CHAPTER 14

Water Management

URS

Water – Summary of Key Outcomes

The water requirements, wastewater production, stormwater management and flooding potential have been assessed for both construction and operation of the Parkes Peaking Power Plant Project.

Process water is proposed to be sourced, if practicable, primarily from treated effluent from the Parkes Sewage Treatment Plant, transported to the site in tankers and treated on site by a water treatment unit (having a reverse osmosis capability) for use as demineralised process water. Maintenance and domestic water is proposed to be sourced from rainwater tanks and, when required, supplemented by mains water transported to the site in tankers. Fire fighting water is proposed to be sourced either (a) from effluent from the Parkes Sewage Treatment Plant and treated by reverse osmosis, or (b) imported mains water. Landscaping water is proposed to be sourced from rainwater, treated effluent and recycled waste water.

Process wastewater would be generated at the facility by the reverse osmosis treatment unit. The expected average volume of wastewater generated is up to 12ML/annum. This water would be discharged to evaporation ponds lined with an appropriate impermeable liner to minimise the risk of the saline waste water escaping into the natural groundwater system. When required the accumulated waste sludge collected in the lined evaporation pond would be disposed of by a licensed contractor.

Rainwater runoff from part of the landscaped areas would be directed into stormwater cut-off drains. The outlet of these drains would be designed to maximize the dispersion of these high flows and thereby minimize their potential to cause soil erosion downstream.

Surface runoff from the developed part of the site will be collected for use as much as possible and the accumulated water within bunds would be directed to the evaporation ponds after passing through the interceptor.

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation.

Wastewater volumes have been estimated and management strategies developed to maintain zero discharge from the site except for part of natural surface flows.

The potential for flooding on the site has been addressed through the application of filling and management of overland flows is addressed through suitable drains and dispersion techniques.

Chapter 14 Water Cycle Management

14.1 Introduction

This section presents an assessment of the water requirements, wastewater production, stormwater management and flooding potential at the site for the Parkes Peaking Power Plant. Both the construction and operation aspects have been considered.

This assessment has been conducted to include:

- an assessment of the water quantity and quality impacts of the proposal, with particular reference to the water needs of the Parkes Peaking Power Plant;
- the proposed sources of water;
- the implementation of water saving measures;
- identification of the quantity and quality of wastewater and how this wastewater is to be disposed of;
- how stormwater is to be managed at the site; and
- potential for flooding on site.

14.2 Existing Environment

The proposed site is located on the Bogan Plain, west of Parkes (refer **Figure 14-1**). The site is currently cleared and cropped, and is adjacent to an existing TransGrid substation which is located on a compacted earth platform raised some 0.75m above the natural land surface.

The site is flat (with less than 1% slope) and falls towards Ridgey Creek, approximately 150m to the west of the site. Ridgey Creek flows into Goobang Creek downstream of Parkes and the site is situated in the overall Murray-Darling Basin.

Runoff from the adjacent paddocks flows onto the site from the east and across the adjacent track and into a swampy area adjacent to Ridgey Creek and hence into Ridgey Creek. . Some runoff from the sides of the substation mound to the north may flow onto the site from the north. These would be of small volume but may have relatively high velocities.

Figure 14-1 presents the local and regional catchments.

Water in this locality is generally considered brackish. While the site does not fall in a Salinity Risk Area, it is within 500m of an area classified as “High Salinity Hazard or Risk 2000”.

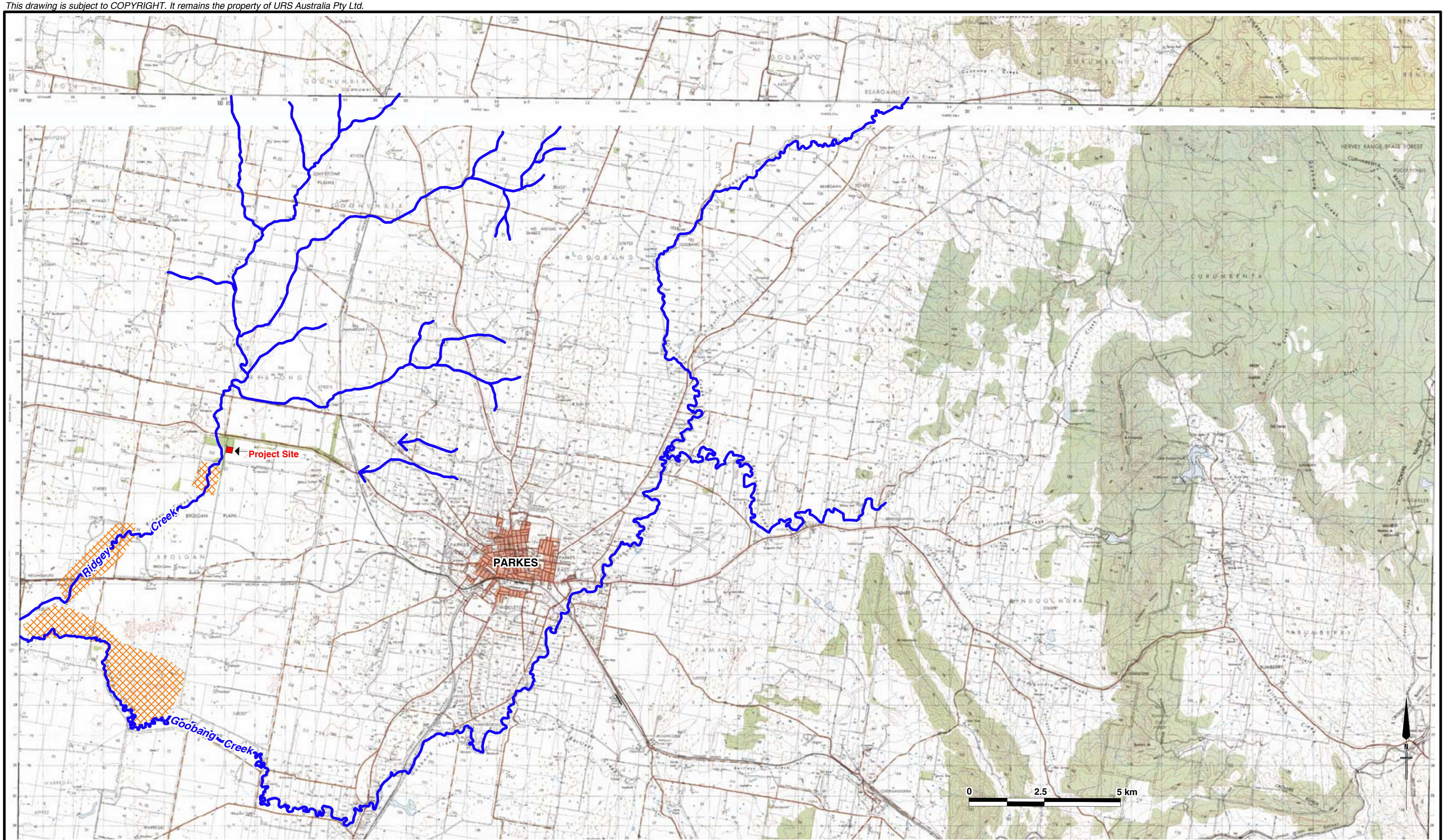
There are no developed water sources at the site.

