



## **PROPOSED WAGGA WAGGA GAS-FIRED POWER STATION**

**WATER MANAGEMENT STRATEGY  
Additional Information Requested by EPA & DIPNR**

**Amended April 2004**

Prepared by



## DOCUMENT CONTROL SHEET

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\* Note: Changes in Revision No 1 have been made to sections 2.0, 3.1, 3.1.1 and 4.2.

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## 1.0 INTRODUCTION

This addendum report provides additional information on water management issues requested by EPA Murray Region for the proposed 600MW gas-fired power station at Uranquinty by Wambo Power Ventures Pty Ltd (WPV). The report addresses the following issues:

- Assessment of the potential volume and quantities of waters discharged from the site during construction and operation.
- Water cycle for the proposed development and its management, including measures to reuse water within the process and any proposal to apply water to land or discharge water to natural waterways.
- Mitigation and management measures for any potential impacts on groundwater and surface water including methodology, data and assumptions used to design any pollution control works.
- Full details of stormwater management systems with a demonstration that those systems can accommodate likely storm events (justification is provided for the design capacity of those systems, especially any effluent management system), and including any location of proposed stormwater infrastructure.
- Design characteristics of evaporation or detention basins.

The Water Management Strategy will be refined and further developed during the detailed design phase.

## 2.0 WATER USE

By comparison with other coal/gas sourced power generation technologies, water use in an open cycle gas turbine (OCGT) plant is relatively small. Table 2.3 of the EIS indicated that a 300MW OCGT plant would only have 5% of the water requirement of a similar-sized coal-fired plant.

The main water uses on site will be:

- Fire services and fire water storage;
- Demineralised water for evaporative coolers in gas turbines
- Site washdown water;
- Turbine blade washing;
- Potable water; and
- Landscaping (vegetation watering).

Average daily makeup demand is estimated at 23m<sup>3</sup>/day, with the principal use being makeup water for the demineralisation plant meant to supply demineralised water to evaporative coolers of the gas turbines when in use. This is discussed further below. For most of the time the only water coming onto the site will be for potable use estimated at 0.15m<sup>3</sup>/day.

Potable water will be accessed from the Riverina Water pipeline that runs through Uranquinty. The current proposal provides for on-site storage of water (of the order of 1 ML) as a buffer to meet peak demand and so that sufficient water supply is available for fighting fires. Riverina Water County Council have undertaken preliminary analysis assuming maximum flows of 130 m<sup>3</sup>/day (1.5 litres/second) and

have been sent a request for additional advice in relation to this matter. As the station is able to source their required water for the demineralisation plant from this on-site storage, WPV can bring in makeup water during off peak / overnight periods. With this set-up it is likely that the existing 50mm PVC main along Uranquinty Cross Road is adequate to cater for these additional flows.

This issue is ongoing, however recent discussions have indicated that a full upgrade to the existing pipeline is unlikely.

## **2.1 DEMINERALISATION PLANT**

Evaporative coolers fitted to the gas turbines help boost the power output from the power station when the ambient relative humidity is low. Also, operation of evaporative coolers is weather dependent and generally expected to run during summer, though it may run for short durations during winters.

Evaporative coolers need water to humidify and cool inlet air to the gas turbine. The process has a strict water chemistry requirement to ensure safe and efficient working of the gas turbines. This requires a high level of blow-down for a relatively lower quality of water. WPV has proposed to use high quality low salinity water produced through a demineralised water plant. This significantly reduces the water consumption in the evaporative coolers.

The proposed demineralised water plant will have a capacity of 130m<sup>3</sup>/day and will operate for 18 hours/day during the peak consumption season. It will consist of two cylindrical vessels to store cation and anion resins. The process shall be controlled by a micro-processor based controller to monitor the process and quality. It will require the regeneration of resins with 53 kg of 100% HCl and 57 kg of 100% NaOH per cycle of operation.

The blowdown water from the regeneration is estimated to be 12m<sup>3</sup> per regeneration (approximately 7.5KL/annum or 62 regenerations/annum) with a salt content of 15000 mg/L. The regeneration product from the demineralised water plant will be treated in the neutralisation pit before being disposed to evaporation ponds.

The annual salt load generated is estimated at 11,160 kg or 30.6 kg/day on average.

## **2.2 CONSTRUCTION WATER USE**

Construction water use is expected to be in the range 5-10 cubic metres/day with a monthly average of 250m<sup>3</sup>. Water will be sourced from the existing/upgraded Riverina Water County Council water main and/or from runoff water stored in sediment/storm water control dams on-site.

## **3.0 WATER MANAGEMENT**

The proponent's water management philosophy is that the site will maximise reuse of water generated on-site and will operate with a "no release" policy. This philosophy will apply to all power plant and other developed areas of the site (apart from the switchyard) where process water and stormwater are generated.

