

## **NHT Funded Project NLP 13188**

# **The effects of waste disposal on groundwater quality in Tasmania**



## **Port Latta waste depot**

**Tasmanian Geological  
Survey Record 2002/07**

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# Groundwater quality investigations at the Port Latta waste depot

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## Abstract

The Port Latta waste depot is a disposal site for general and hazardous waste materials. The local groundwater table slopes away from the site north towards Bass Strait. The regolith profile and related engineering grades of the clay material affects recharge to the fractured bedrock aquifer. Groundwater quality in the area of the leachate ponds is degraded. Ongoing monitoring and changes in the engineering design (i.e. filling sequence, surface water controls and leachate pond infrastructure) are regarded as high priorities at the site.

## INTRODUCTION

Mineral Resources Tasmania (MRT) initiated a project to investigate the effects of waste disposal on groundwater quality in Tasmania. The project was funded by MRT and the Natural Heritage Trust (NHT) and included a number of sites for detailed study. The waste depot at Port Latta was one of these sites.

The objectives of the investigations at the Port Latta waste depot were to:

- ☐ Determine the geological nature of the host materials;
- ☐ Identify the depth of the water table;
- ☐ Examine the quality of the groundwater; and
- ☐ Identify if a potential hydraulic connection exists between the waste fill materials and the local hydrological system.

Hazardous waste (including medical waste) and general municipal waste are disposed of at the site. Australian Bulk Minerals (ABM) currently uses groundwater extracted from two water bores on the Pipeline Track approximately two kilometres to the southwest. The water is used at the Port Latta pelletising plant for processing and office needs.

## SITE DESCRIPTION

The Port Latta waste depot is located approximately 500 metres south of the Bass Highway at Port Latta (362 300 mE, 5 475 300 mN) (fig. 1) and began operation in 1994. The Department of Primary Industries, Water

and Environment (DPIWE) currently licenses the facility.

## Site history and waste management

The site was a greenfield site at the time of construction. An engineered surface water system, filling sequence, landfill liner and leachate collection system have been constructed at the site. The filling sequence has occurred as a series of bench lifts over a clay liner of various thicknesses. The leachate collection system is constructed of PVC pipe surrounded by crushed rock on the top of the clay

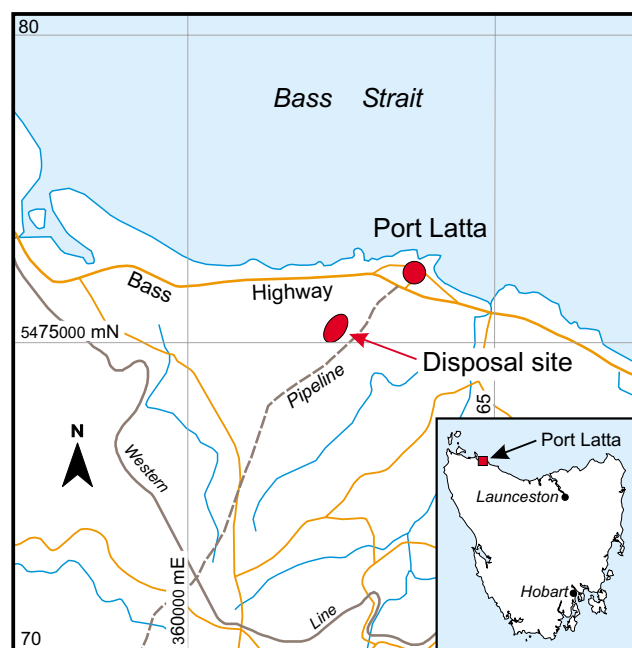
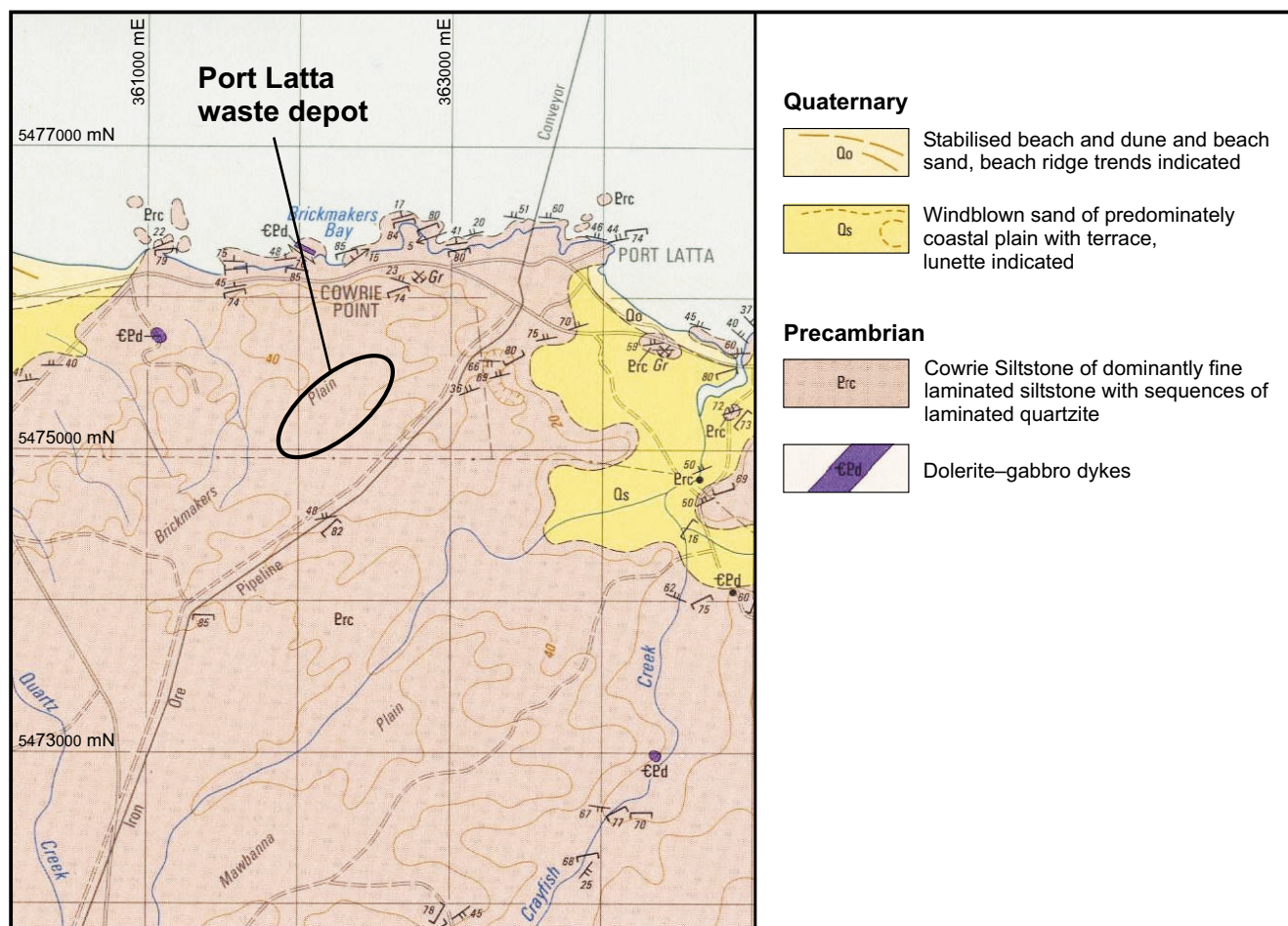


Figure 1. Location of the Port Latta waste depot.





**Figure 2**

*Extract from Smithton geological map (Lennox et al., 1982) of the local area and related geology.*

liner. Because groundwater was intercepted during various stages of development, sections of the landfill liner are underlain by a sub-liner which discharges to the surface water system. The sub-liner collection system is constructed of PVC pipe surrounded by crushed rock on weathered bedrock. Plate 1 shows a discharge point of one of these sub liners to the surface water system.

All disposal sites are located in clay deposits related to Precambrian sediments. Plate 2 shows cement tanks used to store soil contaminated by polychlorinated biphenyls (PCB's), while Plate 3 shows an active medical waste trench in clay materials typical of the site. Plate 4 shows cracking in the clays and related slumping above the most recent trenches.

### Geology

The Tasmania Department of Mines 1:50 000 scale geological map of the area (Lennox et al., 1982) indicates that the waste disposal area is underlain by Precambrian Cowrie Siltstone (fig. 2). This consists of finely laminated siltstone with sequences of laminated quartzite.

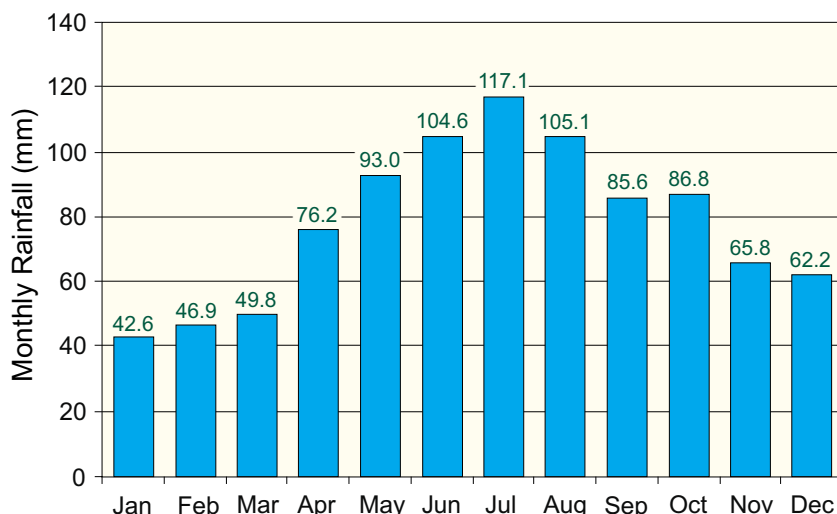
Geological mapping during the present study indicated that two types of clay deposits dominate the site. The first is material related to *in situ* weathering of

the Cowrie Siltstone, forming a regolith profile. The second material lies within a palaeochannel located within the regolith profile and the weathered Cowrie Siltstone (Plate 5). Both materials overlie the Precambrian Cowrie Siltstone with a transitional zone from the regolith profile to the bedrock. This transitional contact is exposed at the western end of the Stage 2 filling area (Plate 6).

The regolith profile controls the engineering behaviour of the respective grades within the profile. The uppermost section of the profile (0 to approximately 6 m) consists of grade IV to VI (Dearman and Fookes, 1974) material. Material beneath approximately six metres progressively grades from III to II.

Grade II Cowrie Siltstone crops out on the coastline to the north of the landfill. Complex folding and faulting are evident within the outcrops, with fold axes ranging in length from 0.4 to over 15 metres (Plate 7) within the coastal exposures. Pyrite, as pods up to 160 mm in diameter (Plate 8) and cubes up to 3 mm, was identified in the outcrops. The Cowrie Siltstone outcrops are heavily fractured, with secondary minerals (limonite) forming on some of the joint planes (Plate 9).





**Figure 3**  
Average monthly rainfall for Australian Bureau of Meteorology rainfall station 091094, Stanley (Post Office).

## Hydrology

The landfill footprint is located within the catchment area of Stinking Creek, which discharges into Bass Strait on the eastern side on of the ABM pelletising plant. Stinking Creek has a total catchment area of approximately two square kilometres. Stormwater runoff from the site is directed into stormwater settling ponds before discharging into Stinking Creek.

Australian Bureau of Meteorology rainfall station 091094 at Stanley (Post Office) is the closest rainfall station to the site. The rainfall chart of average monthly recorded rainfall (fig. 3) shows that the annual average rainfall for the station is 935.7 mm.

## INVESTIGATION METHODS

### Borehole drilling and installation

Nine 120 mm diameter monitoring bores were auger drilled between 22 and 24 August 2000 for this project (fig. 4). Fifty millimetre PVC casing was installed in eight of the bores, with slotted screens with bentonite seals being installed in each hole. Borehole PL2000/1 was drilled as a background hole approximately 500 m south of the landfill footprint. Borehole PL2000/7 intercepted medical waste and was backfilled with bentonite for occupational health and safety reasons. All bores were logged in accordance with AS1726-1993; engineering logs are presented in Appendix 1.

Groundwater was encountered across the site in close proximity to the overburden/bedrock interface. Flow during drilling indicated that the groundwater in the bedrock was being confined to some degree by the overlying clay materials. Figure 5 shows a southwest to northeast cross-section of the site and related standing water levels on 11 August 2001 for boreholes PL2000/3, 4, 5, 6 and 8.

The unsaturated zone consists of heterogenous medium to high plasticity mottled clays. In boreholes PL2000/2, PL2000/3, PL2000/4 and PL2000/5 groundwater was located above bedrock (auger

refusal) in a low to medium plasticity, dark grey to black clay (base of regolith profile).