14.3 Water Requirements and Management

During operation of the plant, water would be required at the site for the following uses:

- process water;
- domestic uses;
- general operations and maintenance ;
- fire fighting;
- landscaping.

The requirements for these uses are discussed in more detail below and presented **Figure 14-2.**



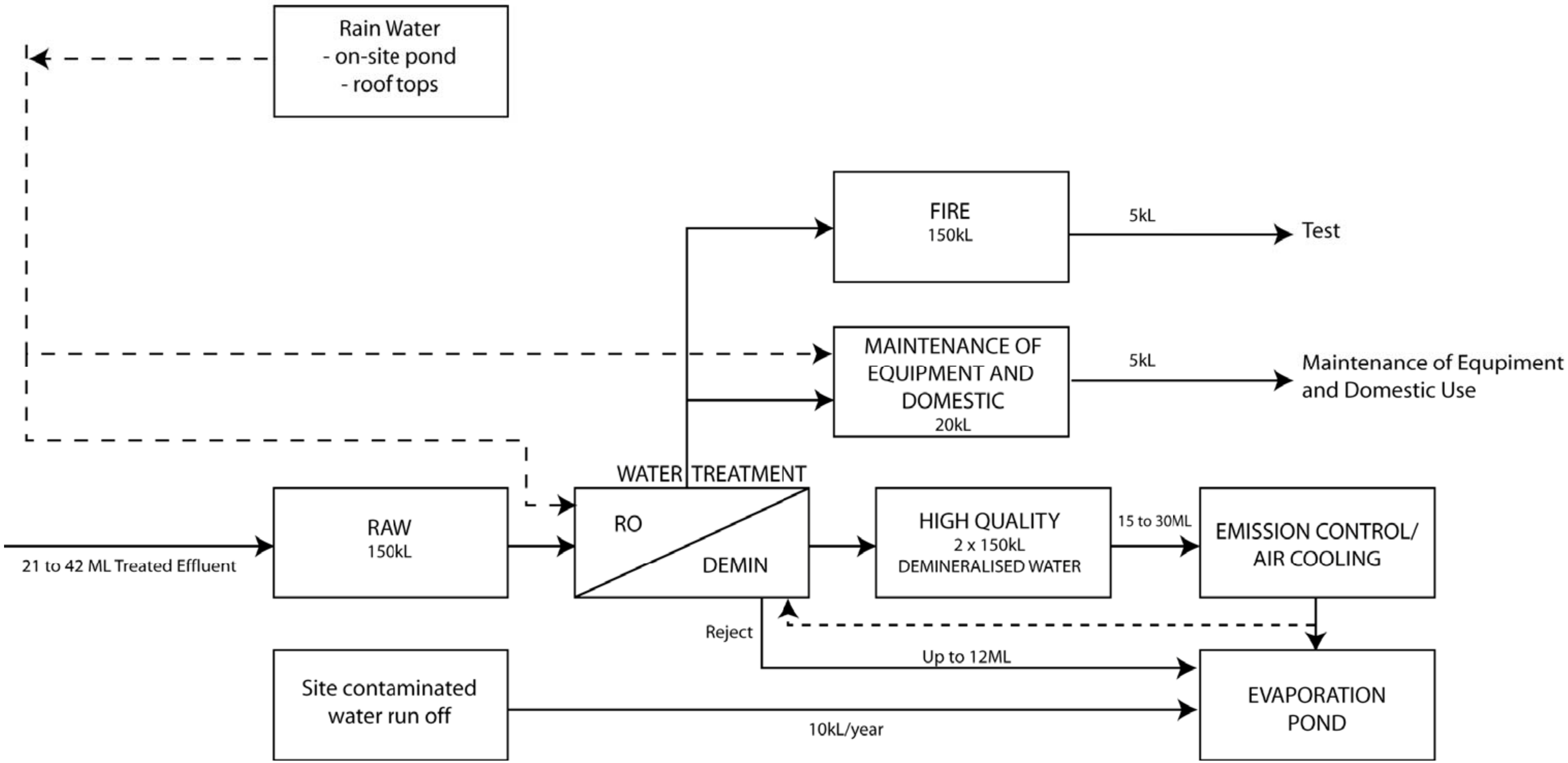
Legend

Swampy Areas

Creeks

Source: TOPOGRAPHIC MAP - LAND AND PROPERTY INFORMATION NSW

Client	Project	Title
INTERNATIONAL POWER (AUSTRALIA) PTY LTD	ENVIRONMENTAL ASSESSMENT - PARKES PEAKING POWER PLANT	**LOCAL AND REGIONAL CATCHMENTS**
URS	Drawn: AJW / Approved: CJ / Date: 18/12/2006	Figure: **14-1**
	Job No: **43177456** / File No: 43177456.007	



Client	Project	Title
INTERNATIONAL POWER (AUSTRALIA) PTY LTD	ENVIRONMENTAL ASSESSMENT - PARKES PEAKING POWER PLANT	**WATER BALANCE - ANNUAL ESTIMATE**
URS	Drawn: AJW; Approved: CJ; Date: 21/08/2007; Job No: **43177456**; File No: 43177456.022.wor	Figure: **14-2**

14.3.1 Process Water Requirements

The main process water requirement is for inlet air cooling and NOx emission control purposes. Comparatively smaller quantities are used for other process purposes, eg compressor blade washing.

Inlet Air Cooling

Inlet air cooling allows the gas turbine to maintain a high level of output and avoid all of the reduction associated with high ambient temperature operation. To achieve this, IPRA proposes to install evaporative cooling equipment in the gas turbine inlet air duct systems.

Gas turbines are “constant air volume” machines which at any given shaft rotation speed always move the same volume of air. As the density of the air passing through the gas turbine reduces with increased temperature, the gas turbine maximum output reduces. To offset this reduction in maximum output on hot days, moisture is injected into the inlet air to cool the air temperature (the air is cooled as the moisture evaporates) and increase the air density or “mass volume”. The increase in the density of the air mixture, allows the gas turbine to operate closer to its optimum design output.

Without such cooling the gas turbine output would reduce by as much as 15% at high summer temperature conditions.

Exhaust NOx Emission Control

NOx air emissions will be controlled through water injection for the reasons described in **Chapter 3**.

Essentially, water injection into the combustion chamber reduces the peak flame temperature so as to reduce the production of NOx which is a product of any combustion of fuel in air.

Total Process Water Requirements

The total process water requirements are presented in **Table 14-1**. These are maximum quantities of treated process water required to allow maximum operating capacity generally during hot summer weather with low humidity.

Table 14-1 Process Water Requirements

Process Water Use	Water Demand Requirement for Operation at Maximum Capacity (kL/hr)	