A water balance has been developed for the operation and is shown at Figure 1. This includes five main circuits/components:

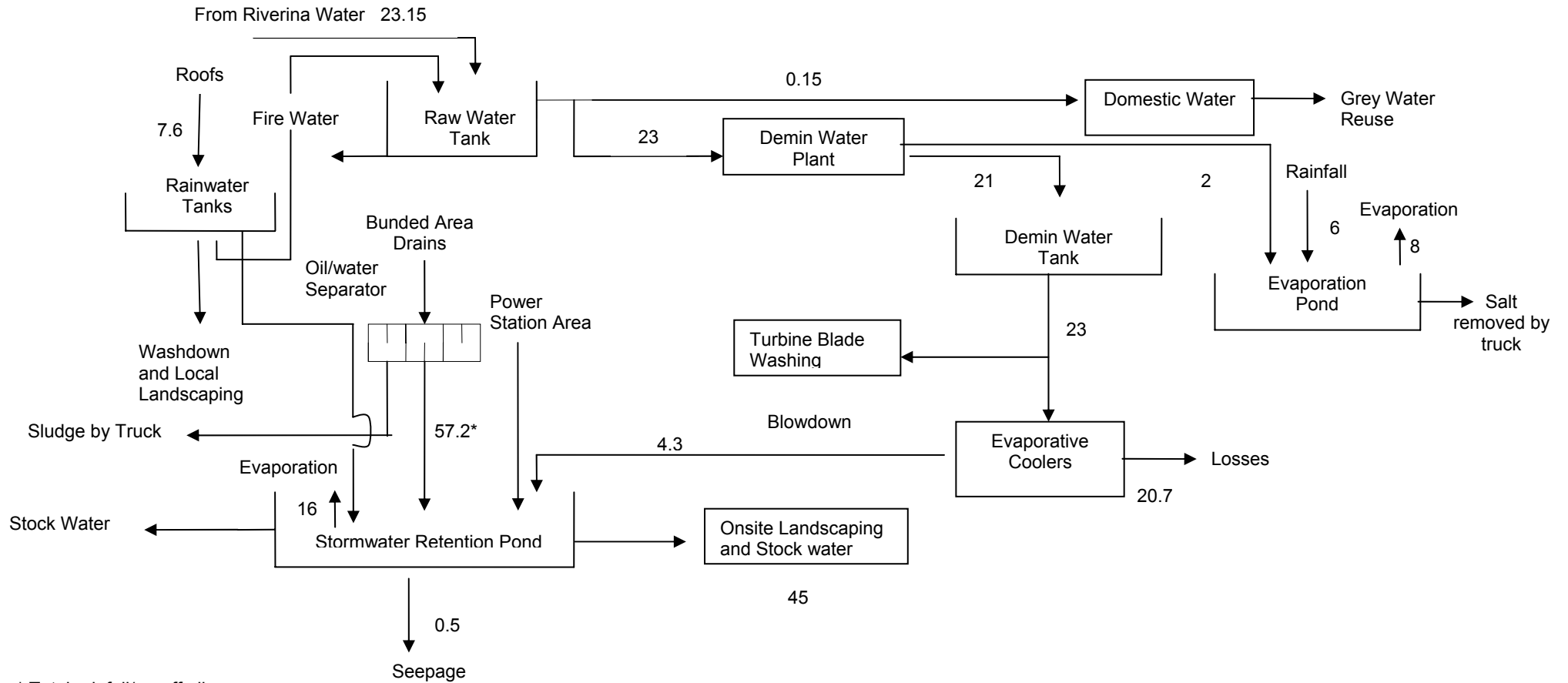
- Demineralised water plant and evaporative coolers
- Demineralised water blowdown and evaporation
- Roof catchments
- Bunded area drains
- Paved area drains/stormwater

Roof catchment rainwater (Figure 2) will be collected and stored separately to other runoff for reuse as fire water, washdown, landscaping purposes and toilet flushing (if required – note: a waterless sewage treatment system is proposed for the site).

Power plant and other developed areas will be separated from natural catchments by diversion drains and bunding as appropriate.

# Figure 1 Water System Schematic – Wet Year (m<sup>3</sup>/day)

Note: Waterless sewage treatment system proposed



\* Total rainfall/runoff all areas

Potential dirty water will be collected from in-plant bunded areas (Figure 3) and will flow via a separate drainage line to an oil separator system before draining to a stormwater retention pond.

Water from the stormwater retention pond will be used for stock watering or on-site vegetation watering for landscaping purposes.

### **3.1 DEMIN PLANT BLOWDOWN MANAGEMENT**

Due to the salt load, it is proposed to store demin plant blowdown in a series of shallow evaporation ponds located at the northern boundary of the site adjacent to the gas turbine units. An indicative location is shown on Figure 4. Water would either drain or be pumped from the demin plant.

#### **3.1.1 Evaporation Ponds Design**

Conceptually it is proposed that the evaporation ponds would be sized (area-wise) to evaporate up to the 1: 10 wet year rainfall. However a freeboard of 1m would be provided to accommodate the highest recorded annual rainfall at Wagga AMO (988mm in 62 years of record).

It is proposed that there would be at least 2 ponds that would allow management flexibility for removal of solid salt residues and water management.

It is proposed that the main evaporation pond would cover an area of 1600m<sup>2</sup> and would be designed to evaporate blowdown plus the average annual rainfall. A secondary pond (1400m<sup>2</sup>) would be used to evaporate excess water generated for the 1:10 wet year annual rainfall. These sizes have been estimated from simple water balance calculations and have been conservatively sized to allow for potential overestimation of evaporative losses.

Salt residues would be removed by rubber tyred loaders and transported to EPA licensed disposal facilities if no recycling or marketable use can be found. It is likely, however, that industries such as chemical manufacturing will utilise this product.

Ponds would be constructed as bunded shallow excavations with a composite liner system. Liner design /specification would have to allow trafficability by rubber-tyred vehicles without damaging the synthetic liner.