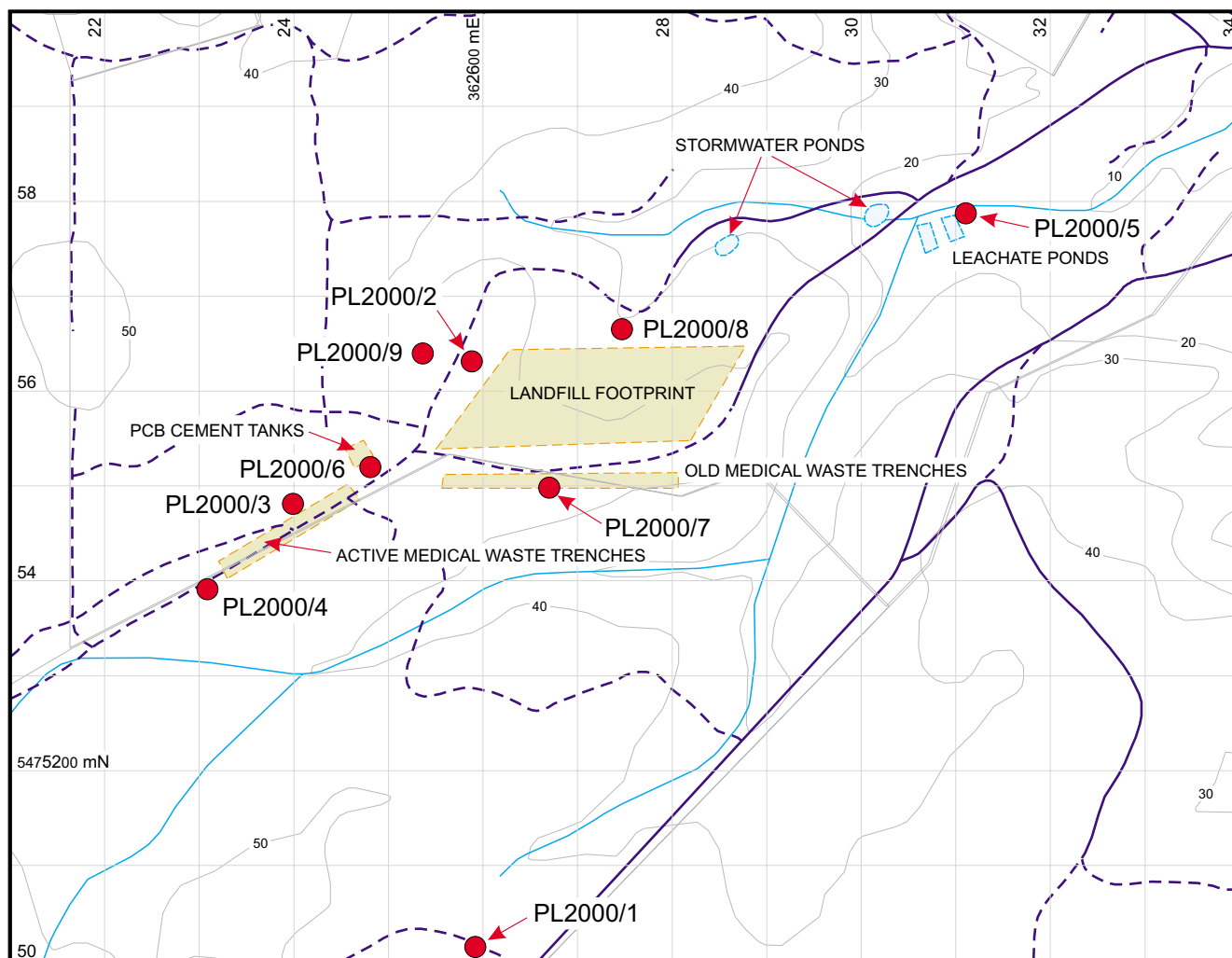
## HYDROLOGICAL MODEL

Boreholes previously drilled outside the landfill footprint in the general area (e.g. ABM bores on the pipeline track to the east) showed that the main aquifer at the site is located within the fractured Precambrian basement bedrock. The Precambrian rocks contain extensive fractures (jointing) which are associated with the complex folding of the area. Two high-yielding bores (12.6 L/s) drilled within the same rock mass have been reported on farmland approximately three kilometres to the east. No engineering logs exist for these bores, but comments from the drillers indicate that the fracturing system increased storage capacity with depth. Both bores were drilled to approximately 70 metres.

A hydraulic boundary condition appears to exist between the regolith profile and the underlying bedrock. As precipitation exceeds evaporation for about nine months of the year (implying a net recharge to groundwater), a concentration of groundwater develops at the base of the regolith profile. Based on observations of the coastline outcrops and the above, joint cementation must be occurring in the upper section of the fractured bedrock aquifer. This has increased the saturation of the regolith materials overlying the low permeability Precambrian bedrock surface.

Groundwater discharges as springs on several beaches approximately one kilometre north of the landfill footprint (Plate 10). Other springs in this area discharge at the interface between bedrock and unconsolidated overburden. Some of these springs discharge discoloured water (Plate 11).

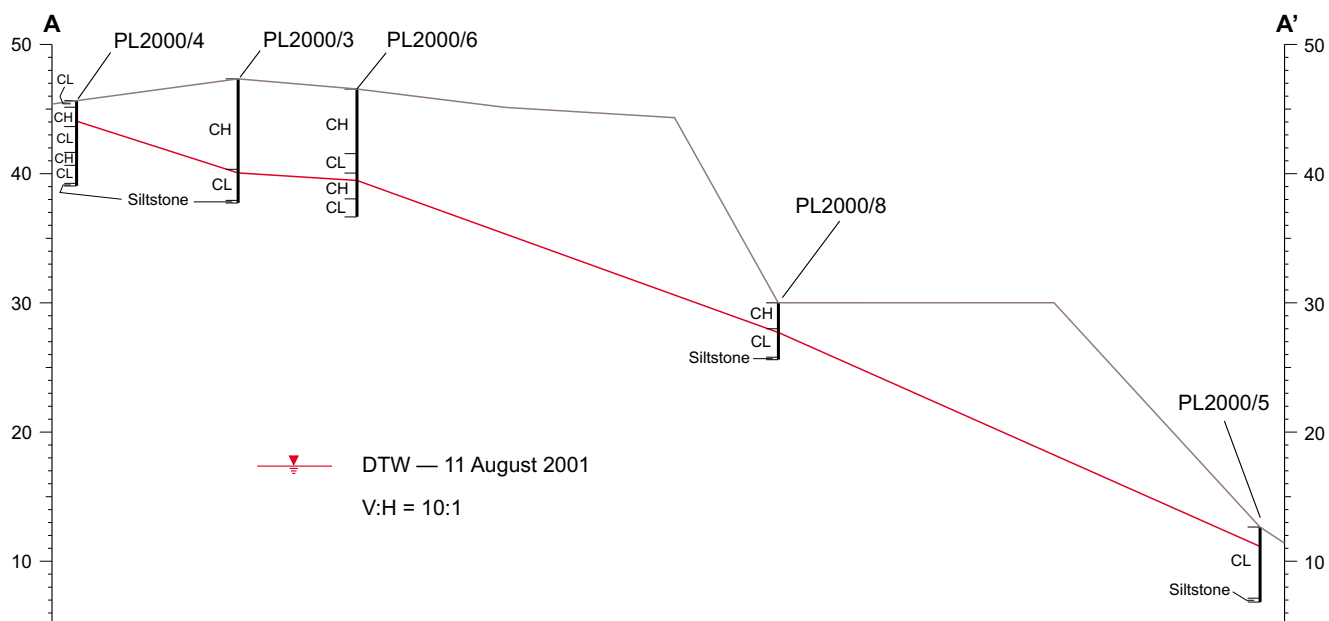
Figure 6 illustrates an interpretation of the piezometric surface based on surveyed heights and groundwater depths of the boreholes in the area of the landfill. The cross-section (fig. 5) and piezometric surface outlined in Figure 6 indicate that the water table at the base of



**Figure 4**

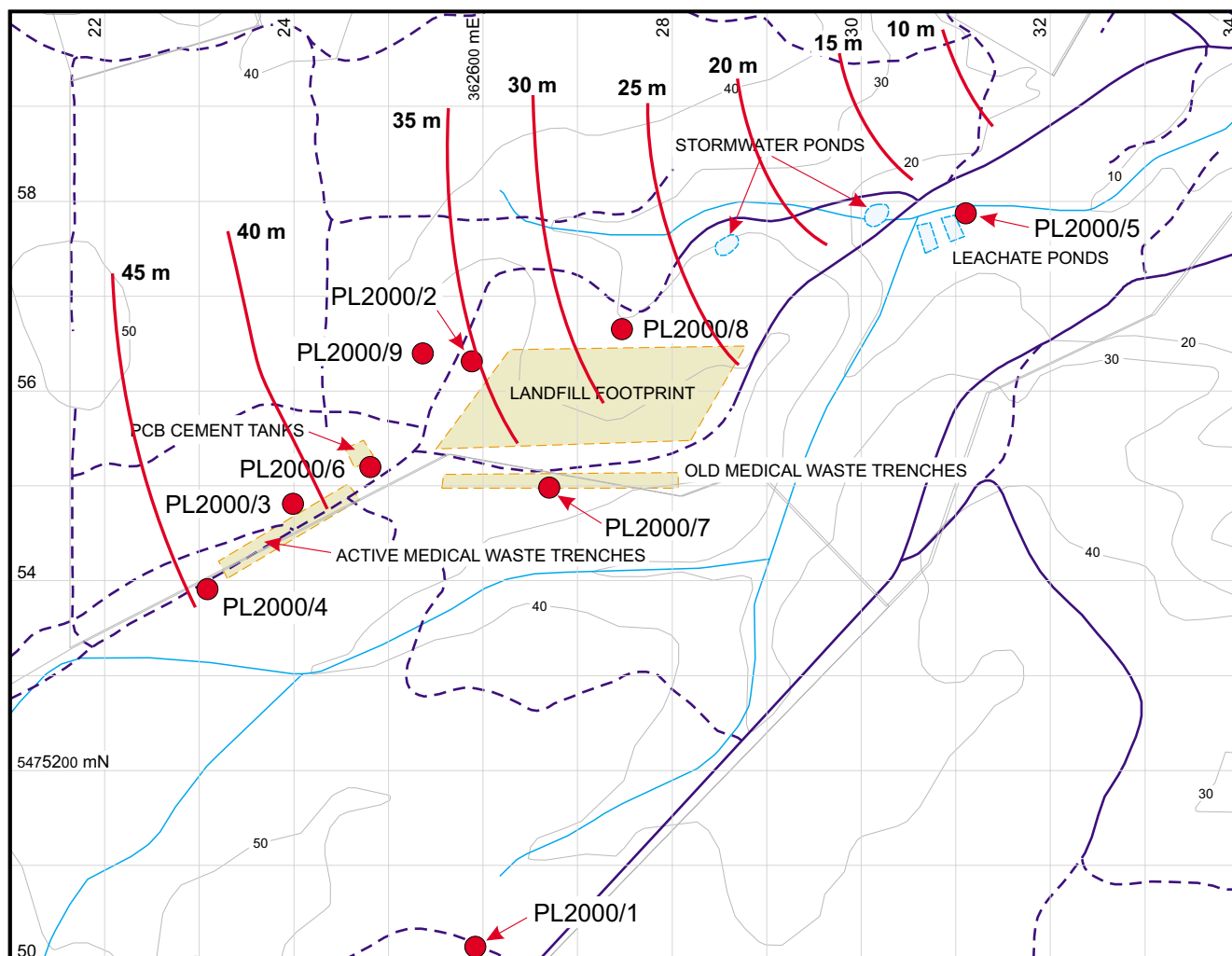
*Locations of the nine environmental monitoring bores drilled at the Port Latta waste depot.*

*Note: no casing was installed in PL2000/7.*



**Figure 5**

*Southwest to northeast cross-section of the site and related standing water levels on 11 August 2001 for boreholes PL2000/3, 4, 5, 6 and 8.*



**Figure 6**

*Interpretation of the piezometric surface based on surveyed heights and groundwater depths of the boreholes (RL water surface contours).*

the regolith profile slopes towards the coastline to the north. This is consistent with spring discharges observed on the beaches along the coastline.

The removal of the clay overburden and associated well-established vegetation (including many large trees) has promoted groundwater discharge from the interface between the regolith profile and the underlying bedrock. Inflows occur in excavations within this zone and some appear to also have a hydraulic connection to the unconfined (confined?) water within the fractured bedrock aquifer.

In summary, groundwater is perched on the bedrock interface with a deeper fractured aquifer within the bedrock itself. Groundwater flow is towards the coast line to the north of the site. Groundwater gradients appear to increase in the area of the leachate and stormwater ponds. When leachate is pumped from the leachate ponds (and irrigated over the landfill site) the water level in the stormwater ponds also decreases, implying a hydraulic connection between the two systems.

## GROUNDWATER CHEMISTRY

All cased bores were sampled on 31 October 2000 in accordance with Australian/New Zealand Standard AS/NZS 5667.11:1998. Analytical Services Tasmania, in accordance with relevant Australian and international standards, carried out laboratory testing of the groundwater samples (Appendix 2). Groundwater values for pH ranged from 5.2 to 7.2, with conductivity values ranging between 180 and 675  $\mu\text{S}/\text{cm}$ . Analytical results for groundwater samples are presented on site maps in Appendix 3. Figure 7 is an anion Ternary plot for the results of the groundwater samples, while Tables 1 and 2 compare the analytical results against international standards where a guideline/emission value is stated by the relevant standard.

Iron and manganese are elevated in the background bore. Limonite and other secondary minerals, which occur in fractures on the coastline, imply that iron and manganese are both naturally occurring within the fractured aquifer cementation processes.



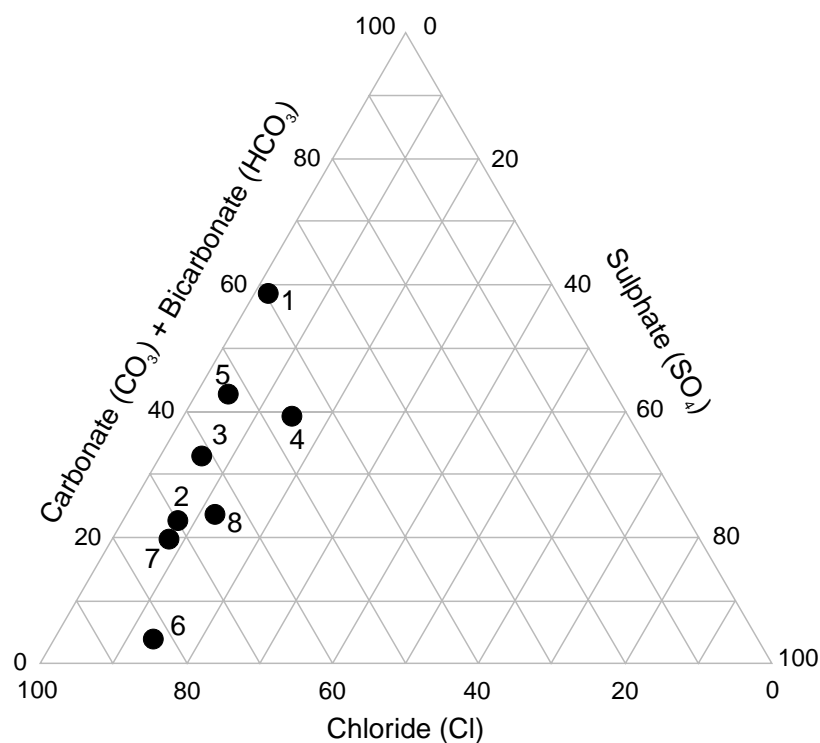
**Table 1.** Comparison of analytical results against water quality standards (guideline value listed when stated by a relevant standard). Highlighted values exceed emission limits.