	per turbine	total (3 turbines)
NO_x emission control	9	27
Air cooling	11	33
Other (eg blade washing)	<<1	<1

Actual water consumption would vary with ambient and operating conditions. It is expected that some extent of evaporative cooling water will be required during most summer months when there is a high ambient temperature. Evaporative cooling may not be required at all during winter months.

The average volume of process water required for combined emission control and inlet air cooling purposes is expected to be 15ML/annum up to a maximum of 30ML/annum. While some evaporative cooling water is recoverable for re-use, in excess of 90% would be evaporated through the unit into the atmosphere.

Domestic Uses

Water would be required for staff facilities, including drinking water, hand washing, showering and toilet flushing. Water for drinking must be of potable quality. It is estimated that up to 5kL/annum would be required. For short periods of time, during major maintenance activities, additional staff would be based at the site and therefore some additional imported domestic water may be required.

General Purpose (Operation & Maintenance)

A small volume of water would be required for operation and maintenance. It is estimated that up to 5kL/annum would be required. This water would not be required to be of potable quality. However it should not be turbid and should have low levels of suspended solids and salts.

Fire Fighting

Water will be stored on the site for fire fighting.

It is proposed that tank storage (comprising up to three tanks, subject to design considerations) would hold 150 kL permanently reserved for this purpose. Approximately 5kL per annum will be produced and used to test fire-fighting equipment. As far as practicable, water used for testing fire-fighting equipment will be recycled for site use.

Fire-fighting water would not need to be of potable water quality. However, it needs to have low levels of suspended solids and salts.

Landscaping

To minimise the potential for soil erosion and enhance the local ecology, disturbed land areas would be planted at the end of the construction process. In order to minimise water usage, these areas would be planted with species that are both local to the area and whose water requirements can be supplied by rainfall alone. Supplementary irrigation water may be required during establishment.

14.3.2 Water Sources

A number of water sources for the various uses for the Project have been considered. Primary source options for each use are discussed below.

Process Water Source

Treated effluent from Parkes Sewage Treatment Plant would be recycled for use at the site as process water, making good use of otherwise wastewater. Currently, some 500ML/annum is produced at the plant, of which 165ML/annum is reused as irrigation at Parkes Golf Course and the remainder discharged into local waterways.