### **3.2 ROOF WATER CATCHMENTS**

Roof water catchments include turbo-generator unit areas, raw and fire water storage tanks, demineralised water tank, demineralisation plant, fuel unloading area and fuel storage tank, office building and works and stores building. Catchment area for units 1 and 2 and other structures is 5360 m<sup>2</sup>, and will be approximately 7400m<sup>2</sup> when all four units are operational.

Water will drain from these areas to an above ground storage tank of approximately 50m<sup>3</sup> capacity. Water will be pumped from here to the main raw water tank to supplement makeup water from the town water supply. In extreme events excess water will drain to the stormwater retention pond.

### 3.3 BUNDED AREAS

Bunding in accordance with Australian Standards and government guidelines will be installed around areas housing hazardous materials such as fuels and chemicals. Bunded areas are shown in Figure 3. Stormwater from these areas will be collected in a separate drainage collection system. Grease and oil traps will be installed downstream of bunded areas. Water will pass through an oil water separator prior to discharge to the stormwater pond. Any spills of fuel, oil or hazardous chemicals which enter the drainage system will be contained in the grease traps or in the case of a very large spill, caught in the stormwater pond.

Depending upon the nature of the spill, cleanup and/or neutralisation can be undertaken according to the appropriate emergency response plan.

### 3.4 STORMWATER MANAGEMENT

As described in the EIS, stormwater will be managed by a series of stabilised diversion banks to prevent run-on to the site and divert runoff from clean water areas off-site. Indicative locations of diversion banks are shown at Figure 4. Stormwater runoff will be collected from the plant site, and roadway areas by a series of stabilised drains which will direct water to a 5000m<sup>2</sup> stormwater collection pond located on the eastern boundary of the site (Figure 4). The catchment area for power plant, building surrounds and roads is estimated to be approximately 26400m<sup>2</sup>.

Drainage from the construction laydown area and undeveloped parts of the catchment will bypass the stormwater collection pond. This is discussed further below.

#### 3.4.1 Stormwater Basin Design

The stormwater collection pond will be constructed using local soils for embankments to standard engineering specifications. The pond dimensions will be optimised depending upon site topography and geology. The stormwater basin has been sized to store the 10 percentile exceedance annual rainfall of 771mm. Wet year water balance calculations (see Section 4.1) indicate that the quantity of water requiring storage to prevent spillage and discharge from site is approximately 20000 m<sup>3</sup> for a pond with 5000 m<sup>2</sup> surface area. The storage will have sufficient capacity to store a 1:100 year 72 hour storm event. This is estimated at 136.8mm (1.9 mm/hr) and is derived from intensity-frequency-duration data provided by the Bureau of Meteorology. Runoff from this storm is estimated to be approximately 3250 m<sup>3</sup>.

The pond will be constructed to act as a sediment trap during construction and to serve as the stormwater retention pond after construction has been completed. The dam will incorporate a grassed spillway area which will drain to the natural depression at the eastern side of the site. Consideration will be given to placing an engineered liner at the base of the pond. This will consist of either a synthetic liner/geomembrane or compacted natural soils. Given the nature of the windblown clayey soils at the site natural permeabilities could be quite low. Further insitu field and laboratory studies are proposed to assess insitu permeabilities and the likely permeabilities that can be achieved with mechanical compactive effort.

During the operational stage, the basin will be operated to maximise the recovery of stormwater for reuse. Provisions will be made to pipe stormwater to a stock watering point on the adjacent property.

### 3.5 CONSTRUCTION LAYDOWN AREA

This area is located upstream of the main plant area and will be only used during construction periods. Stormwater from this area will be managed separately to general plant area stormwater, and will be allowed to discharge from the eastern part of the site (Figure 4). A small sediment basin (capable of holding a 1 in 5 year storm) will be constructed downstream of the area.

### 3.6 SEDIMENT AND EROSION CONTROL MEASURES

Sediment and erosion control measures will be implemented in accordance with NSW government requirements and current industry approaches and guidelines. A site specific Sediment and Erosion Control Plan will be developed prior to detailed design of the site civil works commencing.

## 4.0 WATER CYCLE

A water cycle for the site has been developed incorporating the various site water usages and based on the proponent's water management strategy. The performance of the site water management strategy has been assessed by preparing water balances for dry, average and wet year scenarios.

### 4.1 WATER BALANCE

Water balance scenarios have been based on using available rainfall and evaporation records from Station 072150 Wagga Wagga AMO, which is located approximately 22.5 km north east of the site and is considered to be the most representative station in proximity to the site. Data used for the various water balance cases are summarized below and presented in Table 1. Water balances for dry, average and wet scenarios for the stormwater retention system are presented in Tables 2,3 and 4. Average and wet season water balances for the demin plant blowdown/evaporation system are presented at Tables 5 and 6.