Parameter	2000/1	2000/2	2000/3	2000/4	2000/5	2000/6	2000/8	2000/9	Emission limit
pH	7.2	6.6	5.9	6.0	6.3	5.2	5.6	6.1	N/A
Conductivity ( $\mu\text{S}/\text{cm}$ )	645	393	216	180	675	285	277	471	N/A: note average sea water value 36 000
TDS (mg/L)	390	243	142	110	406	161	161	280	N/A
Alkalinity $\text{CO}_3$ (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	N/A
Alkalinity $\text{HCO}_3$ (mg/L)	167	43	23	31	154	5	24	57	N/A
Chloride (mg/L)	65	76	25	21	110	63	51	90	250* (mg/L)
Fluoride (mg/L)	0.41	0.09	0.06	<0.02	0.11	<0.02	0.04	0.04	1.5* (mg/L)
Sulphate (mg/L)	3.7	11	3.1	9.1	12	14	7.2	23	250* (mg/L)
Ammonia (mg/L)	<0.002	0.008	<0.002	<0.002	0.400	0.003	<0.002	<0.002	0.5* (mg/L) nitrogen (as ammonia)
Nitrate + Nitrite (mg/L)	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.007	10.0* (mg/L) nitrogen (as nitrate or nitrite)
Nitrite (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	10.0* (mg/L) nitrogen (as nitrate or nitrite)
Ortho-P (mg/L)	0.011	0.003	<0.002	<0.002	0.003	0.002	0.003	0.005	2.0* as phosphorus
Aluminium (mg/L)	0.012	0.025	0.011	<0.010	1.370	0.036	0.031	0.752	N/A
Arsenic (mg/L)	0.006	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	0.05* (mg/L)
Cadmium (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01* (mg/L)
Cobalt (mg/L)	0.001	0.002	0.018	0.007	0.014	<0.001	<0.001	0.002	N/A
Chromium (mg/L)	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	0.5* (mg/L)
Copper (mg/L)	<0.001	0.004	<0.001	<0.001	0.041	<0.001	0.006	<0.001	1.0* (mg/L)
Iron (mg/L)	<b>4.460</b>	0.029	<0.020	0.094	<b>1.230</b>	0.020	<0.020	<b>1.590</b>	( Combined iron and manganese
Manganese (mg/L)	<b>1.980</b>	0.281	0.693	0.693	<b>0.288</b>	0.014	0.107	<b>0.133</b>	( total 1.0* (mg/L)
Nickel (mg/L)	<0.001	0.005	<0.001	0.001	0.033	0.002	0.002	0.003	0.1** (mg/L)
Lead (mg/L)	<0.005	<0.005	<0.005	<0.005	0.009	0.014	<0.005	<0.005	0.05* (mg/L)
Zinc (mg/L)	0.016	0.018	0.003	0.004	0.319	0.005	0.010	0.006	5.0* (mg/L)

\* Environment Protection (Water Pollution) Regulations 1974, emission into inland water.

\*\* Australian Water Quality Guidelines for Fresh and Marine Waters 1992.

N/A – no emission limit available.



**Figure 7**

Anion Ternary plot for groundwater bores at the Port Latta waste depot. 1 – PL2000/1; 2 – PL2000/2; 3 – PL000/3; 4 – PL2000/4; 5 – PL2000/5; 6 – PL2000/6; 7 – PL2000/8; 8 – PL2000/9.

**Table 2.** Comparison of analytical results against the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

Bore hole number (PL2000/)	PORT LATTA WASTE DEPOT								ANZECC 2000		
	1	2	3	4	5	6	8	9	IRRIGATION STV (Short-term)	LTV (Long-term)	LIVESTOCK DRINKING
Analyte											
Standing Water Level (m)	0.05	13.00	6.10	1.98	1.39	6.02	2.19	5.46			
pH – field (pH Units)	7.3	6.7	6.2	6.1	6.0	5.5	5.7	6.4	**6.0–8.5		
PH – lab (pH Units)	7.2	6.6	5.9	6.0	6.3	5.2	5.6	6.1	**6.0–8.5		
Conductivity – field (µS/cm)	578	384	201	152	570	275	251	410	(1) (Refer Tables 4.2.3 & 4.2.4)		
Conductivity – lab (µS/cm)	645	393	216	180	675	285	277	471			
TDS (mg/L)	390	243	142	110	406	161	161	280			(2) 2,000-10,000 (Refer Table 4.3.1)
Chloride (mg/L)	65	76	25	21	110	63	51	90	(3) MT (Refer Table 4.2.6) MR (Refer Table 4.2.7)		
Fluoride (mg/L)	0.41	0.09	0.06	<0.02	0.11	<0.02	0.04	0.04	4	1	
Sulphate (mg/L)	3.7	11	3.1	9.1	12	14	7.2	23			
NH <sub>3</sub> -N (mg/L)	<0.002	0.008	<0.002	<0.002	0.400	0.003	<0.002	<0.002			
(NO <sub>2</sub> + NO <sub>3</sub> )-N (mg/L)	0.005	0.005	0.005	0.005	0.005	0.005	0.004	0.007			
NO <sub>2</sub> -N (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003			
PO <sub>4</sub> -P (mg/L)	0.011	0.003	<0.002	<0.002	0.003	0.002	0.003	0.005			
Aluminium (µg/L)	12	25	11	<10	1370	36	31	752	20,000	5,000	5,000
Arsenic (µg/L)	6	<5	<5	<5	7	<5	<5	<5	2000	100	500
Cadmium (µg/L)	<1	<1	<1	<1	<1	<1	<1	<1	50	10	10
Cobalt (µg/L)	1	2	18	7	14	<1	<1	2	100	50	1,000
Chromium (µg/L)	<1	<1	<1	<1	4	<1	<1	<1	1,000***	100***	1,000
Copper (µg/L)	<1	4	<1	<1	41	<1	6	<1	5,000	200	400-5,000
Iron (µg/L)	4460	29	<20	94	1230	20	<20	1590	10,000	200	NST
Manganese (µg/L)	1980	281	693	693	288	14	107	133	10,000	200	NST
Nickel (µg/L)	<1	5	<1	1	33	2	2	3	2000	200	1,000
Lead (µg/L)	<5	<5	<5	<5	9	14	<5	<5	5,000	2,000	100
Zinc (µg/L)	16	18	3	4	319	5	10	6	5,000	2,000	20,000

Shaded areas indicate values above relevant guideline levels

Notes: \*\* set to limit potential for corrosion and fouling of pumping, irrigation and stock watering systems  
\*\*\* chromium (VI)

(1) Suitability depends on salt tolerance of crop & calculation of EC<sub>se</sub>, the average root zone salinity.  
EC<sub>se</sub> depends on soil type & average root zone leaching fraction

(2) Depending on animal type, within this salinity range may be reluctance to drink or may be some scouring but stock should adapt without loss of production.

(3) ES = Suits extremely sensitive crops

MS = Suits moderately sensitive crops, may affect sensitive crops

MT = Suits moderately tolerant crops

MR = Medium risk of increasing crop cadmium concentrations

MA = may affect crops sensitive to foliar injury through foliar absorption

STV – Short term trigger value for contaminant in irrigation water (<20 years) use

LTV – Long term trigger value for contaminant in irrigation water (100 years) use

NST – Not sufficiently toxic

## CONTAMINATION ASSESSMENT

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On the premise that PL2000/1 is the control bore, groundwater is slightly more acidic in bores at the landfill site. Conductivity, TDS, and chloride are slightly higher in bore PL2000/5 and aluminium, copper, nickel and zinc are significantly elevated compared to the control bore.

Plate 12 shows soakage observed on the north side of the leachate ponds ten metres west of borehole PL2000/5. The soakage is within ten metres of Stinking Creek, the main surface drainage outlet from the site. Other subsurface leakage from the leachate ponds could inter-react with this surface water system. Data relating to the area in close proximity to the leachate pond demonstrates that groundwater contamination has occurred at this location.

Transportation rates of contaminants within the clay material at the site are expected to be very low. The clay material would also aid in the absorption of metals concentrated within migrating water from either the fill material or any part of the leachate management infrastructure.

Transportation rates of any contaminants within the surface water system could be extremely rapid, depending on residence time for flows in the settling ponds (i.e. hydraulic retention time) and rainfall at the time. Trap efficiency of the surface drainage collection system (in particular during stormwater events) is considered critical to avoid recharge of stormwater into the waste fill materials.

As no hard rock bores exist at the site the quality of the bedrock aquifer in close proximity to the landfill remains unknown. Any contaminants that enter the fractured aquifer are expected to migrate north towards the coast.

## PRINCIPAL CONCLUSIONS

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This site is an excellent location for a regional waste facility. More efficient management procedures could include the use of natural clay liners, regular cleaning of leachate collection and recirculation infrastructure, quality controlled engineered encapsulation for some materials (i.e. medical waste) and reforestation using appropriate tree and shrub species to control erosion.

Future cells should retain two metres of *in situ* clay material over the bedrock to aid in the prevention of

groundwater discharges in the vicinity of the landfill liner and prevent leachate migration into the groundwater. Regular cleaning of the leachate collection system (to prevent calcium carbonate build ups) would also aid in preventing excessive leachate hydraulic heads developing on the landfill liner.

Where groundwater is able to directly recharge waste fill, discharges from the fill material may cause the degradation of surface and groundwater quality within the area of the activity. This site demonstrates the impact groundwater hydraulic pressure may exert on landfill material and related infrastructure. Additional engineering specifications will be required to maintain a standard of best practice environmental management. An integrated site management plan should include long-term monitoring of surface water and groundwater for quality control assessment of the developing engineering design.

## FURTHER WORK

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Long-term monitoring of groundwater quality would require the drilling of additional boreholes to monitor both groundwater within the regolith profile and the bedrock aquifer. At least one hole could be diamond drilled to assess joint density and cementation at shallow depth within the bedrock aquifer. Bedrock bores should be sited up gradient, within the landfill area, and down gradient of the site. The up-gradient bore may need to be drilled to approximately 70 m to allow for pump testing to gain an understanding of the hydraulic setting within the bedrock aquifer.

Test pitting across the site and the production of related isopach maps would aid in the future management and maximum potential use of clay resources at this site.

## REFERENCES

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- DEARMAN, W. R.; FOOKES, P. G. 1974. Engineering geological mapping for civil engineering practice in the United Kingdom. *Quarterly Journal of Engineering Geology* 7:223-256.
- LENNOX, P. G.; CORBETT, K. D.; BAILLIE, P. W.; CORBETT, E. B.; BROWN, A. V. 1982. *Geological Atlas 1:50 000 Series. Sheet 21 (7916S). Smithton.* Department of Mines Tasmania.

[30 May 2002]





**Plate 1**

*Discharge point of one of the sub-liners to the surface water system.*



**Plate 2**

*Cement tanks used to store soil contaminated by polychlorinated biphenyls (PCB's).*



**Plate 3**

*Active medical waste trench in southern area of the site.*





**Plate 4**

*Cracking in the clay and related slumping above a recent medical waste trench.*



**Plate 5**

*Palaeochannel located within the weathered Cowrie Siltstone exposed in the northern wall of the Stage 2 filling area.*



**Plate 6**

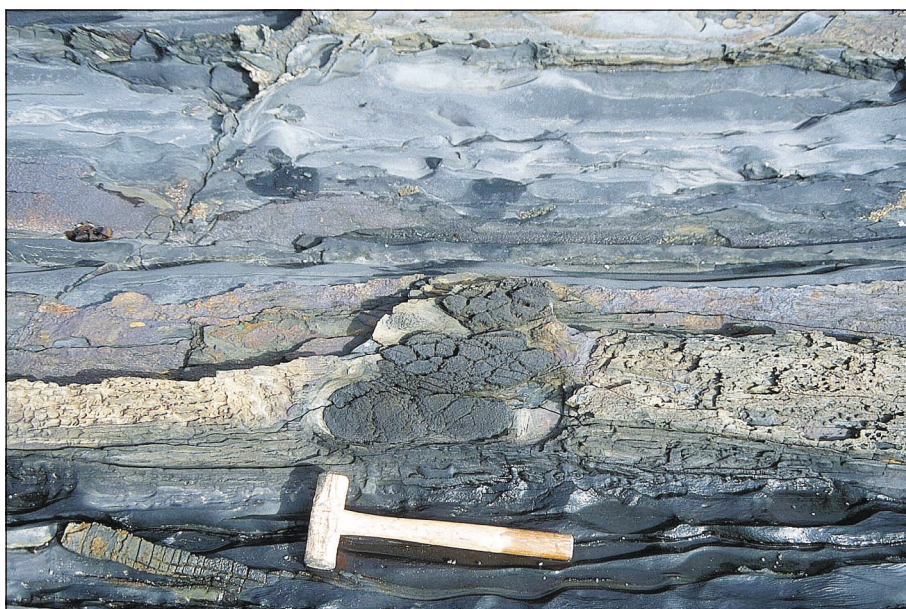
*Precambrian Cowrie Siltstone bedrock exposed on the western end of the Stage 2 filling area.*





**Plate 7**

*Tight axial hinge fold in the Precambrian Cowrie Siltstone coastal outcrops.*



**Plate 8**

*Pyrite pods in the Precambrian Cowrie Siltstone coastal outcrops.*



**Plate 9**

*Limonite on jointing within the heavily fractured Precambrian Cowrie Siltstone in the coastal outcrops.*





**Plate 10**

*One of many springs discharging on beaches approximately one kilometre to the north of the landfill footprint.*



**Plate 11**

*Spring discharging at the bedrock interface with unconsolidated overburden approximately one kilometre to the north of the landfill footprint. Note discolouration of water.*



**Plate 12**

*Soakage observed on the north side of the leachate ponds 10 metres west of bore hole PL2000/5.*

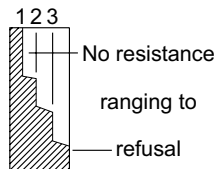
## Appendix 1

### Engineering logs of boreholes

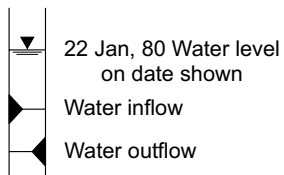
#### EXPLANATION SHEET FOR ENGINEERING LOGS

##### Borehole and excavation log

###### Penetration



###### Water



###### Notes — samples and tests

U50	Undisturbed sample 50 mm diameter
D	Disturbed sample
N	Standard penetrometer blow count for 300 mm
N*	SPT + Sample

###### Material classification

Based on Unified Soil Classification System.  
In Graphic Log materials are represented by clear contrasting symbols consistent for each project.

