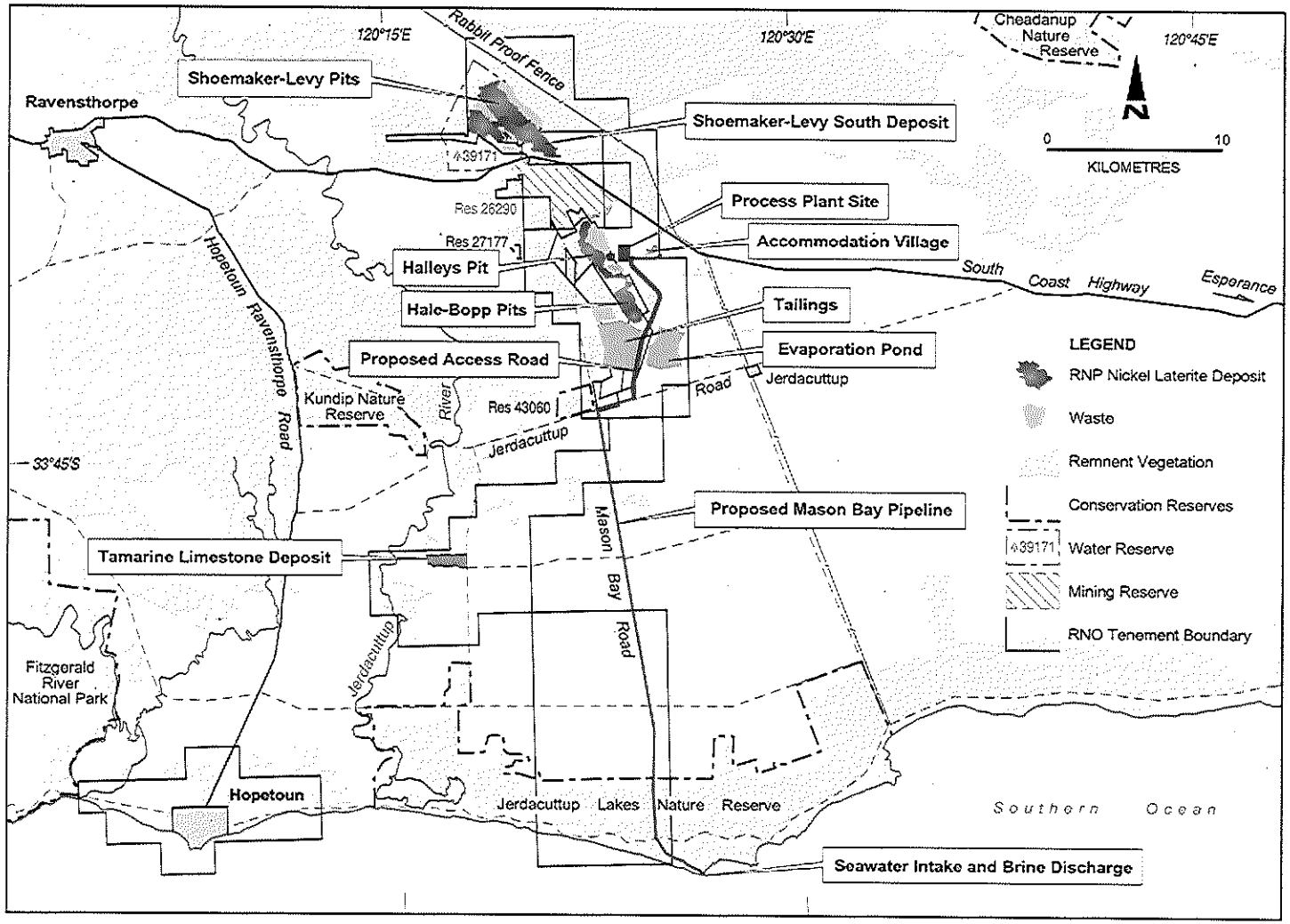

FIGURE 2 WATER SAMPLING CATCHMENT BOUNDARIES AND DRAINAGE LINES WITHIN THE PROJECT AREA