Dry	1 <sup>st</sup> decile (ie 90% exceedance) monthly rainfalls adjusted to sum to 1 <sup>st</sup> decile annual rainfall (418mm)
Average	5 <sup>th</sup> decile (ie 50% exceedance) monthly rainfalls adjusted to sum to 5 <sup>th</sup> decile annual rainfalls (584mm)
Wet	9 <sup>th</sup> decile (ie 10% exceedance) monthly rainfalls adjusted to sum to 9 <sup>th</sup> decile annual rainfalls (771mm)



**Table 1 Monthly Rainfalls Wagga Wagga AMO**

mm	Dry 90% Exceedance	Dry Adjusted	Median 50% Exceedance	Median Adjusted	Wet 10% Exceedance	Wet Adjusted
January	6.5	23	33.4	40	91.6	60
February	3.7	13	25.7	31	86	56
March	1.6	6	30.2	36	114.2	75
April	9.7	34	30.6	36	88.3	58
May	8.2	29	42.2	50	128.4	84
June	11.4	40	44.2	53	94	61
July	21.9	76	56.4	67	96.2	63
August	9.2	32	54.6	65	89.7	59
September	17.1	59	49	58	88.9	58
October	16.5	57	50.7	60	118.9	78
November	10.4	36	37.8	45	91	60
December	3.9	14	35.9	43	92	60
Sum of Monthly	120.1	419	490.7	584	1179.2	772
Annual		417.7		583.5		771.2

**Table 2 Stormwater Pond Dry Season Water Balance**

	90% Rain mm	Runoff Runoff mm	Plant Inflow m3	Total Flows m3	Total Inflow m3	Evap mm/d	Pond Evap mm	Evap m3 Area m2 5000	Pond Rainfall m3	Seepage m3	Total Excess m3
Jan	23	16.1	544	71.3	615.3	8.9	193.1	966	115	15	-251
Feb	13	9.1	308	64.4	372.4	8.1	175.8	879	65	15	-457
Mar	6	4.2	142	71.3	213.3	5.9	128	640	30	15	-412
Apr	34	23.8	805	69	874	3.6	78.12	391	170	15	638
May	29	20.3	686	71.3	757.3	1.9	41.23	206	145	15	681
Jun	40	28	947	69	1016	1.2	26.04	130	200	15	1071
Jul	76	53.2	1799	71.3	1870.3	1.2	26.04	130	380	15	2105
Aug	32	22.4	757	71.3	828.3	1.8	39.06	195	160	15	778
Sep	59	41.3	1396	69	1465	2.6	56.42	282	295	15	1463
Oct	57	39.9	1349	71.3	1420.3	4.1	88.97	445	285	15	1245
Nov	36	25.2	852	69	921	6.3	136.7	684	180	15	402
Dec	14	9.8	331	71.3	402.3	8.5	184.5	922	70	15	-465
Total	419	293.3	9916	839.5	10755.5		1174	5870	2095	180	6798

**Table 3 Stormwater Pond Average Year Water Balance**

	50% rain	Runoff	Runoff inflow	Plant Flows	total Inflow	Evap mm/d	Pond Evap	Evap m3 Area m2	Pond Rainfall	Seepage	Total Excess
	mm	mm	m3	m3	m3		mm	5000	m3	m3	m3
Jan	40	30	1014	71.3	1085	8.9	193.13	966	200	15	304
Feb	31	23.25	786	64.4	850.4	8.1	175.77	879	155	15	111
Mar	36	27	913	71.3	984.3	5.9	128.03	640	180	15	509
Apr	36	27	913	69	982	3.6	78.12	391	180	15	756
May	50	37.5	1268	71.3	1339	1.9	41.23	206	250	15	1368
Jun	53	39.75	1344	69	1413	1.2	26.04	130	265	15	1533
Jul	67	50.25	1699	71.3	1770	1.2	26.04	130	335	15	1960
Aug	65	48.75	1648	71.3	1719	1.8	39.06	195	325	15	1834
Sep	58	43.5	1471	69	1540	2.6	56.42	282	290	15	1533
Oct	60	45	1521	71.3	1592	4.1	88.97	445	300	15	1432
Nov	45	33.75	1141	69	1210	6.3	136.71	684	225	15	736
Dec	43	32.25	1090	71.3	1161	8.5	184.45	922	215	15	439
Total	584	438	14808	839.5	15648		1173.97	5870	2920	180	12515
Av/day			40.6	2.3	42.9			16	8		34.3

**Table 4 Stormwater Pond Wet Year Water Balance**

	10% rain	Runoff	Runoff inflow	Plant Flows	total Inflow	Evap mm/d	Pond Evap	Evap m <sup>3</sup> Area m <sup>2</sup>	Pond Rainfall	Seepage	Total Excess
	mm	mm	m3	m3	m3		mm	5000	m3	m3	m3
Jan	60	48	1623	71.3	1694.3	8.9	193.13	966	240	15	953
Feb	56	44.8	1515	64.4	1579.4	8.1	175.77	879	224	15	909
Mar	75	60	2028	71.3	2099.3	5.9	128.03	640	300	15	1744
Apr	58	46.4	1569	69	1638	3.6	78.12	391	232	15	1464
May	84	67.2	2272	71.3	2343.3	1.9	41.23	206	336	15	2458
Jun	61	48.8	1650	69	1719	1.2	26.04	130	244	15	1818
Jul	63	50.4	1704	71.3	1775.3	1.2	26.04	130	252	15	1882
Aug	59	47.2	1596	71.3	1667.3	1.8	39.06	195	236	15	1693
Sep	58	46.4	1569	69	1638	2.6	56.42	282	232	15	1573
Oct	78	62.4	2110	71.3	2181.3	4.1	88.97	445	312	15	2033
Nov	60	48	1623	69	1692	6.3	136.71	684	240	15	1233
Dec	60	48	1623	71.3	1694.3	8.5	184.45	922	240	15	997
Total	772	694.8	20882	839.5	21722		1173.97	5870	3474	180	18757
Av/day			57.2		59.5			16	10		51.4