###### Moisture content

D	Dry, looks and feels dry
M	Moist, no free water on hand when remoulding
W	Wet, free water on hand when remoulding
LL	Liquid limit
PL	Plastic limit
PI	Plasticity index
e.g. M>PL — Moist, moisture content greater than the plastic limit	

###### Consistency

		: hand penetrometer
VS	Very soft	<25 (kPa)
S	Soft	25 – 50
F	Firm	50 – 100
St	Stiff	100 – 200
VSt	Very stiff	200 – 400
H	Hard	>400
Fb	Friable	

Notes: X on log is test result  
— is range of results

###### Density index

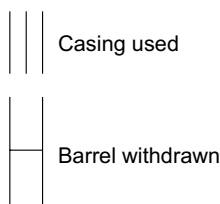
		%
VL	Very loose	0 – 15
L	Loose	15 – 35
MD	Medium dense	35 – 65
D	Dense	65 – 85
VD	Very dense	85 – 100

###### Fracture description

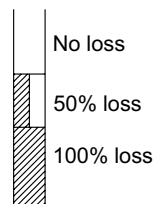
RP	Rough planar
RL	Rough irregular
SP	Smooth planar
SL	Smooth irregular

#### Cored borehole log

###### Case - lift



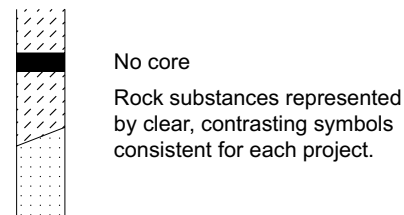
###### Fluid loss



###### Lugeons

Lugeon units (uL) are a measure of rock mass permeability. For a 46 to 74 mm diameter borehole 1 Lugeon is defined as a rate of loss of 1 litre per metre per minute. 1 Lugeon is roughly equivalent to a permeability of  $1 \times 10^{-4}$  mm / sec.

###### Graphic log



###### Weathering

Fr	Fresh
SW	Slightly weathered
HW	Highly weathered
EW	Extremely weathered

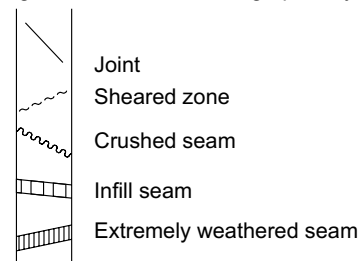
###### Strength

		point load strength index 1.5 (50) (MPa)
EL	Extremely low	< 0.03
VL	Very low	0.03 – 0.1
L	Low	0.1 – 0.3
M	Medium	0.3 – 1
H	High	1 – 3
VH	Very high	3 – 10
EH	Extremely high	>10

Notes: X on log is test result.

###### Significant defects

Significant defects shown graphically





# ENGINEERING LOG - BOREHOLE

Borehole no. **PL2000/1**  
Sheet **1** of **2**

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362592 mE 5475014 mN		Drill type		Auger		Hole commenced		22 August 2000	
				Drill method		Rotary		Hole completed		22 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing		-						Checked by		Mr Adrian Waite	

penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
1 2 3										
		Cement	D Sample ID 1			CH	CLAY - high plasticity, light brown-grey	M	F	Tertiary clay overburden
		Bentonite	D Sample ID 2	0.5		CH	CLAY - high plasticity, light grey	M	S	Tertiary clay overburden
			D Sample ID 3	1.0		CH	CLAY - high plasticity, light grey-green	D	S L	Tertiary clay overburden
			D Sample ID 4	1.5		CH	CLAY - high plasticity, light grey	D	S L	Tertiary clay overburden
			D Sample ID 5	2.0		CH	CLAY - high plasticity, light grey-green	D	S L	Tertiary clay overburden
		7 mm Gravel	D Sample ID 6	2.5		CH	CLAY - high plasticity, light grey	D	S L	Tertiary clay overburden
			D Sample ID 7	3.0		CH	CLAY - high plasticity, yellow, siltstone chips	D	S L	Tertiary clay overburden
			D Sample ID 8	3.5		CH	CLAY - high plasticity, dark brown, 3% siltstone and mudstone chips	M	F	Tertiary clay overburden
		1.5 metre N.R.F.S. Screen	D Sample ID 9	4.0		CH	CLAY - high plasticity, yellow-brown	W	VL	Tertiary clay overburden
				4.5						
	NS						* Nylon Rock Fabric Sock			



**ENGINEERING LOG - BOREHOLE**
 Borehole no.  
**PL2000/1**  
 Sheet 2 of 2

Project		Port Latta waste depot			Location		Brickmakers Plain, Port Latta		
Co-ordinates		55 362592 mE 5475014 mN			Drill type		Auger		
					Drill method		Rotary		
R.L.					Drill fluid		Nil		
Inclination		Vertical			Hole commenced		22 August 2000		
Bearing					Hole completed		22 August 2000		
					Drilled by		Mr Shane Heawood		
					Logged by		Mr Andrew Ezzy		
					Checked by		Mr Adrian Waite		

penetration 1 2 3	support water	notes samples, tests	metres		graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
			R.L.	depth						
				5.5						
	Back in fill	D Sample ID 10								
	Back in fill	D Sample ID 11		6.0			SILTSTONE - dark grey	W		Bedrock - Precambrian Cowrie Siltstone
		Sample ID numbers refer to samples stored in MRT core shed					End of hole due to auger refusal at 6.2 m			

## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/2  
Sheet 1 of 3

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362588 mE 5475631 mN		Drill type		Auger		Hole commenced		22August 2000	
				Drill method		Rotary		Hole completed		22 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support		water		notes		metres			
1 2 3						samples, tests		R.L.		depth	
						graphic log		classification		symbol	
								material			
								soil type: plasticity or particle characteristics, colour, secondary and minor components.			
								moisture		condition	
								consistency		density index	
										structure, geology	

## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/2  
Sheet 2 of 3

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta													
Co-ordinates		55 362588 mE 5475631 mN				Drill type		Auger		Hole commenced		22August 2000									
						Drill method		Rotary		Hole completed		22 August 2000									
R.L.						Drill fluid		Nil		Drilled by		Mr Shane Heawood									
Inclination		Vertical								Logged by		Mr Andrew Ezzy									
Bearing										Checked by		Mr Adrian Waite									
penetration		support		water		notes		metres		graphic log		classification		material		moisture		consistency		structure, geology	
1 2 3						samples, tests		R.L.		depth		symbol		soil type: plasticity or particle characteristics, colour, secondary and minor components.		condition		density index			
						D Sample ID 11				5.5		CH		CLAY - high plasticity, red, clay grey mottles		M		L		Tertiary clay overburden	
						D Sample ID 12				6.0		CH		CLAY - high plasticity, red, 20% clay grey mottles		M		L		Tertiary clay overburden	
						D Sample ID 13				6.5		CL		CLAY - medium plasticity, red, siltstone fragments		M		L		Tertiary clay overburden	
						D Sample ID 14				7.0		CL		CLAY - medium plasticity, brown, siltstone fragments		M		S		Tertiary clay overburden	
						D Sample ID 15				7.5		CH		CLAY - high plasticity, red, orange siltstone fragments		M		S		Tertiary clay overburden	
						D Sample ID 16				8.0											
						D Sample ID 17				8.5											
						D Sample ID 18				9.0		CH		CLAY - high plasticity, red- yellow, various coloured siltstone fragments		M		S L		Tertiary clay overburden	
						D Sample ID 19				9.5		CH		CLAY - high plasticity, brown		M		S L		Tertiary clay overburden	
						D Sample ID 20															

## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/2  
Sheet 3 of 3

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362588 mE 5475631 mN		Drill type		Auger		Hole commenced		22 August 2000	
				Drill method		Rotary		Hole completed		22 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support		water		notes		metres		structure, geology	
1 2 3						samples, tests		R.L. depth		graphical log	
								classification symbol		material	
								soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	
										consistency density index	



## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/3  
Sheet 1 of 2

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362399 mE 5475481 mN		Drill type		Auger		Hole commenced		22August 2000	
				Drill method		Rotary		Hole completed		23 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology
1 2 3				samples, tests	R.L. depth		symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	
			Cement	D Sample ID 1	0.5		CH	CLAY - high plasticity, red- brown	M	St D	Tertiary clay overburden
			Bentonite	D Sample ID 2							
				D Sample ID 3	1.0		CH	CLAY - high plasticity, light red, clay light grey mottles	M	St D	Tertiary clay overburden
				D Sample ID 4	1.5		CH	CLAY - high plasticity, light grey, clay orange mottles	D	S L	Tertiary clay overburden
				D Sample ID 5	2.0		CH	CLAY - high plasticity, white	D	S L	Tertiary clay overburden
				D Sample ID 6	2.5		CH	CLAY - high plasticity, light red, 30% clay white mottles	D	S L	Tertiary clay overburden
				D Sample ID 7	3.0		CH	CLAY - high plasticity, light red, 5% clay white mottles	D	S L	Tertiary clay overburden
				D Sample ID 8	3.5		CH	CLAY - high plasticity, red, 5% clay light brown mottles	D	S L	Tertiary clay overburden
				D Sample ID 9	4.0		CH	CLAY - high plasticity, light red, 5% clay white mottles	D	S L	Tertiary clay overburden
					4.5						

## ENGINEERING LOG - BOREHOLE

 Borehole no.  
**PL2000/3**  
 Sheet 2 of 2

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362399 mE 5475481 mN		Drill type		Auger		Hole commenced		22 August 2000	
				Drill method		Rotary		Hole completed		23 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support		water		notes		metres		material	
1 2 3						samples, tests		R.L.		soil type: plasticity or particle characteristics, colour, secondary and minor components.	
						depth		graphic log		classification symbol	
										moisture condition	
										consistency density index	
										structure, geology	

## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/4  
Sheet 1 of 2

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362309 mE 5475391 mN		Drill type		Auger		Hole commenced		23August 2000	
				Drill method		Rotary		Hole completed		23 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support	water	notes	metres			material			
1 2 3				samples, tests	R.L.	depth	graphic log	classification symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index
			Cement	D Sample ID 1				CL	CLAY - black-brown	M	F
			Bentonite	D Sample ID 2	0.5			CH	CLAY - high plasticity, light red	M	F
				D Sample ID 3	1.0			CH	CLAY - high plasticity, red-yellow, 40% clay grey mottles	D	L
				D Sample ID 4	1.5						
				D Sample ID 5	2.0			CL	CLAY - medium plasticity, red-yellow, 20% clay grey mottles, strong sulphide odour in returns	D	L
				D Sample ID 6	2.5			CL	CLAY - medium plasticity, yellow, clay 10% grey and 5% red mottles	D	L
				D Sample ID 7	3.0			CL	CLAY - medium plasticity, light red, siltstone fragments	D	L
				D Sample ID 8	3.5						
				D Sample ID 9	4.0			CH	CLAY - high plasticity, light red, clay 5% white mottles and 10% siltstone fragments	D	L
				D Sample ID 10	4.5			CH	CLAY - high plasticity, light red, siltstone chips	M	F

## ENGINEERING LOG - BOREHOLE

 Borehole no.  
**PL2000/4**  
 Sheet 2 of 2

Project			Port Latta waste depot			Location			Brickmakers Plain, Port Latta																											
Co-ordinates			55 362309 mE 5475391 mN			Drill type			Auger																											
						Drill method			Rotary																											
R.L.						Drill fluid			Nil																											
Inclination			Vertical			Hole commenced			22 August 2000																											
Bearing						Hole completed			23 August 2000																											
						Drilled by			Mr Shane Heawood																											
						Logged by			Mr Andrew Ezzy																											
						Checked by			Mr Adrian Waite																											
<table><tr><td rowspan="2">penetration</td><td rowspan="2">support</td><td rowspan="2">water</td><td rowspan="2">notes samples, tests</td><td colspan="2">metres</td><td rowspan="2">graphic log</td><td rowspan="2">classification symbol</td><td rowspan="2">material  soil type: plasticity or particle characteristics, colour, secondary and minor components.</td><td rowspan="2">moisture condition</td><td rowspan="2">consistency density index</td><td rowspan="2">structure, geology</td></tr><tr><td>R.L.</td><td>depth</td></tr><tr><td>1</td><td>2</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>											penetration	support	water	notes samples, tests	metres		graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology	R.L.	depth	1	2	3									
penetration	support	water	notes samples, tests	metres		graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index					structure, geology																					
				R.L.	depth																															
1	2	3																																		
			D Sample ID 11																																	
			D Sample ID 12			5.5	CL	CLAY - medium plasticity, light red, siltstone and mudstone	W	F	Clay overburden transitional zone to Cowrie Siltstone bedrock																									
			D Sample ID 13			6.0																														
			D Sample ID 14			6.5	CL	CLAY - low plasticity, black	M	F	Weathered Cowrie Siltstone																									
								SILTSTONE - various colours, mudstone chips			Cowrie Siltstone bedrock																									
			Sample ID numbers refer to samples stored in MRT core shed					End of hole due to auger refusal at 6.6 m																												



## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/5  
Sheet 1 of 2

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta				
Co-ordinates		55 363111 mE 5475787 mN		Drill type		Auger		Hole commenced		23August 2000		
				Drill method		Rotary		Hole completed		23 August 2000		
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood		
Inclination		Vertical						Logged by		Mr Andrew Ezzy		
Bearing								Checked by		Mr Adrian Waite		
penetration	support	water	notes samples, tests	metres		graphic log	classification symbol	material  soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology	
				R.L.	depth							
1	2	3										
			Cement	D Sample ID 1			CL	CLAY - medium plasticity, grey, siltstone fragments - cover material	M	F	Tertiary clay overburden	
			Bentonite	D Sample ID 2	0.5		CL	CLAY - medium plasticity, yellow, siltstone fragments - cover material	M	F	Tertiary clay overburden	
			No screen	D Sample ID 3	1.0		CL	CLAY - medium plasticity, black, humic, quartz pebbles	M	S	Tertiary clay overburden	
				D Sample ID 4	1.5							
				D Sample ID 5	2.0		CL	CLAY - medium plasticity, light grey, mudstone grey fragments	D	S VL	Tertiary clay overburden	
			7 mm Gravel	D Sample ID 6	2.5		CL	CLAY - medium plasticity, dark grey, 5% clay brown mottles	D	S L	Tertiary clay overburden	
			3 metre N.R.F.S. Screen with 4 x 150mm spaced 5mm holes	D Sample ID 7	3.0		CL	CLAY - medium plasticity, dark grey, mudstone dark grey fragments	D	S L	Tertiary clay overburden	
				D Sample ID 8	3.5							
				D Sample ID 9	4.0		CL	CLAY - medium plasticity, dark grey, mudstone dark grey fragments	D	S L	Tertiary clay overburden	
				D Sample ID 10	4.5							

**ENGINEERING LOG - BOREHOLE**
 Borehole no.  
**PL2000/5**  
 Sheet 2 of 2

Project		Port Latta waste depot			Location		Brickmakers Plain, Port Latta				
Co-ordinates		55 363111 mE 5475787 mN		Drill type		Auger		Hole commenced		22 August 2000	
				Drill method		Rotary		Hole completed		23 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	

penetration 1 2 3	support water	notes samples, tests	metres		graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	structure, geology
			R.L.	depth						
		D Sample ID 11, 12 & 13								
	7 mm Gravel									
	No screen	D Sample ID 14		5.5		CL	CLAY - medium plasticity, dark grey	M	F	Tertiary clay overburden
							SILTSTONE - dark grey			Cowrie Siltstone bedrock
		Sample ID numbers refer to samples stored in MRT core shed					End of hole due to auger refusal at 5.75 m.			

## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/6  
Sheet 1 of 2

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta					
Co-ordinates		55 362481 mE 5475520 mN				Drill type		Auger		Hole commenced		23August 2000	
						Drill method		Rotary		Hole completed		24 August 2000	
R.L.						Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical								Logged by		Mr Andrew Ezzy	
Bearing										Checked by		Mr Adrian Waite	
penetration		support	water	notes	metres			classification		material	moisture	consistency	structure, geology
1 2 3				samples, tests	R.L. depth		graphic log	symbol		soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	
			Cement	D Sample ID 1	0.5			CH		CLAY - high plasticity, red-brown, clay various coloured mottles - cover material	M	F	Tertiary clay overburden
			Bentonite	D Sample ID 2									
				D Sample ID 3	1.0			CH		CLAY - high plasticity, brown, clay various coloured mottles	M	F	Tertiary clay overburden
				D Sample ID 4	1.5								
				D Sample ID 5	2.0								
			7 mm Gravel	D Sample ID 6	2.5			CH		CLAY - high plasticity, light red, 30% clay light grey mottles	D	S L	Tertiary clay overburden
				D Sample ID 7	3.0			CH		CLAY - high plasticity, light red, 20% clay white mottles	D	S L	Tertiary clay overburden
				D Sample ID 8	3.5			CH		CLAY - high plasticity, light red	D	S L	Tertiary clay overburden
				D Sample ID 9	4.0			CH		CLAY - high plasticity, light red, siltstone light red fragments	D	S L	Tertiary clay overburden
				D Sample ID 10	4.5			CH		CLAY - high plasticity, yellow, 5% clay brown mottles and siltstone fragments	D	S L	Tertiary clay overburden

## ENGINEERING LOG - BOREHOLE

 Borehole no.  
**PL2000/6**  
 Sheet 2 of 2

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362481 mE 5475520 mN		Drill type		Auger		Hole commenced		23 August 2000	
				Drill method		Rotary		Hole completed		24 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration		support		water		notes		metres		structure, geology	
1 2 3						samples, tests		R.L. depth		classification symbol	
								material		moisture condition	
								soil type: plasticity or particle characteristics, colour, secondary and minor components.		consistency density index	



## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/7  
Sheet 1 of 1

Project			Port Latta waste depot			Location			Brickmakers Plain, Port Latta																										
Co-ordinates			55 362670 mE 5475498 mN			Drill type			Auger																										
						Drill method			Rotary																										
R.L.						Drill fluid			Nil																										
Inclination			Vertical			Hole commenced			24 August 2000																										
Bearing						Hole completed			24 August 2000																										
						Drilled by			Mr Shane Heawood																										
						Logged by			Mr Andrew Ezzy																										
						Checked by			Mr Adrian Waite																										
penetration			support			water			notes			metres			graphic log			classification			material			moisture			consistency			structure, geology					
1 2 3									samples, tests			R.L.			depth									soil type: plasticity or particle characteristics, colour, secondary and minor components.			condition			density index					
						Bentonite			D Sample ID 1			0.5						CH			CLAY - high plasticity, light red, siltstone fragments			M			F			Cover material - made					
									D Sample ID 2			1.0						CH			CLAY - high plasticity, light red, 10% clay various coloured mottles			M			F			Cover material - made					
									D Sample ID 3			1.5																							
									D Sample ID 4			2.0						CH			CLAY - high plasticity, white			M			F			Cover material - made					
									D Sample ID 5			2.5									WASTE fill - medical waste, clay green									Medical waste					
									D Sample ID 6			3.0																							
									Sample ID numbers refer to samples stored in MRT core shed												End of hole at 3.0 m														

## ENGINEERING LOG - BOREHOLE

 Borehole no.  
**PL2000/8**  
 Sheet 1 of 1

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta					
Co-ordinates		55 362747 mE 5475665 mN		Drill type		Auger		Hole commenced		24 August 2000			
				Drill method		Rotary		Hole completed		24 August 2000			
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood			
Inclination		Vertical						Logged by		Mr Andrew Ezzy			
Bearing								Checked by		Mr Adrian Waite			
penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	structure, geology			
1	2	3	samples, tests	R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index				
		Cement	D Sample ID 1	0.5		CH	CLAY - high plasticity, light red, siltstone fragments	M	F	Tertiary clay overburden			
		Bentonite	D Sample ID 2										
		No screen	D Sample ID 3			1.0	CH	CLAY - high plasticity, light red, 10% clay various coloured mottles	M	F	Tertiary clay overburden		
		7 mm Gravel	D Sample ID 4	1.5	CH	CLAY - high plasticity, mottled light red and grey, black siltstone fragments	M	F	Clay overburden transitional zone to Cowrie Siltstone bedrock				
			D Sample ID 5	2.0	CL	CLAY - low plasticity, black, 10% black siltstone and 5% quartz fragments	M	F	Clay overburden transitional zone to Cowrie Siltstone bedrock				
			D Sample ID 6	2.5	CL	CLAY - medium plasticity, dark grey, 10% siltstone dark grey fragments	D	S L	Clay overburden transitional zone to Cowrie Siltstone bedrock				
			D Sample ID 7	3.0									
			D Sample ID 8	3.5	CL	CLAY - low plasticity, black, 10% siltstone fragments	M	S L	Clay overburden transitional zone to Cowrie Siltstone bedrock				
			No screen	D Sample ID 9 & 10	4.0	CL	CLAY - medium plasticity, mottled grey and yellow	M	F				
						SILTSTONE - Various colours			Cowrie Siltstone				
		Sample ID numbers refer to samples stored in MRT core shed						End of hole due to auger refusal at 4.3 m.					
								* Nylon Rock Fabric Sock					

## ENGINEERING LOG - BOREHOLE

Borehole no.  
PL2000/9  
Sheet 1 of 3

Project		Port Latta waste depot				Location		Brickmakers Plain, Port Latta			
Co-ordinates		55 362536 mE 5475640 mN		Drill type		Auger		Hole commenced		22August 2000	
				Drill method		Rotary		Hole completed		22 August 2000	
R.L.				Drill fluid		Nil		Drilled by		Mr Shane Heawood	
Inclination		Vertical						Logged by		Mr Andrew Ezzy	
Bearing								Checked by		Mr Adrian Waite	
penetration	support	water	notes	metres			material				
1	2	3	samples, tests	R.L.	depth	graphic log	soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency	density index	structure, geology
			D Sample ID 1			CH	CLAY - high plasticity, light red, 10% siltstone fragments	M	F	D	Tertiary clay overburden
			D Sample ID 2		0.5	CH	CLAY - high plasticity, light red, 10% clay white mottles	M	F		Tertiary clay overburden
			D Sample ID 3		1.0	CH	CLAY - high plasticity, light red and grey	M	F		Tertiary clay overburden
			D Sample ID 4		1.5	CH	CLAY - high plasticity, light grey	D	F		Tertiary clay overburden
			D Sample ID 5		2.0	CH	CLAY - high plasticity, red-orange, 30% clay mottles various colours	D	S		Tertiary clay overburden
			D Sample ID 6		2.5	CH	CLAY - high plasticity, light red, 15% clay mottles various colours	D	S		Tertiary clay overburden
			D Sample ID 7		3.0	CH	CLAY - high plasticity, light red-brown, 10% clay mottles white	D	S		Tertiary clay overburden
			D Sample ID 8		3.5	CH	CLAY - high plasticity, light red, 10% clay mottles white	D	S		Tertiary clay overburden
			D Sample ID 9		4.0	CH	CLAY -high plasticity, red-brown, 5% clay mottles various colours	D	F		Tertiary clay overburden
			D Sample ID 10		4.5	CH	CLAY - high plasticity, light red, 5% siltstone various coloured fragments	D	S		Tertiary clay overburden



## ENGINEERING LOG - BOREHOLE

Borehole no. **PL2000/9**  
 Sheet 2 of 3

Project				Port Latta waste depot				Location				Brickmakers Plain, Port Latta									
Co-ordinates				55 362536 mE 5475640 mN				Drill type				Auger									
								Drill method				Rotary									
R.L.								Drill fluid				Nil									
Inclination				Vertical				Hole commenced				24August 2000									
Bearing								Hole completed				24 August 2000									
								Drilled by				Mr Shane Heawood									
								Logged by				Mr Andrew Ezzy									
								Checked by				Mr Adrian Waite									
penetration		support		water		notes		metres		graphic log		classification		material		moisture		consistency		structure, geology	
1 2 3						samples, tests		R.L. depth				symbol		soil type: plasticity or particle characteristics, colour, secondary and minor components.		condition		density index			
						D Sample ID 11		5.5				CH		CLAY - high plasticity, light brown and red, 5% clay mottles various colours		D		S		Tertiary clay overburden	
						D Sample ID 12		6.0													
						D Sample ID 13		6.5				CH		CLAY - high plasticity, light brown, siltstone various coloured fragments		D		S		Tertiary clay overburden	
						D Sample ID 14		7.0				CH		CLAY - high plasticity, light brown, 10% clay mottles yellow		D		S		Tertiary clay overburden	
						D Sample ID 15		7.5				CH		CLAY - high plasticity, light red		D		S		Tertiary clay overburden	
						D Sample ID 16		8.0				CH		CLAY - high plasticity, green-grey, green-yellow and brown		D		S		Tertiary clay overburden	
						D Sample ID 17		8.5				CH		CLAY - high plasticity, yellow and green-grey, 5% siltstone grey fragments		M		S		Clay overburden transitional zone to Cowrie Siltstone bedrock	
						D Sample ID 18		9.0				CL		CLAY - medium plasticity, grey and green-brown, siltstone yellow and grey inter banded (1mm) fragments		D		S		Clay overburden transitional zone to Cowrie Siltstone bedrock	
						D Sample ID 19		9.5				CL		CLAY - low plasticity, mottled various colours, siltstone chips		M		F		Clay overburden transitional zone to Cowrie Siltstone bedrock	
						D Sample ID 20								* Nylon Rock Fabric Sock							

[illegible]

## Appendix 2

### Analytical Services Tasmania — laboratory reports



#### ANALYTICAL SERVICES TASMANIA

Sandy Bay Laboratory

c/- Chemistry Department University of Tasmania

Sandy Bay Tasmania 7005

Telephone: (03) 6226 7175 Fax: (03) 6226 7825

Email: ast.sandybay@dpiwe.tas.gov.au



NATA Accreditation  
Number: 5589

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#### Laboratory Report

**Report No:** 13772 *Please quote this number when making enquiries about this report*  
**Submitted By:** Andrew Ezzy  
**Client:** Mineral Resources Tasmania  
**Site Description:** Port Latta Waste Depot  
**Received:** 03-Nov-00 **Client Order No:**  
**Report Date:** 01-Dec-00  
**Report To:** Andrew Ezzy  
**Address:** Gordons Hill Rd Rosny TAS 7018

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#### Test Method(s) :

1001-Water:	pH in Water by APHA Method 4500-H
1002-Water:	Conductivity by APHA Method 2510
1004-Water:	Solids, Total Dissolved by APHA Method 2540C
1101-Water:	Alkalinity by APHA Method 2320/4500-CO2
1103-Water:	Anions by Ion Chromatography APHA Method 4110C
1201-Water:	Nutrients by APHA Method 4500
1301-Water:	Metals in Water by APHA Method 3030/3120



NATA endorsed test report.  
This document shall not be reproduced, except in full.  
Samples analysed as received.