Treated effluent is not of the quality required for process water as it contains salts and other impurities. It is proposed to construct a water treatment unit (including a reverse osmosis capability) at the site to treat this water before its reuse as process water. Treated effluent would be trucked to the site in appropriate tankers.

Up to 150kL of raw water would be stored at the site before treatment. Up to 300kL of process water would be stored at the site for use on an as required basis.

As indicated in **Section 14.3.1**, process water requirements will range from an expected average 15ML/annum up to a maximum of 30ML/annum. Depending upon the type of water treatment plant installed, this equates to a total “raw water” requirement (that is, before treatment) of between 21ML/annum up to a maximum of 42ML/annum.

Discussions have taken place with Parkes Shire Council to confirm the availability of treated effluent. Parkes Shire Council have indicated that, in principle, they support the effluent being trucked from ponds at the Sewage Treatment Plant for use at the Parkes Peaking Power Plant.

Domestic and General Purpose (Operations and Maintenance) Use Source

A relatively small volume of water would be required for domestic and general purpose operations and maintenance use. This has been estimated as 10kL/year. As there will be a number of buildings at the site (including administration, store, controls, and workshop buildings) and the gas turbine enclosures, some or all of these roofed areas will be connected to rainwater tanks (of at least 10kL capacity).

Rainwater would be of suitable quality for potable and non-potable domestic uses including drinking, showers, toilet flushing and for the required maintenance activities. In the unlikely event of a shortfall, the rainwater system would be supplemented by potable water from the Parkes township water supply, trucked to the site in water tankers.

The rainwater collection system will be properly designed and maintained to ensure that water entering and stored in these tanks remains of good quality.

Fire Fighting

It is anticipated that water for fire fighting purposes would be sourced from treated effluent from the Parkes Sewage Treatment Plant, and treated on site in the water treatment plant.

Landscaping

Water would be required for landscaping of the disturbed areas surrounding the power plant on completion of the proposed construction activities and particularly during the vegetation establishment phase. Some water may be also required for establishment of vegetation over disturbed areas of the pipeline. This water would be sourced from the plant’s domestic wastewater treatment system or from appropriately treated effluent from Parkes Sewage Treatment Plant.

14.4 Wastewater Generation and Management

Wastewater volumes have been estimated and management strategies developed that maintain zero discharge from the site except for natural surface water flows. Wastewater from the proposed facility would be generated by the following operations:

- wastewater from the water treatment unit;
- domestic wastewater;
- wastewater from general purpose use (operations & maintenance) activities;
- fire water;
- water storage tanks overflow and spills; and
- stormwater from bunded areas that may be contaminated.

These sources are discussed in further detail below and shown in **Figure 14-2** *Water Balance*.

14.4.1 Wastewater from Processes

The water treatment unit including its reverse osmosis (RO) components would produce a wastewater stream of highly saline water. Subject to the ultimate water treatment/RO plant selected, wastewater volume may range between 25% to 40% of the volume of incoming raw water. The maximum annual volume generated would be approximately 12ML/annum. This would be the primary source of wastewater generated on site.

A liquid waste generated through the washdown of the turbine blades is expected to contain only contaminants from the inlet air and the cleaning agents used. This waste water would be directed into the evaporation pond.

A small quantity of chemicals (anti-scalant, citric acid, sulphuric acid, caustic soda) will be required to recondition the RO membrane from time to time. The spent chemicals will be neutralised before being discharged into the evaporation pond.

To ensure zero discharge, wastewater would be directed to appropriately sized and constructed lined evaporation ponds. The generation of wastewater would be concentrated at certain times of the year coinciding with the anticipated operating regime of the power plant.

The Parkes Peaking Power Plant will incorporate in its design appropriate systems where water usage will be at a high level of efficiency to minimise waste water. Any waste water would, as far as practicable, be directed back to the water treatment unit for re-treatment and reuse.

As outlined above, the required volume of the evaporation ponds would be dependant on the usage of the unit and the actual climatic conditions. Occasionally, large volumes of waste water from the RO unit and rainwater may be required to be stored for some time until conditions allow it to evaporate. The evaporation ponds would be sized to ensure that they do not overflow (up to 1 in 100 year probability). The expected timing of wastewater generation and corresponding evaporation rates and rainfall would be taken into account. The final size required will be determined during the detailed design phase.

There would be provision for pump out and off-site disposal in the unlikely event that the evaporation ponds are full when additional storage is required. Evaporation ponds would be provided (refer to **Figure 14-3** for location) and their sizing is based on an optimal depth for evaporation.

The evaporation ponds would be lined with an impermeable liner to prevent ingress of saline water into the groundwater. Salt would accumulate on the bottom of these ponds and be removed from site by a licensed waste contractor.