**Table 5 Demin Plant Blowdown/Evaporation Pond Water Balance**

	50% rain	Pond Rainfall	Plant inflow	Total Inflow	Evap mm/d	Pond Evap	Evap m <sup>3</sup> Area m <sup>2</sup>	Total Excess	Cumulative Excess
	mm	m3	m3	m3		mm	1600	m3	m3
Jan	40	64	190.65	254.7	8.1	193.13	309	-54	-54
Feb	31	50	172.2	222.2	5.9	175.77	281	-59	-113
Mar	36	58	190.65	248.7	3.6	128.03	205	44	-69
Apr	36	58	0	58	1.9	78.12	125	-67	-136
May	50	80	0	80	1.2	41.23	66	14	-122
Jun	53	85	0	85	1.2	26.04	42	43	-79
Jul	67	107	0	107	1.8	26.04	42	65	-14
Aug	65	104	0	104	2.6	39.06	62	42	28
Sep	58	93	0	93	4.1	56.42	90	3	31
Oct	60	96	0	96	6.3	88.97	142	-46	-15
Nov	45	72	0	72	8.5	136.71	219	-147	-162
Dec	43	69	190.65	259.7		184.45	295	-35	-197
Total	584	936	744.15	1680		1173.97	1878	-198	

**Table 6 Demin Plant Blowdown/Evaporation Pond Water Balance**

	10% rain	Pond Rainfall	Plant inflow	Total Inflow	Evap mm/d	Pond Evap	Evap m <sup>3</sup> Area m <sup>2</sup>	Total Excess	Cumulative Excess
	mm	m3	m3	m3		mm	3000	m3	m3
Jan	60	180	190.65	370.65	8.5	184.45	553	-182	-182
Feb	60	180	190.65	370.65	8.9	193.13	579	-208	-390
Mar	56	168	172.2	340.2	8.1	175.77	527	-187	-577
Apr	75	225	190.65	415.65	5.9	128.03	384	32	-545
May	58	174	0	174	3.6	78.12	234	-60	-605
Jun	84	252	0	252	1.9	41.23	124	128	-477
Jul	61	183	0	183	1.2	26.04	78	105	-372
Aug	63	189	0	189	1.2	26.04	78	111	-261
Sep	59	177	0	177	1.8	39.06	117	60	-201
Oct	58	174	0	174	2.6	56.42	169	5	-196
Nov	78	234	0	234	4.1	88.97	267	-33	-229
Dec	60	180	0	180	6.3	136.71	410	-230	-459
Total	712	2136	553.5	2689.5		989.52	2967	-278	

## 4.2 SALT BALANCE

Under the current proposal blowdown from the demineralisation plant will drain to an evaporation pond after neutralisation. The salt concentration build up in the site water management system has been assessed. Indicative water qualities of various water inputs are summarised in Table 7.

**Table 7 Water Cycle Components Water Quality**

	Unit	Mains Water	Demin plant blowdown	Evap coolers blowdown	Site Runoff
Total Dissolved Solids	mg/L	90-150	15000	15	60
Calcium	mg/L	9.75-12.45	N.A.	N.A	5
Magnesium	mg/L	7.4-12.42	N.A.	N.A	3
Sodium	mg/L	14.5-31.2	N.A.	2.3	2
Potassium	mg/L	N.A* -	N.A.	N.A	7
Chloride	mg/L	14.6-27.3	N.A.	N.A	4
Sulphate	mg/L	6.9-14.8	N.A.	N.A	3
Nitrate	mg/L	<1-1.4	N.A.	N.A	<0.01

\* N.A. = Not available

Salinities at various stages of the water cycle are summarised in Table 8 below.

**Table 8 Salinity Concentrations in Water Cycle**

Input/Output	Quantity m <sup>3</sup> /d	Salinity mg/L	Salt Load kg/d	Comment
Potable Makeup Water	23.15	125	2.9	23m <sup>3</sup> /day to demin plant
Demin plant blowdown	2	15000	30	Blowdown to evap pond
Evap coolers blowdown	2.3	15	0.03	Blowdown to stormwater retention pond
Rainfall/Runoff Average Year	40.6	60	2.44	
Stormwater Retention Basin salinity	42.9	58	2.47	
Stormwater Retention Basin after evaporation*	-	72	-	

\* assumes no landscaping water or reuse

Because of the low salt content in potable makeup water and the low estimated salinity of site runoff the estimated average salinity of water entering the stormwater retention pond is 58 mg/L if it is assumed that no water was extracted from the pond for stock watering or water for onsite plant watering. The estimated salinity at the end of an average year would be 72 mg/L.

Consequently the salinity of water available for onsite watering of vegetation or stock watering is estimated to have an average salinity of 58-72 mg/L. This water would be suitable for both on site vegetation watering and stock watering.

### 4.3 STORMWATER COLLECTION POND REUSE

As discussed above it is proposed to reuse water from the stormwater retention pond for stock watering, on-site vegetation watering/landscaping and raw water makeup.

Recycled stormwater will be used for the watering of native vegetation grown for landscaping purposes. Given the area to be landscaped and evaporation rates, all collected stormwater can be used for plant watering.