NATA Accreditation Number: 5589

  
Mike Johnson  
Manager

Page 1 of 3

Report No: 13772

Report Date: 01-Dec-00

Method	Analyte	Units / Sampled On :	Lab.No.: 13081	13082	13083	13084
			Sample Id.: PL 2000/1	PL 2000/2	PL 2000/3	PL 2000/4
			31/10/00 14:50	31/10/00 12:50	31/10/00 14:35	31/10/00 15:20
1001-Water	pH		7.2	6.6	5.9	6.0
1002-Water	Conductivity	µS/cm	645	393	216	180
1004-Water	TDS	mg/L	390	243	142	110
1101-Water	Alkalinity CO3	mg/L CaCO3	<1	<1	<1	<1
	Alkalinity HCO3	mg/L CaCO3	167	43	23	31
1103-Water	Chloride	mg/L	65	76	25	21
	Fluoride	mg/L	0.41	0.09	0.06	<0.02
	Sulphate	mg/L	3.7	11	3.1	9.1
1201-Water	Ammonia	µg-N/L	<2	8	<2	<2
	Nitrate+Nitrite	µg-N/L	5	5	5	5
	Nitrite	µg-N/L	<2	<2	<2	<2
	Ortho-P	µg-P/L	11	3	<2	<2
1301-Water	Al (Dissolved)	µg/L	12	25	11	<10
	As (Dissolved)	µg/L	6	<5	<5	<5
	Cd (Dissolved)	µg/L	<1	<1	<1	<1
	Co (Dissolved)	µg/L	1	2	18	7
	Cr (Dissolved)	µg/L	<1	<1	<1	<1
	Cu (Dissolved)	µg/L	<1	4	<1	<1
	Fe (Dissolved)	µg/L	4460	29	<20	94
	Mn (Dissolved)	µg/L	1980	281	693	693
	Ni (Dissolved)	µg/L	<1	5	<1	1
	Pb (Dissolved)	µg/L	<5	<5	<5	<5
	Zn (Dissolved)	µg/L	16	18	3	4

Report No: 13772

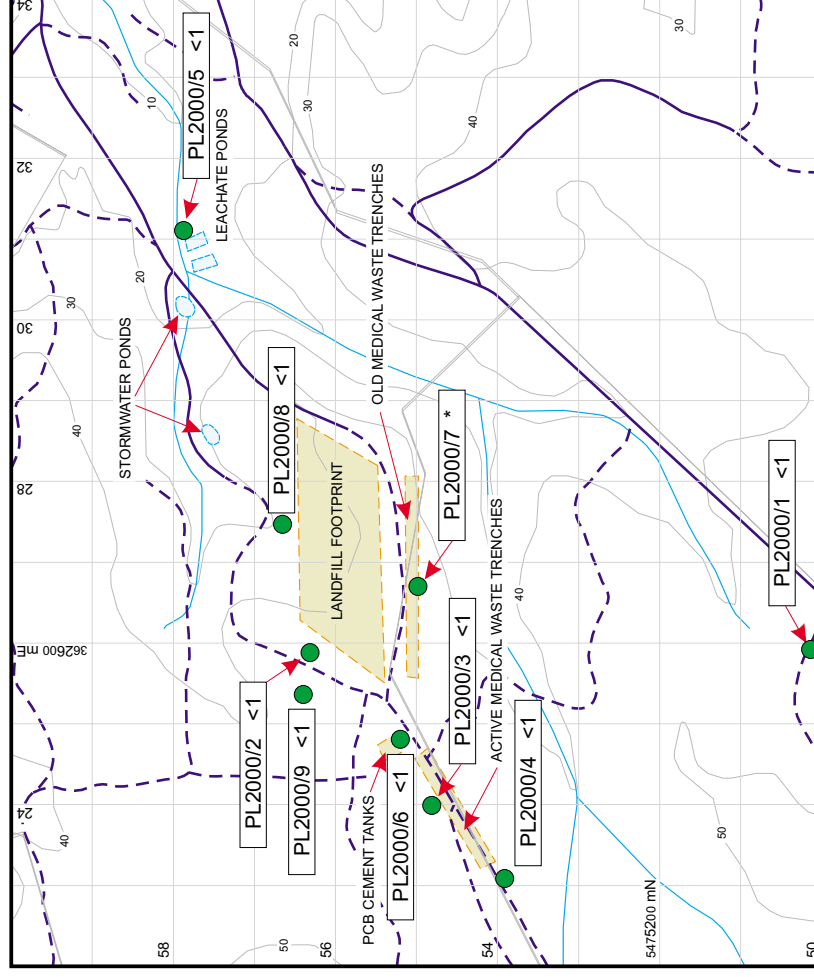
Report Date: 01-Dec-00

Method	Analyte	Units / Sampled On :	Lab.No.: 13085	13086	13087	13088
			Sample Id.: PL 2000/5	PL 2000/6	PL 2000/8	PL 2000/9
			31/10/00 11:10	31/10/00 14:20	31/10/00 11:50	31/10/00 13:45
1001-Water	pH		6.3	5.2	5.6	6.1
1002-Water	Conductivity	µS/cm	675	285	277	471
1004-Water	TDS	mg/L	406	161	161	280
1101-Water	Alkalinity CO3	mg/L CaCO3	<1	<1	<1	<1
	Alkalinity HCO3	mg/L CaCO3	154	5	24	57
1103-Water	Chloride	mg/L	110	63	51	90
	Fluoride	mg/L	0.11	<0.02	0.04	0.04
	Sulphate	mg/L	12	14	7.2	23
1201-Water	Ammonia	µg-N/L	400	3	<2	<2
	Nitrate+Nitrite	µg-N/L	5	5	4	7
	Nitrite	µg-N/L	<2	<2	<2	3
	Ortho-P	µg-P/L	3	2	3	5
1301-Water	Al (Dissolved)	µg/L	1370	36	31	752
	As (Dissolved)	µg/L	7	<5	<5	<5
	Cd (Dissolved)	µg/L	<1	<1	<1	<1
	Co (Dissolved)	µg/L	14	<1	<1	2
	Cr (Dissolved)	µg/L	4	<1	<1	<1
	Cu (Dissolved)	µg/L	41	<1	6	<1
	Fe (Dissolved)	µg/L	1230	20	<20	1590
	Mn (Dissolved)	µg/L	288	14	107	133
	Ni (Dissolved)	µg/L	33	2	2	3
	Pb (Dissolved)	µg/L	9	14	<5	<5
	Zn (Dissolved)	µg/L	319	5	10	6

### **Appendix 3**

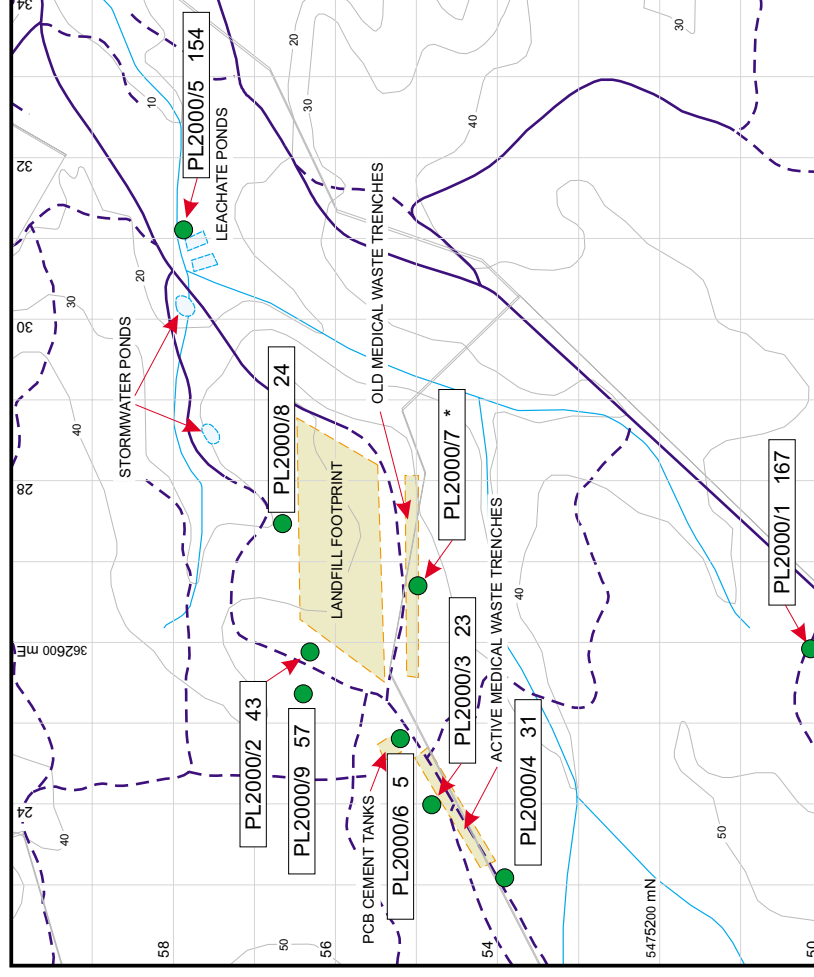
### **Analytical results on site maps**

# Port Latta Waste Depot October 2000 Alkalinity CO<sub>3</sub> (mg/L CaCO<sub>3</sub>)



\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

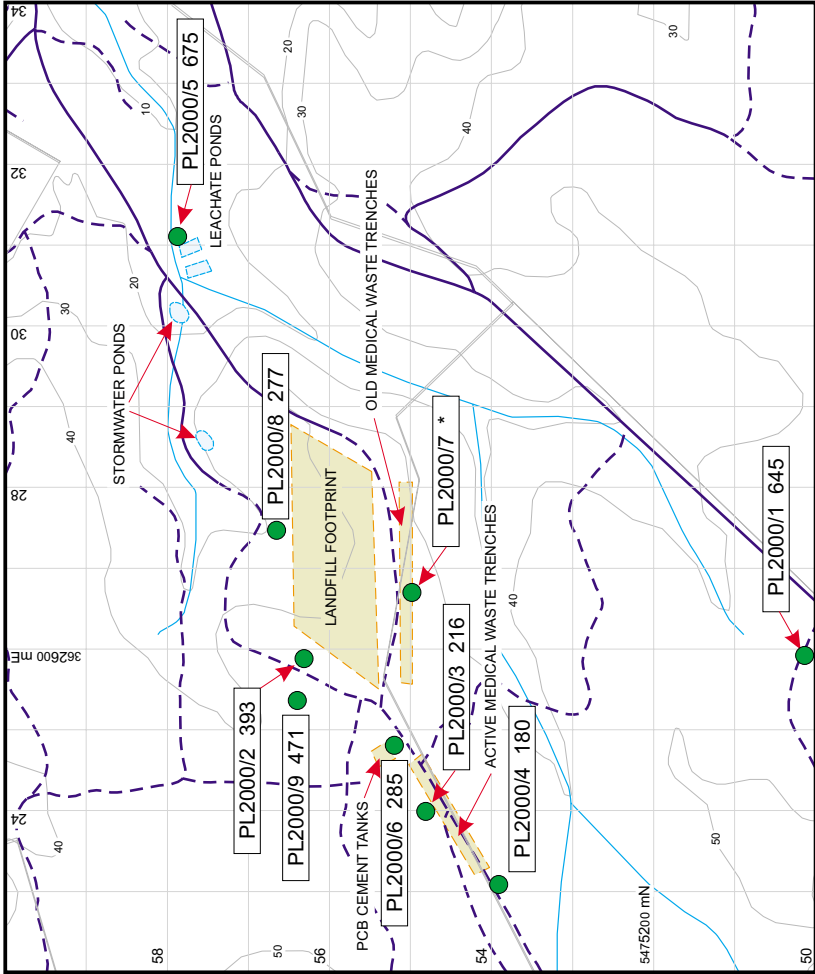
# Port Latta Waste Depot October 2000 Alkalinity HCO<sub>3</sub> (mg/L CaCO<sub>3</sub>)