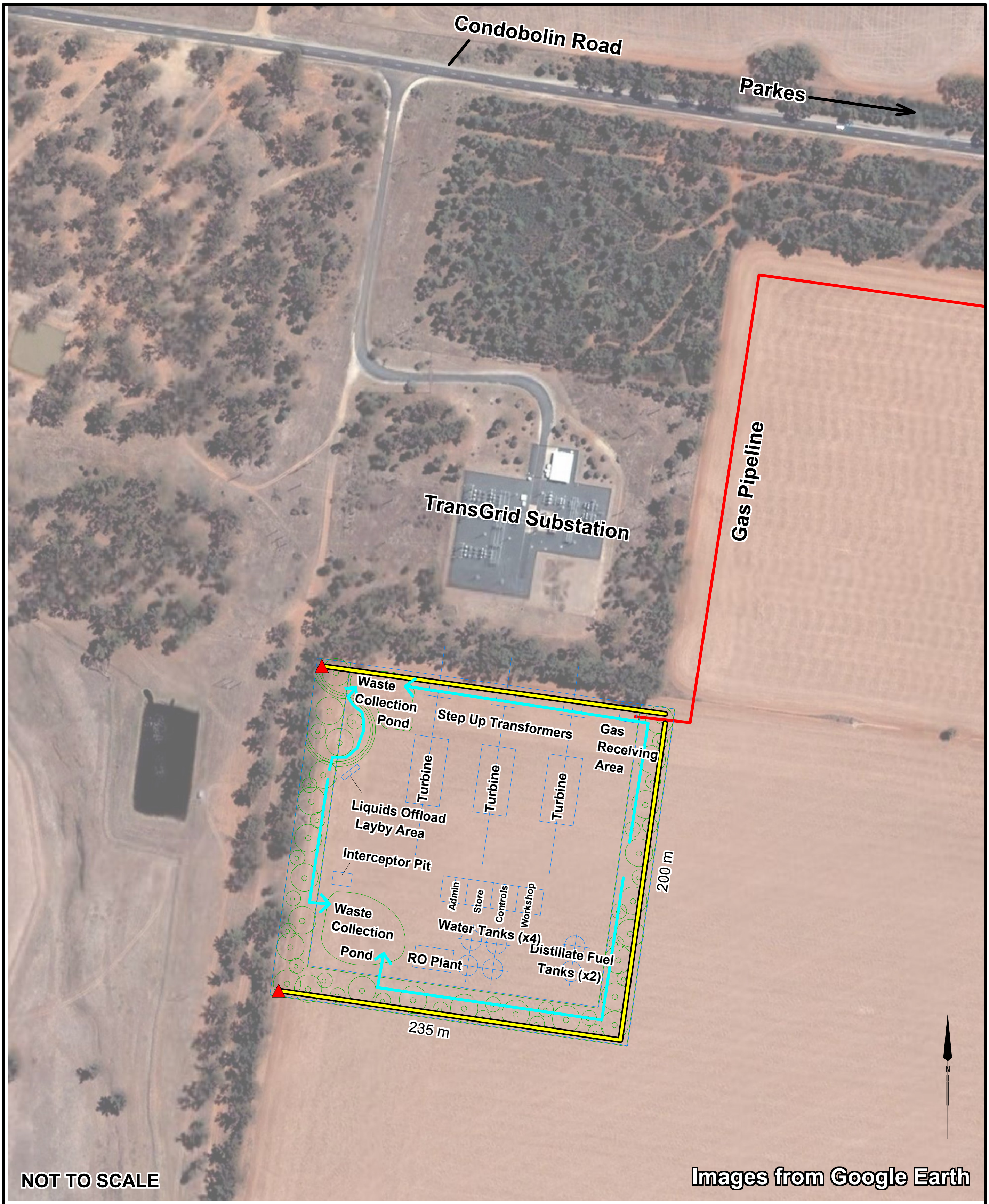
14.4.2 Wastewater from General Operations and Maintenance

Domestic Wastewater

A small amount of domestic wastewater would be generated by on-site staff and may contain pathogens, oils and greases and small amounts of chemicals such as detergents and soaps.

The generation of wastewater would occur year-round and increase over the 4 to 5 weeks each year when plant is undergoing inspection or maintenance.

Domestic wastewater is estimated to be less than 5kL/annum on average and be treated to meet on-site disposal standards.



Legend

- Cut-off drain (indicative location)
- Erosion prevention measures
- Site drains (indicative location)

Client	Project	Title
INTERNATIONAL POWER (AUSTRALIA) PTY LTD	ENVIRONMENTAL ASSESSMENT - PARKES PEAKING POWER PLANT	**STORMWATER INFRASTRUCTURE**
URS	Drawn: AJW / Approved: CJ / Date: 18/12/2006 / Job No: **43177456** / File No: 43177456.028.wor	Figure: **14-3**

On-site disposal will comprise either a recognised proprietary treatment system and/or a storage and pump-out system for disposal of wastewater off-site at an appropriately licensed facility.

The sewerage system would comply with the requirements of Parkes Shire Council and the Department of Health.

Fire Water

In the event of a fire, wastewater from fire fighting would be collected in bunded areas and/or be drained into the evaporation ponds. It may be of poor quality and would be assessed after any event and disposed of off site at licensed facilities if necessary.

All bunds would be sized to conform to relevant industry guidelines and Australian Standards.

Spills

Accidental spills would produce liquid wastes - this would be most likely at the distillate fuel tanks, liquid offload area, liquid stores, the generating plant, transformers and workshop areas. Some of these areas are required by Regulation to be bunded. Spills will be contained within bunds or a waste collection system to prevent contaminated water from entering the stormwater / overland flow system.

A spill management plan will minimise the likelihood of spills occurring and to minimise their impact if they do occur.

14.5 Bund Water

As far as is possible, rainwater collected in fuel storage, fuel unloading and transformer bunds are directed into an oil and water interceptor unit where residue hydrocarbon material is retained.

Stormwater may fall into bunds and become contaminated. Bunds would be sized to contain both potential spills and the maximum potential firewater and/or rainfall. Stormwater falling into bunds would be directed into the evaporation ponds. This system would be fitted with overflow sensors providing prior warning to the operator. Water collected in bunded areas would be released manually into the site interceptor pit.