Given the sodic and clayey nature of the sites soils it will be important to design and manage site landscaping appropriately to ensure effective plant growth and to minimise soil erosion. A site-specific "On-site Plant Watering Management Plan" will be developed for this purpose.

## 5.0 WASTEWATER MANAGEMENT

An on-site sewerage treatment facility will cater for sewerable wastes for the operational staff. The facility will be a contained system, such as waterless Clivus Multrum or Rota-Loo units and all solid and liquid wastes will be collected from the unit for off-site removal.

During the construction phase, additional temporary units will be provided with collection, transport and disposal dealt with in a similar manner.

## 6.0 SUMMARY

The issues raised by the EPA are addressed in turn below.

- *Assessment of the potential volume and quantities of waters discharged from the site during construction and operation.*

No water from site work areas will discharge from the site during the construction period.

During operations, no waters from plant areas will discharge from the site. Most process and stormwater (apart from demin plant blowdown and water collected from roof catchments) will drain to a stormwater retention pond. Pipework will be installed to allow access for stock watering on the adjacent property. The construction laydown area will be rehabilitated so that waters from this area can be discharged from site at rates and quantities similar to the current land use. Runoff from undisturbed/revegetated land on the site will continue to discharge off site. Potential quantities of water handled by the various water management systems have been assessed.

- *Water cycle for the proposed development and its management, including measures to reuse water within the process and any proposal to apply water to land or discharge water to natural waterways.*

A water cycle and water balance have been developed for the site. Because of the type of power plant (gas turbine), water usage is very low compared to other plant. Average daily water makeup is estimated at 23.15m<sup>3</sup>/d which can

be provided from Riverina Water County Council. Stormwater that drains to the stormwater retention pond will be used for on-site watering of native vegetation proposed for site landscaping.

Roof catchment runoff will be collected for reuse as fire water makeup, washdown, watering of onsite vegetation and toilet flushing (if required). Excess roof water will drain to the stormwater retention pond. Grey water from potable use on-site will be collected and reused for on-site maintenance of vegetation.

Demin plant blowdown will be transferred to an evaporation pond. Salt residues will be removed periodically and trucked to licensed receival facilities if no recycling or marketable use can be found.

- *Mitigation and management measures for any potential impacts on groundwater and surface water including methodology, data and assumptions used to design any pollution control works.*

### **Surface Water**

The main mitigation works for surface water include:

- Provision of necessary bunding of fuel and hazardous chemicals;
- Provision of a separate drainage collection system and triple interceptor pit oil removal system from bunded areas;
- Implementation of an emergency response and recovery plan in the event of fuel spillage into the drainage system;
- Separate roof catchment drainage and collection/reuse system;
- Stormwater retention system capable of holding the 90% exceedance annual rainfall of 771mm;
- Provision of an evaporation system for demin plant blowdown capable of evaporating the 90% exceedance annual rainfall (771mm) and storing 1m rainfall in total;
- Reuse of collected stormwater for onsite vegetation maintenance and stock watering;
- No servicing/maintenance of vehicles on site; and
- Conduct surface water quality monitoring.

Management measures include the provisions for hazard and risk management, storage and handling of chemicals and sediment control and water quality management as outlined in the draft Construction and Operational Environmental Management Plans.

### **Groundwater**

Due to the geological conditions at the site groundwater is not present in quantities and at a depth that is economic to extract. Groundwater has been observed at the site beneath a sequence of silty clays at a depth of 50m.

Due to the depth to groundwater, the thickness of low permeability surficial silty clays and the nature of the sites operations potential impacts on groundwater are considered to be negligible. Notwithstanding this conclusion it is proposed to:

- Consider the installation of a low permeability engineered liner at the base of the stormwater retention pond to minimise seepage losses;
  - Install a composite liner at the base of the evaporation ponds; and
  - Install waterless sewage treatment systems at the site and remove sewage wastewaters from site for off-site treatment; and
  - Conduct groundwater quality monitoring.
- *Full details of stormwater management systems with a demonstration that those systems can accommodate likely storm events (justification should be provided for the design capacity of those systems, especially any effluent management system), and including any location of proposed stormwater infrastructure.*

Details of the stormwater management system have been provided in the report. This system will be further developed during the detailed design phase of the project along with the upgrading of the Environmental Management Plans.

- *Design characteristics of evaporation or detention basins.*

### **Stormwater Detention Pond**

One stormwater detention pond is proposed capable of holding the 90% exceedance annual rainfall of 771mm and the 1 in 100 year 72 hour storm of 136.8mm. The pond will have a surface area of 5000m<sup>2</sup> and be able to store 20000m<sup>3</sup>.

The pond will be constructed to act as a sediment trap during construction and to serve as a stormwater retention pond after construction has been completed. The dam will incorporate a grassed spillway area which will drain to the natural depression east of the site.

Consideration will be given to placing an engineered liner at the base of the pond. This will consist of either a synthetic liner/geomembrane or compacted natural soils. Given the nature of the windblown clayey soils at the site natural permeabilities could be quite low. Further insitu field and laboratory studies are proposed to assess insitu permeabilities and the likely permeabilities that can be achieved with mechanical compactive effort.