\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

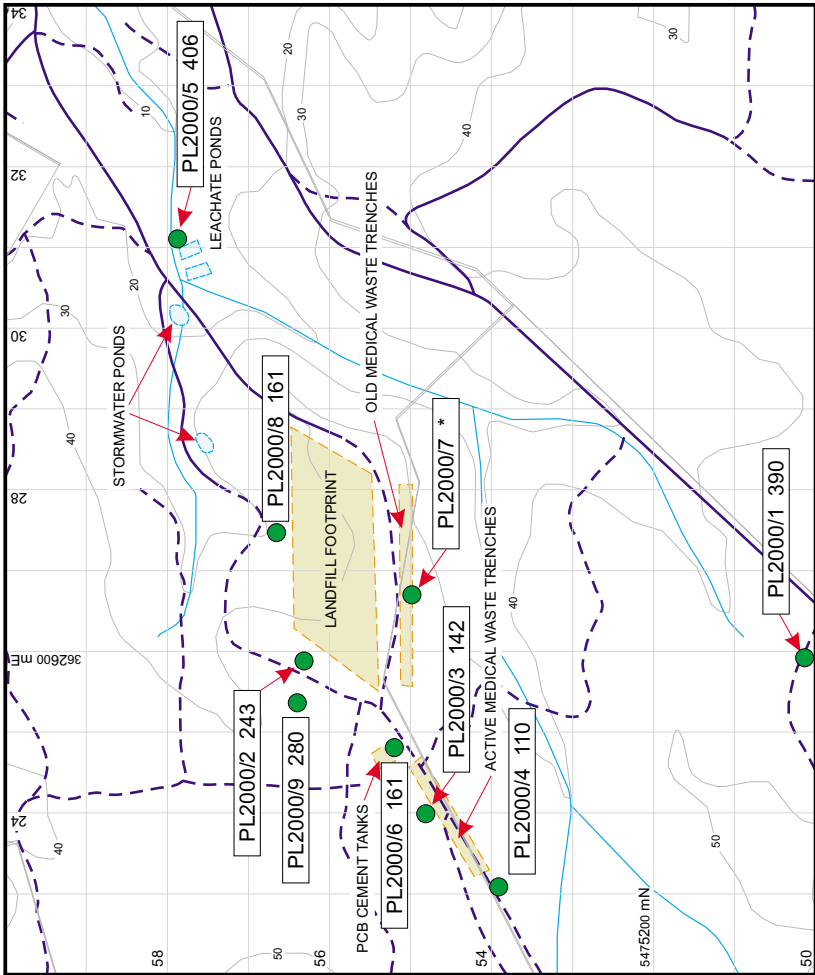


# Port Latta Waste Depot October 2000 Conductivity ( $\mu\text{S}/\text{cm}$ )



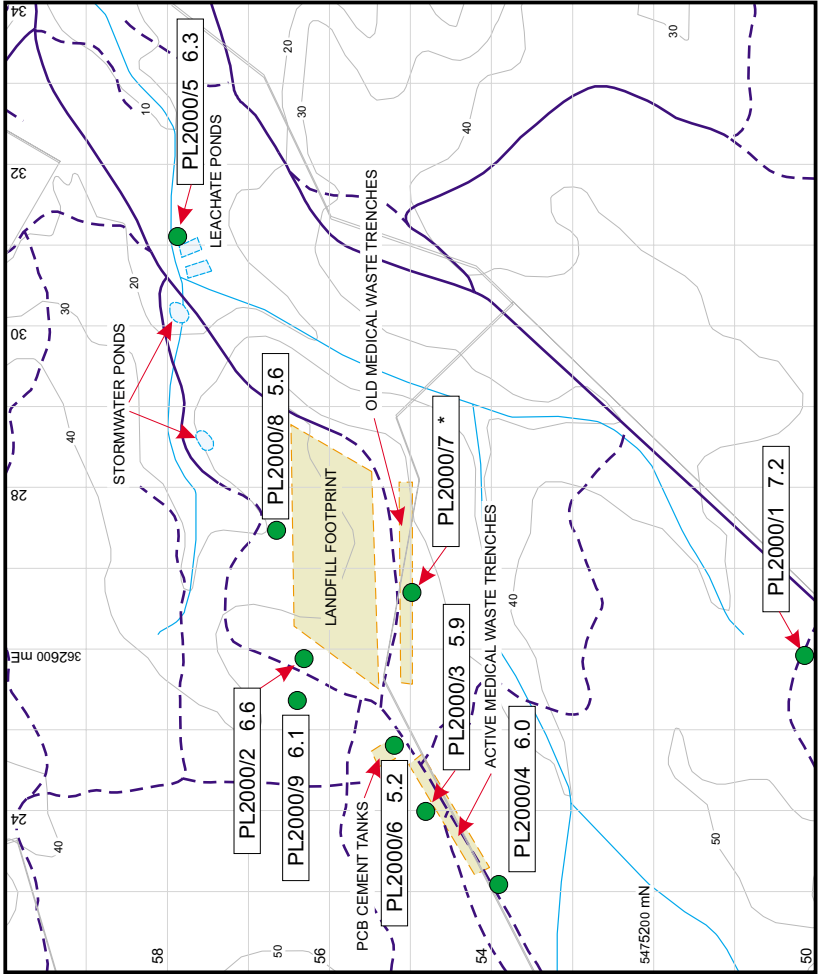
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 TDS (mg/L)



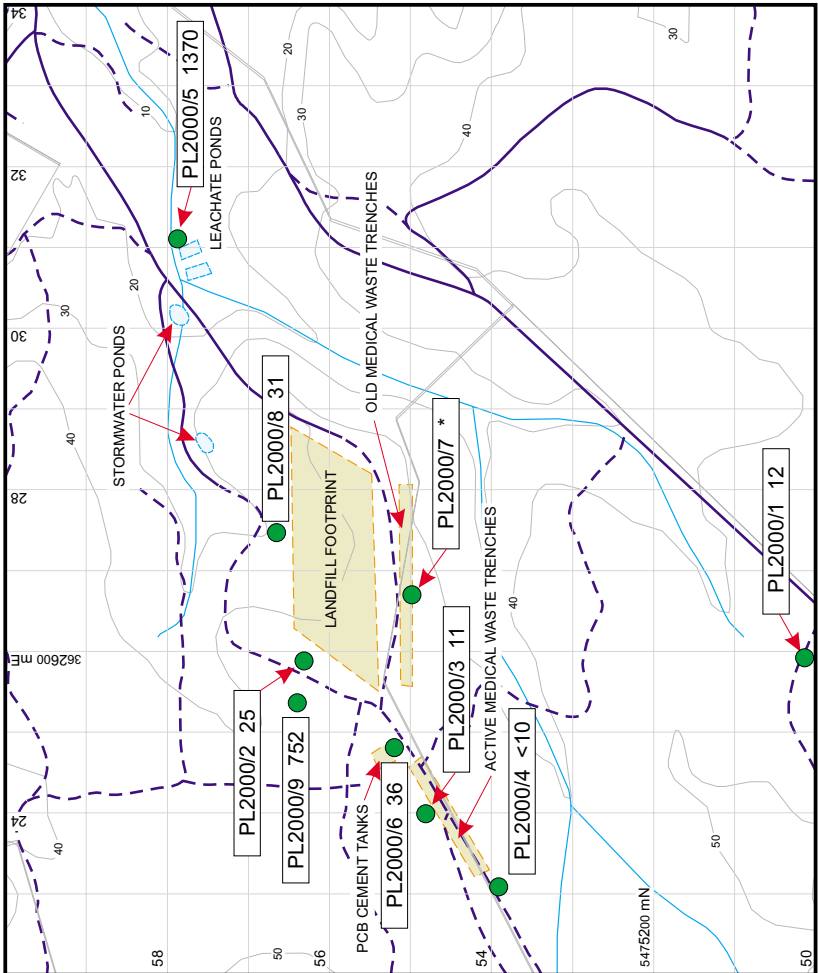
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 pH



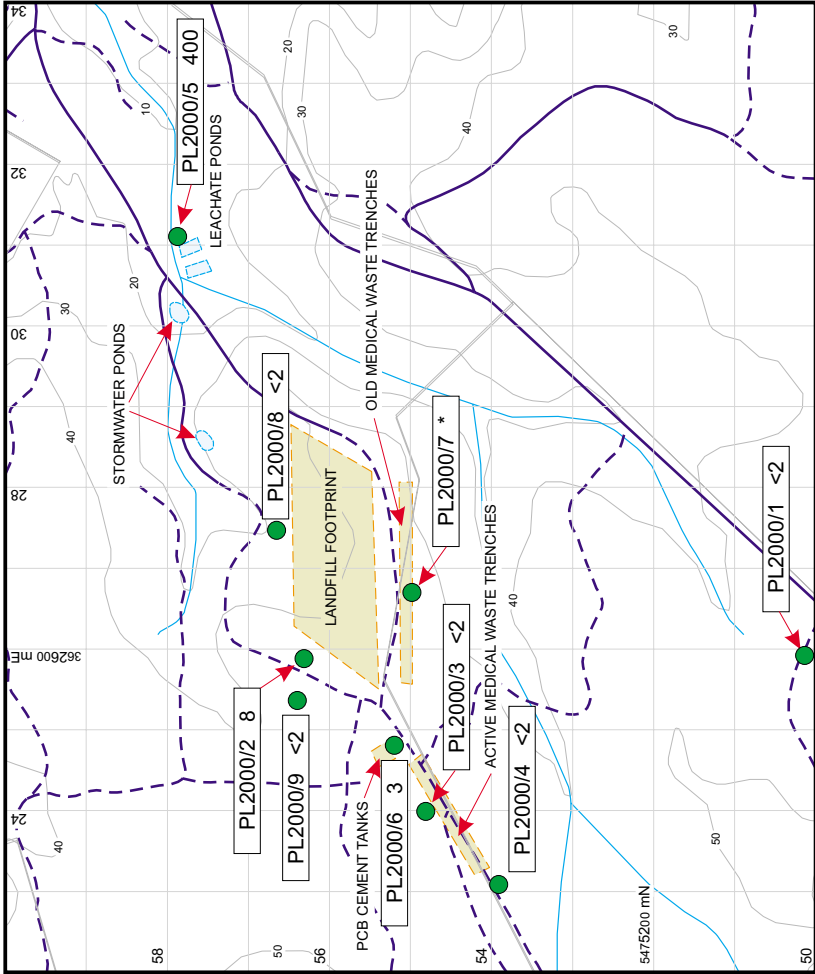
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Al ( $\mu\text{g/L}$ )



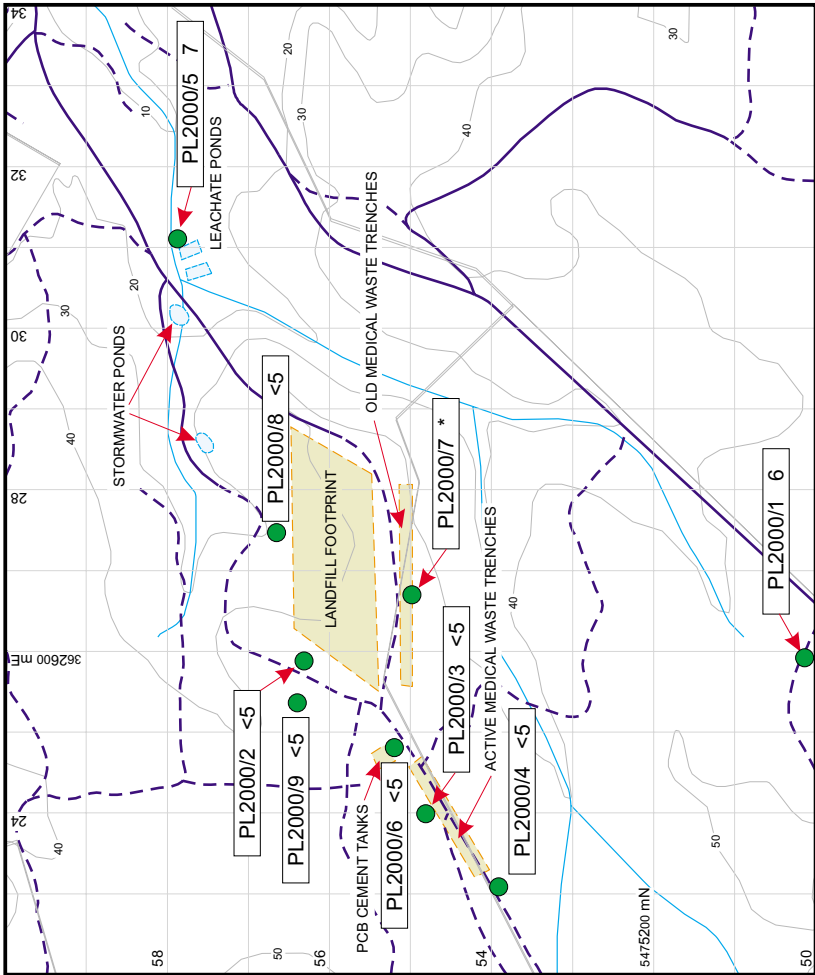
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Ammonia ( $\mu\text{g-N/L}$ )



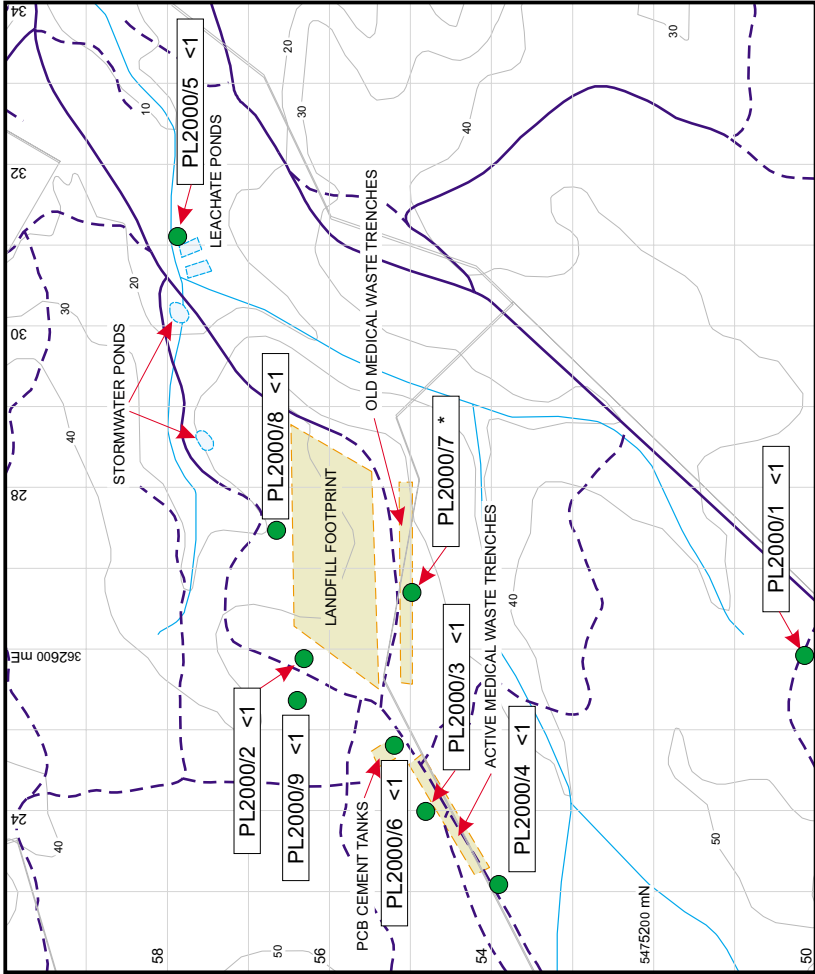
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 As ( $\mu\text{g/L}$ )