Fire water or spills from the minor chemical storage area will be directed to the on-site evaporation pond. Except where recycling is possible, contaminated water will be contained and disposed off site.

14.6 Flooding

The proposed site is near Ridgey Creek, an ephemeral stream and no detailed flood studies have been undertaken for this area.

The nearest rainfall station with any significant record is at Parkes (commenced October 1889) and the daily rainfall records were obtained from the Bureau of Meteorology. The records indicate only seven occurrences when rainfall exceeded 100mm in a 24 hour period and all theses occurrences are isolated events (thunderstorms). These events would be the most likely causes of flooding at this location however it is possible that the Parkes rain gauge does not capture data from all storms that may affect adjoining catchments, such as Ridgey Creek.

Two flood levels for floods in 1981 and 2005 were obtained from an adjoining landholder. The levels as recorded are:

Highest Flood level in 1981 ...... **RL=269.80** Highest Flood level in 2005 ...... **RL=269.10**

The location of these flood marks is shown on **Figure 14-4**.

As **Table 14-2** indicates, the 2005 event is the second highest in the recorded period and can be used as a guide to the likely occurrence of flooding. The highest recorded event at Parkes in 1981 was recorded in May at 37.8mm for the 24 hour period. Local anecdotal evidence indicates that there was a major storm on the Ridgey Creek catchment that was not as significant in Parkes and that 2005 and 1981 are the most recent major flood events in the vicinity of the proposed site.

Table 14-2 Peak Daily Rainfalls - Parkes

Date	Recorded Rainfall (mm)
19/11/1943	149.9
8/11/2005	127
20/01/1956	118.9
30/01/1971	112.8
6/01/1968	110.5
13/01/1898	102.1
19/02/1959	100.8

Figure 14-4 Flood Level Locations

In addition to the flood levels, a range of ground levels were obtained in the vicinity of the property in question. The location of these levels is shown in **Figure 14-4** and the levels are listed in **Table 14-3**.

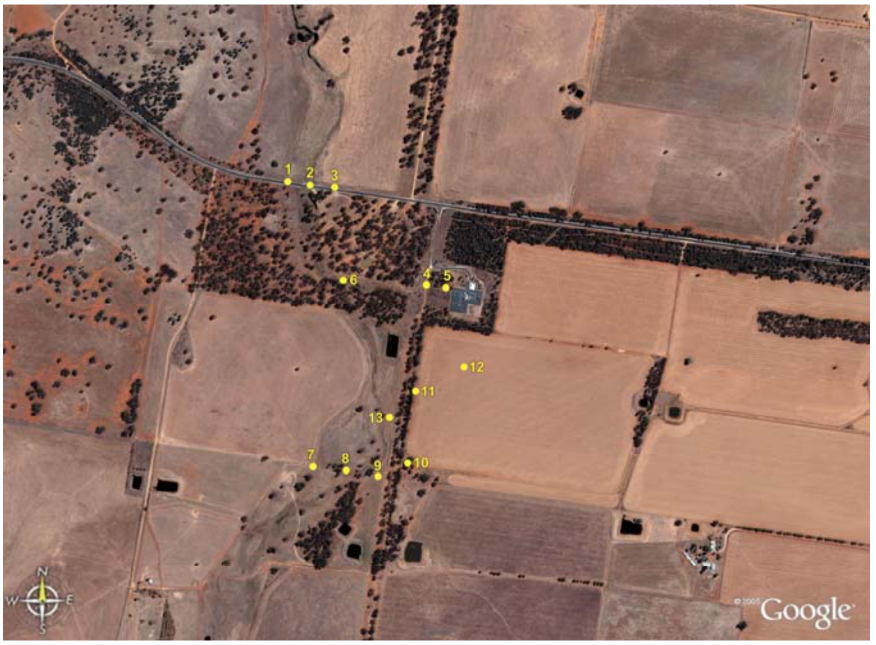


Figure 14-5 Ground Level Locations

Table 14-3 Ground Levels

Point	Description	RL (A.H.D) (metres)
1	Top bank (west)	272.20
2	Bed of creek	269.75
3	Top of bank (east)	271.00
4	Nat Surf in TransGrid fence	271.70
5	Top of fill at substation	272.65
6	Bed of creek in TSR	269.35
7	Top of bank (west)	268.80
8	Bed of creek	267.95
9	Top of bank (east)	269.45
10	Fence line	270.20
11	South west corner of proposed power plant	270.40
12	Middle of proposed power plant	271.80
13	Top of berm	269.80

Given the ephemeral nature of the stream, and the hydrologic uncertainty associated with that, a detailed flood study was not undertaken to determine floods of various recurrence intervals. Such a study would have to be based on very broad regional parameters and any modelling could not be suitably calibrated or validated due to the lack of reliable rainfall and stream flow data, as well as very limited flood level data. Accordingly, an approach based on the highest known flood in the area was adopted as described below.

With the flood levels located, a flood profile based on the 1981 flood level was projected past the property, based on a flood slope equal to the bed slope. This projection indicted a flood level of 270.5m AHD at the south west corner of the property or a flood depth at that location of 0.10m.

At the centre of the property, the flood level was projected to be 270.75m AHD, with the centre of the block being surveyed at 271.80m AHD. Without fill, this would provide a freeboard of 1.05m above a 1981 level of flooding, however without a detailed flood study, it is unwise to assign any recurrence interval to this event. The plot of the various slopes and flood levels is at **Figure 14-6**.