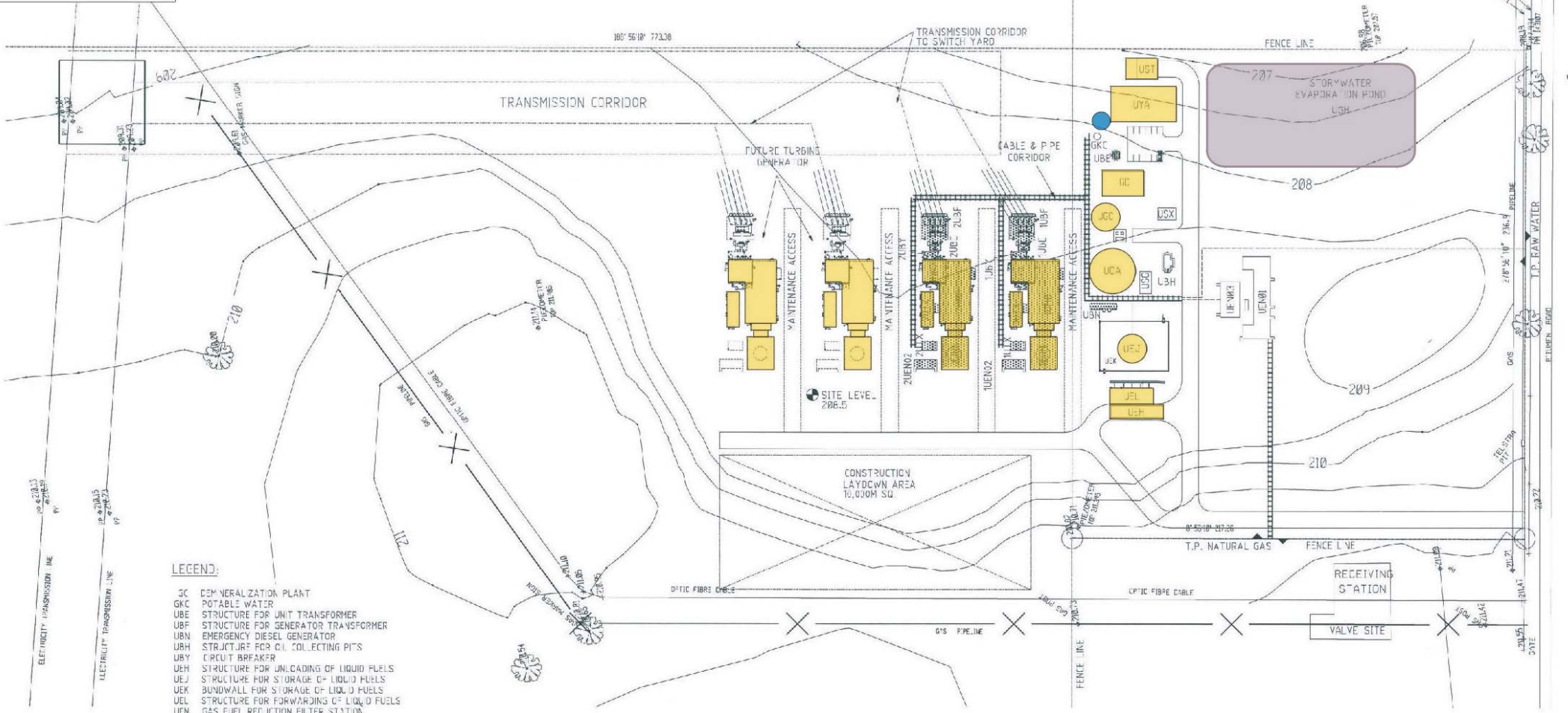
### **Evaporation ponds**

It is proposed that the main evaporation pond would cover an area of 1600m<sup>2</sup> and would be designed to evaporate blowdown plus the average annual rainfall. A secondary pond (1400m<sup>2</sup>) would be used to evaporate excess water generated for the 90% exceedance wet year annual rainfall.

Ponds would be constructed as banded shallow excavations with a composite liner system.. Liner design /specification would have to allow trafficability by rubber-tired vehicles without damaging the synthetic liner.

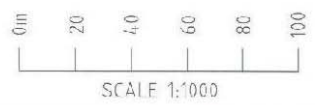
**LEGEND:**

- Roofed areas
- Stormwater evaporation pond
- Rainwater tank



- LEGEND:**
- GC DEMINERALIZATION PLANT
  - GKC POTABLE WATER
  - UBE STRUCTURE FOR UNIT TRANSFORMER
  - UBF STRUCTURE FOR GENERATOR TRANSFORMER
  - UBN EMERGENCY DIESEL GENERATOR
  - UBH STRUCTURE FOR OIL COLLECTING PITS
  - UBY CIRCUIT BREAKER
  - UEH STRUCTURE FOR UNLOADING OF LIQUID FUELS
  - UEJ STRUCTURE FOR STORAGE OF LIQUID FUELS
  - UEK BUNDWALL FOR STORAGE OF LIQUID FUELS
  - UEL STRUCTURE FOR FORWARDING OF LIQUID FUELS
  - UEN GAS FUEL REDUCTION FILTER STATION
  - UGA RAW & FIRE WATER STORAGE TANK
  - UGH DEMINERALIZED WATER TANK
  - UJH CLEAN WATER DRAINAGE EVAPORATION POND
  - UHN EXHAUST STACK
  - UMB GAS TURBINE BUILDING
  - USG FIRE FIGHTING PUMP HOUSE
  - US WORKSHOP AND STORES BUILDING
  - USX STRUCTURE FOR FOAM STATION
  - UTK MECHANICAL MODULE
  - UTX LUBE OIL COOLER
  - UYA OFFICE BUILDING