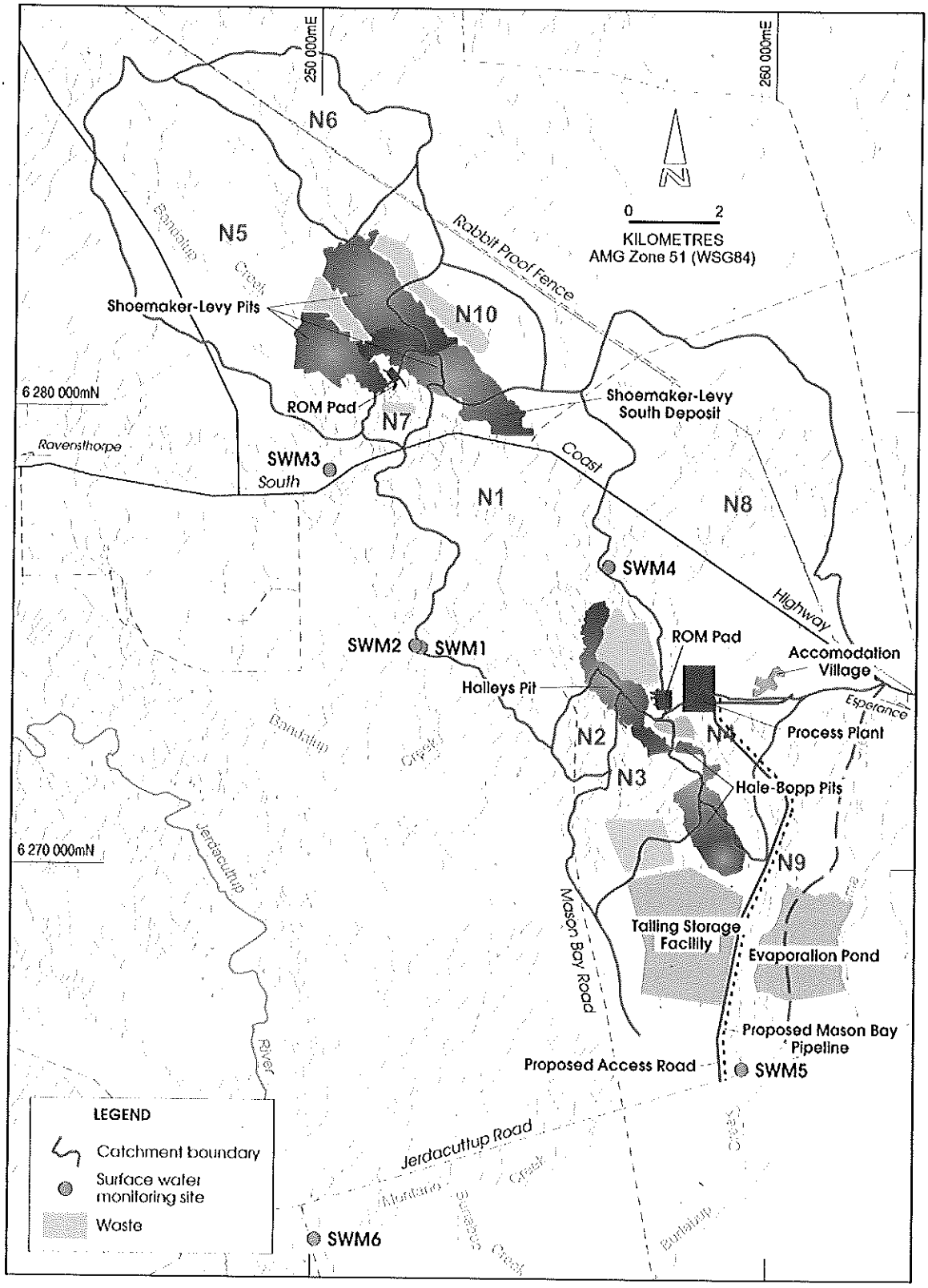

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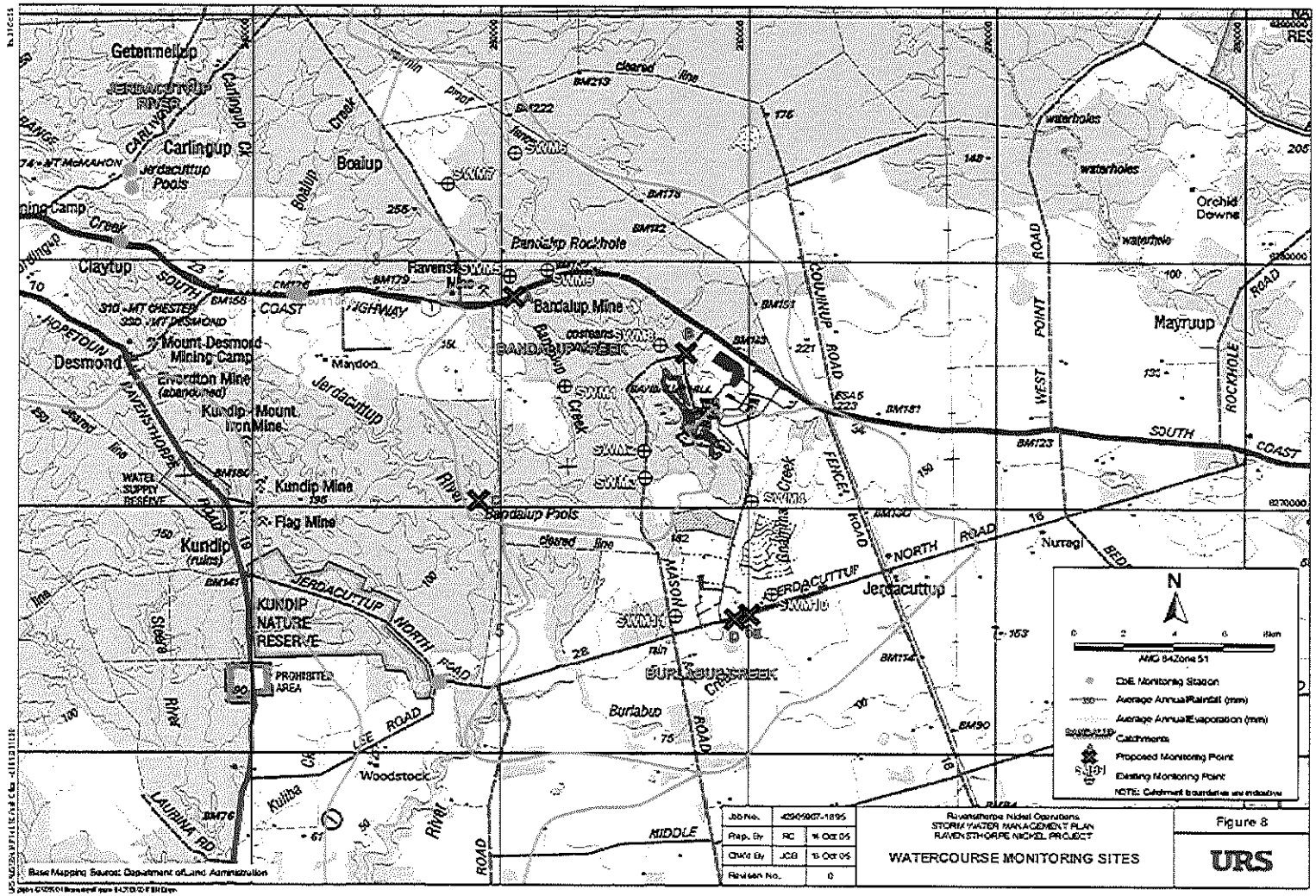
FIGURE 3 WATER SAMPLING LOCATIONS (REVISED 2006)



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