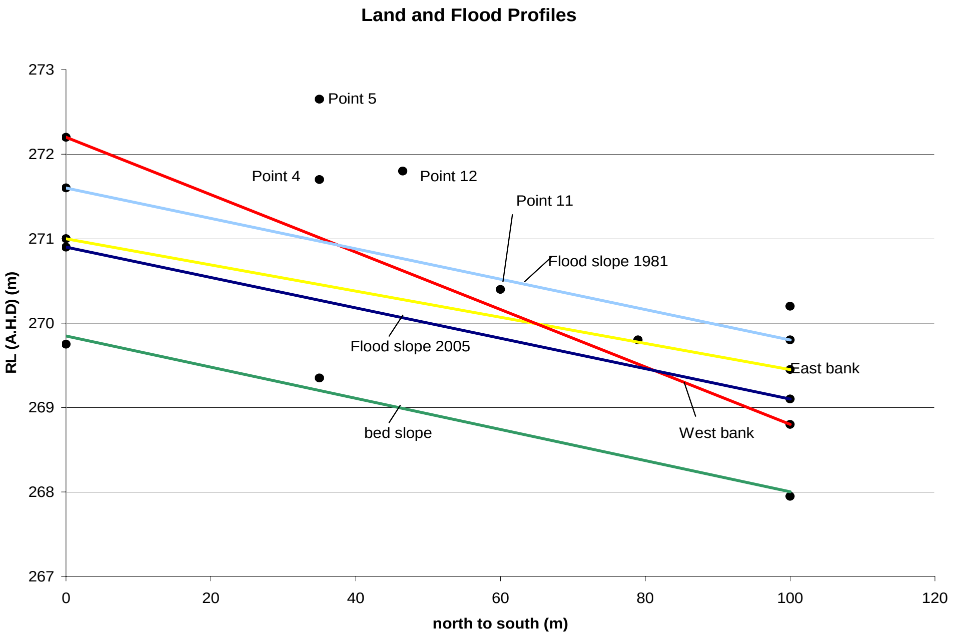


Figure 14-6 – Profiles used for flood investigation

There will also be considerable overland runoff from the areas to the east of the site. It will be necessary to establish catch drains around the site to manage these flows and to allow, as much as possible, the natural distribution of overland flows to continue without causing any scour or erosion.

14.6.1 Mitigation Measures

Best practice for developments on or adjoining a floodplain is to provide a freeboard of 0.5m above a set flood level. If the development is flood sensitive, or could be considered as essential infrastructure, the freeboard may be significantly increased or located out of the risk area.

For the proposed development, it is considered that a general fill 0.5m above the existing surface would be sufficient to mitigate the potential for flooding, giving a general level some 1.5m above the highest known flood level. Later detailed design may allow for variations in that fill profile, allowing for sensitive landscaping and drainage design to allow for the management of runoff from the site as well as from the adjoining land.

No additional freeboard would be necessary for the screening areas or water collection ponds.

14.7 Stormwater Management

14.7.1 Construction Period – Potential Impacts

During the construction period, approximately 4.7 ha of land would be disturbed in order to construct the compound, access roads, and electricity supply and approximately 10 km of natural gas pipeline would be constructed on an easement strip up to 25 metres wide. Rainfall on disturbed sites may cause soil erosion and runoff may contain high levels of sediments which could then enter the natural drainage system.

There is a high likelihood that soils at the site are dispersible. Given the relatively flat slopes for most of the areas which would be disturbed, most of the disturbed sites are likely to present minimal erosion hazard and be classified Soil Loss Class 1. The edge of the fill area of the proposed peaking power plant site, which is likely to have relatively steeper sides, is likely to be classified as a slightly higher Soil Loss Class.

There would also be the potential for spills and gross pollutants to be mobilised by runoff and enter the natural drainage system if no mitigation measures are put in place.

There is little likelihood that during the construction period that there would be a significant increase in either the rate or volume of water entering the stormwater system.

14.7.2 Construction Period – Mitigation

All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation. At a minimum, the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented.

Construction would be planned to minimise the time that disturbed land is exposed. Soil testing at the site would be undertaken to determine erodability and dispersiveness. (While there are no known soil tests at the site, testing of nearby sites indicates that soils could be highly dispersive.) Within areas which are disturbed, appropriate erosion prevention and sedimentation devices would be installed and maintained in line with *Managing Urban Stormwater – Vol 1 Soils and Construction* guidelines. This may include the installation of sediment filters and the construction of a sedimentation basin downstream of the construction area. These devices would remain in place until the surface is restored. These devices would also capture any gross pollutants. All works would be designed to minimise the potential for problems associated with salinity.

Disturbed sites would be revegetated or covered with a non-erodable surface as soon as possible following construction.

Stormwater flowing onto the site from the adjacent paddocks and electricity substation would be directed around any earth works.

Spills would be minimised through proper site management. If any spill was to occur, it would be likely to be of a small volume and contaminate only a small area. All possible pollutant materials would be stored well clear of site boundaries and stormwater drainage lines. They would be stored in a designated covered area. Containment bunds would be constructed with provision for collection of any spilt material. Waste collection areas would be designated. Appropriate bunding would be installed and appropriate containers would be provided. Waste disposal and collection would be properly undertaken. All vehicle maintenance would be undertaken offsite. Any vehicle washing on-site would be restricted to specific bunded areas.

Staff facilities would be provided and installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater.