**SITE PLAN**  
SCALE 1 : 1000



PRELIMINARY ONLY

REV	DATE	DRN	DRG	ENC	ENG	CLIENT	REVISION DETAILS
4	16.12.03	A.R.					ISS. I/O FOR "EMERGENCY PROPOSES ONLY"
REFERENCE DRAWINGS							

**Wambo Power Ventures Pty Ltd**

Braemar Power Station

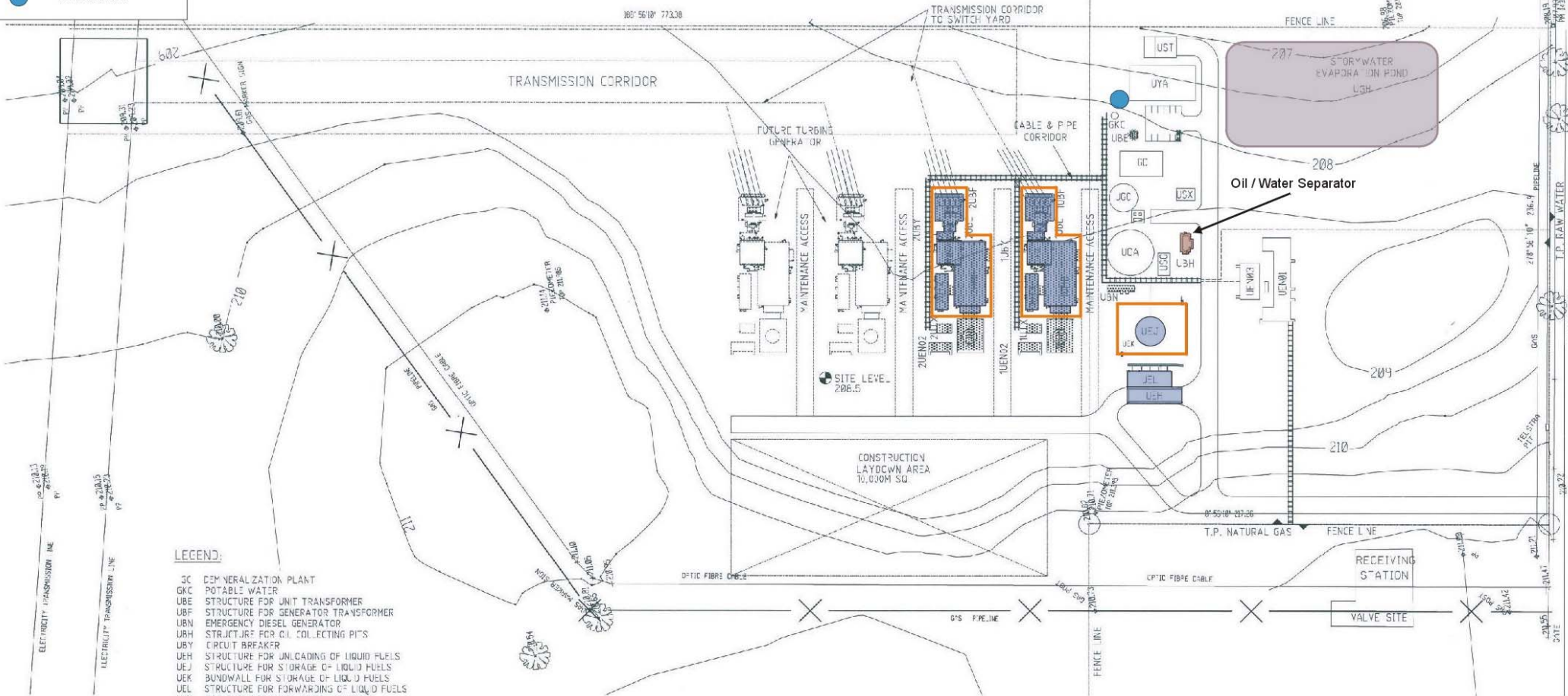
**Figure 2 Roofed areas**

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**LEGEND:**

-  Plant water drain areas
-  Bunded areas
-  Stormwater evaporation pond
-  Rainwater tank

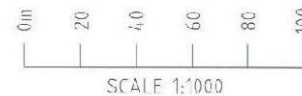


**LEGEND:**

- GC DEMINERALIZATION PLANT
- GRC POTABLE WATER
- UBE STRUCTURE FOR UNIT TRANSFORMER
- UBF STRUCTURE FOR GENERATOR TRANSFORMER
- UBN EMERGENCY DIESEL GENERATOR
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- US WORKSHOP AND STORES BUILDING
- USX STRUCTURE FOR FOAM STATION
- UTK MECHANICAL MODULE
- UTX LUBE OIL COOLER
- UYA OFFICE BUILDING

**SITE PLAN**

SCALE 1 : 1000



SCALE 1:1000

PRELIMINARY ONLY

REFERENCE DRAWINGS

REV	DATE	DRN	ENG	CHK	ENG	APPD	CLIENT
4	16.12.03	A.R.					

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REVISION DETAILS



Wambo Power Ventures Pty Ltd

DRAWN PA

CHECKED PS

DATE April 2004

CLIENT ERM-ES

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Braemar Power Station

Figure 3 Plant Water Drain Areas

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