During the construction period water may be required for dust suppression. This would likely be sourced from the Parkes potable water supply or other water source proven safe for such use.

14.7.3 Operation Period – Potential Impacts

Runoff from the east and possibly the north of the site, presently flows over the site land area and then into Ridgey Creek. When the site area is built up as described in **Section 14.6.1** above, this will no longer occur.

The proposed fill forming the construction pad would have steeper sides and runoff from these relatively steep sides of the mound may flow faster than would naturally occur. This could then cause localised soil erosion.

Surface water from the site that may potentially be contaminated could include:

- Rainfall runoff from operational areas of the site; and
- Accumulated water within bunds.

Liquid spills could potentially occur in the compound area or during transportation to the site.

14.7.4 Operation Period – Mitigation

The flow path of stormwater controls and treatment systems is presented in **Figure 14-3**.

Rain falling onto the site would not be allowed to run off the site as it would be collected for use within the site. Some excess rain water will be directed into the site evaporation ponds or otherwise into perimeter vegetation areas.

Priority will be given to recycle stormwater as much as possible - excess volume will be directed into the evaporation ponds to ensure no off-site discharge of contaminants. This will be done by appropriate sloping of surfaces and the construction of drains as shown in **Figure 14-3**.

Water falling into bunded areas (such as the step-up transformers and distillate fuel tanks), on driveways and on other operational areas would be directed into the evaporation ponds (see Section 14.5.1). This system would be designed to contain 1 in 100 year flows.

Where flows are concentrated, soil erosion may occur. Landscaping around the base of the mounds would slow runoff before it runs over the adjoining grassed surface. This would minimise the potential for soil erosion. **Chapter 9** provides further discussion on the landscaping treatment at the site.

To minimise the volume of potentially contaminated stormwater, surface runoff normally flowing onto the site from adjacent areas would be directed around the site using grass lined cut-off drains. This is shown in **Figure 14-3**. The site is very flat and these cut-off drains would likewise have minimal slope to fit into the existing surfaces. These flows would be concentrated when compared to current conditions and appropriate measures would be put in place to maximize the dispersion of these flows over a wide area, thereby minimising their potential to cause soil erosion downstream.

Stormwater falling onto areas where there was a low chance of contamination such as the small vegetated area of the site adjacent to the boundaries, would flow off-site into the cut-off drains or onto the adjacent road.

Parkes Peaking Power Plant will implement an emergency spill preparedness and response and management plan to manage collection, neutralisation (if possible) and disposal of any spills off-site through a licensed contractor.

14.8 Summary of Mitigation Measures

Table 14-4 presents a summary of mitigation measures related to water management

Table 14-4 Summary of Mitigation Measures

Mitigation Measure	Implementation of mitigation measure		
	Design Phase	Construction	Operation
Soil Erosion			
All construction works would be undertaken in a manner to minimise the potential for soil erosion and sedimentation.		✓	
At a minimum the measures outlined in the *Managing Urban Stormwater – Vol 1 Soils and Construction* would be implemented. Measures may include: • installation of sediment filters and • the construction of a sedimentation basin downstream of the plant area		✓	
Soil erosion and sedimentation devices would remain in place until the surface is restored. These devices would also capture any gross pollutants.		✓	
Disturbed sites would be revegetated or covered with a non-erodable surface as soon as practicable following construction		✓	
Spills and site management			
All possible pollutant materials would be stored in appropriate containers in designated areas and where required these areas will be bunded.		✓	✓
Appropriately bunded areas would be included for storage of distillate, oils and minor quantity of chemicals.		✓	✓
Waste collection areas would be designated.		✓	✓
Appropriate bunding would be installed and appropriated containers would be provided.			✓
Waste disposal and collection would be properly undertaken.		✓	✓
All vehicle maintenance would be undertaken offsite or in appropriately managed site areas.		✓	✓
Any vehicle washing on-site would be restricted to specific bunded areas		✓	✓
Staff facilities would be provided and installed and maintained so that pollutants, including wash water are not conveyed from the site in stormwater		✓	✓

Mitigation Measure	Implementation of mitigation measure		
	Design Phase	Construction	Operation
Water may be required for dust suppression and would be of a quality that represents no health risk .		✓	
Surface water			
Treatable stormwater will be reused at the site; No contaminated effluent will be discharged to local waterways.	✓	✓	✓
Water management strategies developed and implemented to maintain zero discharge from the site (apart from natural flows), minimising the possibility of polluted stormwater to be discharged from the site.	✓	✓	✓
Landscaping around the base of the mounds to minimise the potential for soil erosion.	✓		✓
At risk elements of the site will be built on mounds of varying heights to protect elements and to work in with overall site landscaping	✓	✓	
Cutoff drains will be constructed to divert overland flows around the site. The outlets of the cut off drains would be designed to replicate, as far as possible, natural overland flows by maximizing the dispersion of these high flows and spreading the flows out over a wider area; thereby minimising their potential to cause soil erosion downstream.	✓	✓	✓
Wastewater Treatment			
All process wastewater will be collected in evaporation ponds and evaporated into the atmosphere. No off-site discharge will occur.	✓		✓
Waste solids and sludge will be removed from site and disposed of by a licensed contractor.		✓	✓
All domestic wastewater during construction would be collected and disposed of through a licensed septic system or offsite by a licensed contractor.		✓	
Domestic and maintenance wastewater during operations would be treated by a zero discharge proprietary treatment system or stored and disposed of offsite by a licensed contractor.	✓		✓