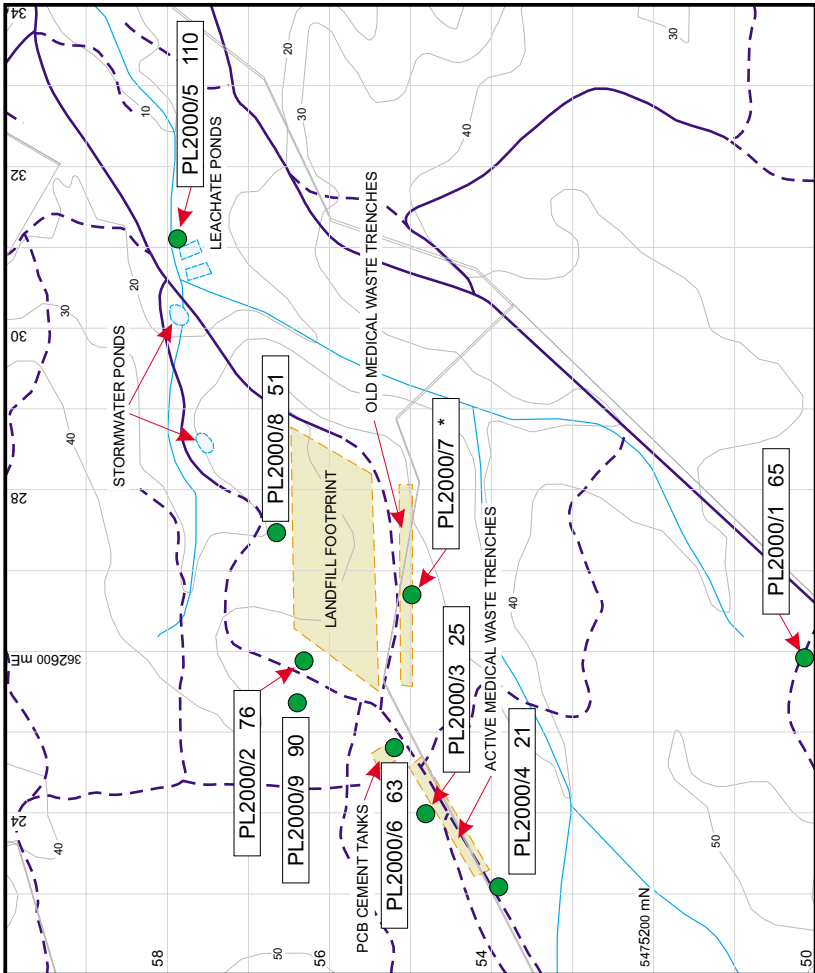
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Cd (µg/L)



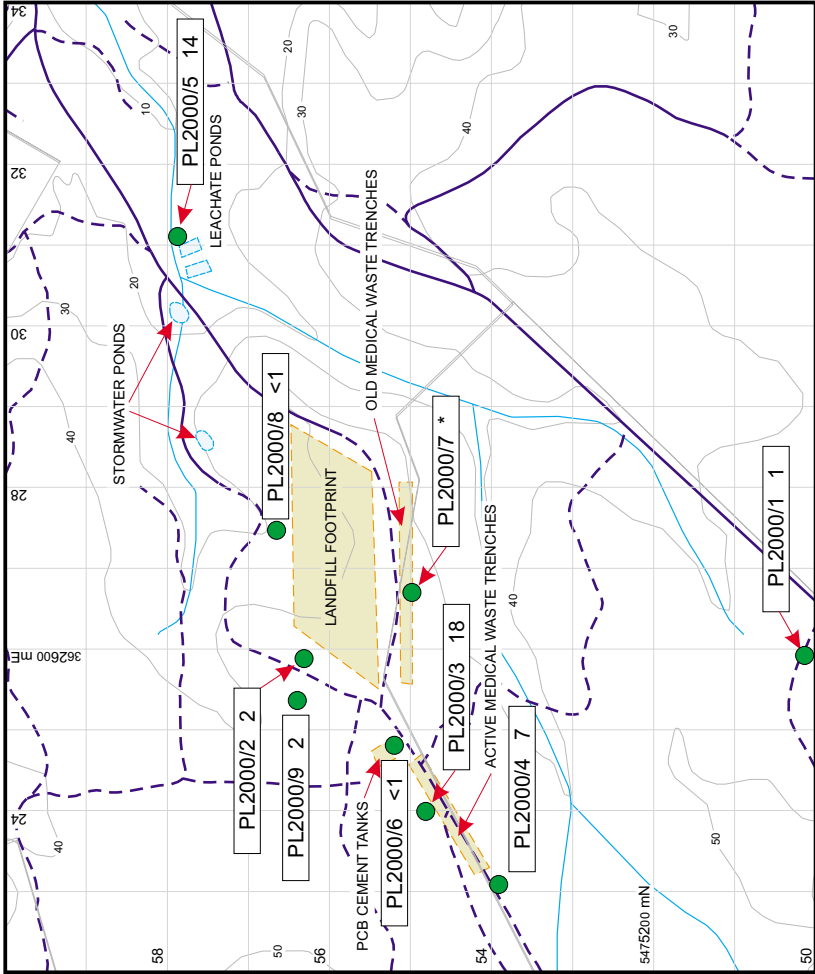
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Chloride (mg/L)



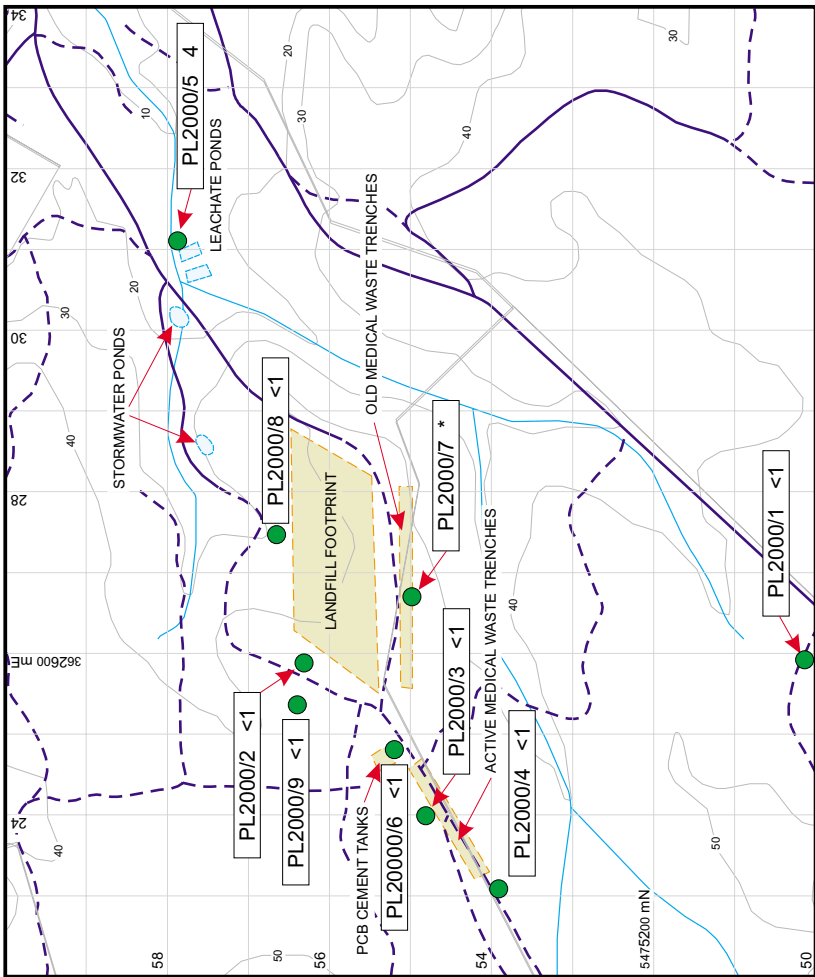
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Co (µg/L)



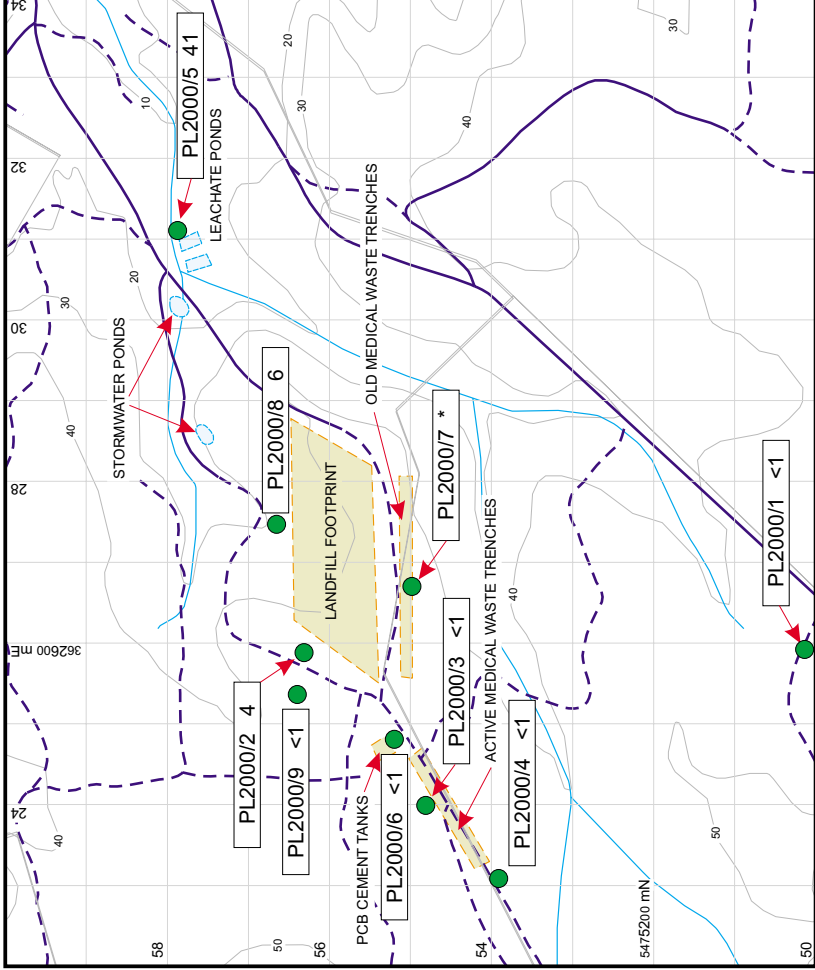
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Cr (µg/L)



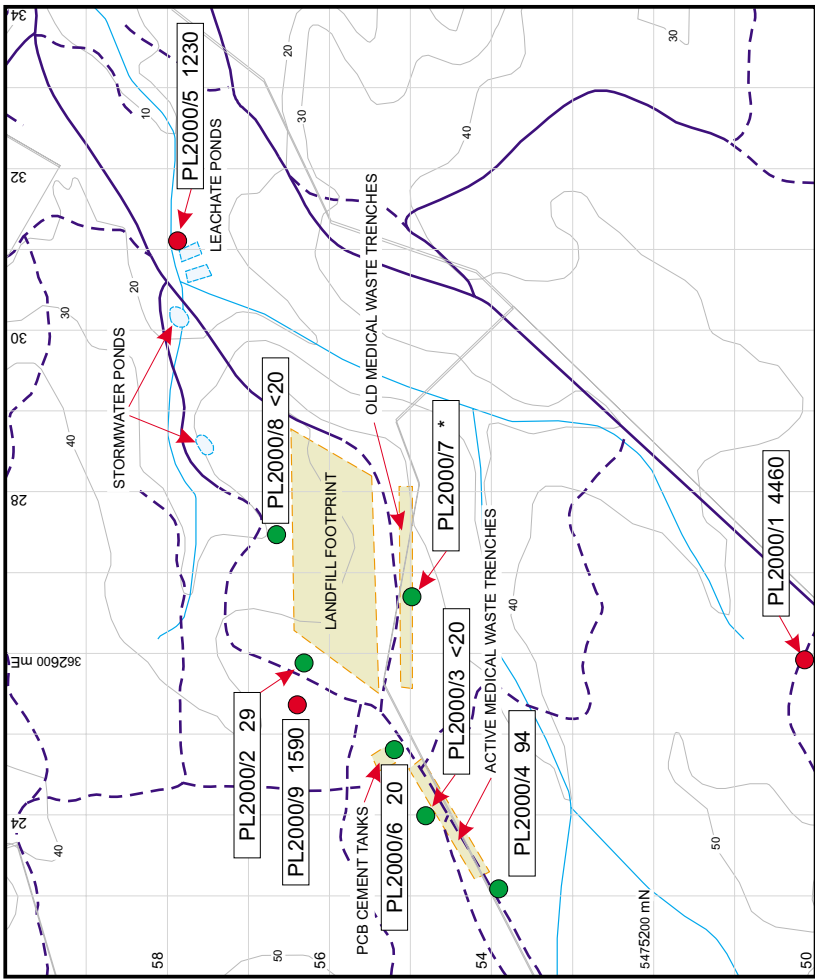
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

Port Latta Waste Depot  
October 2000  
Cu (µg/L)



\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

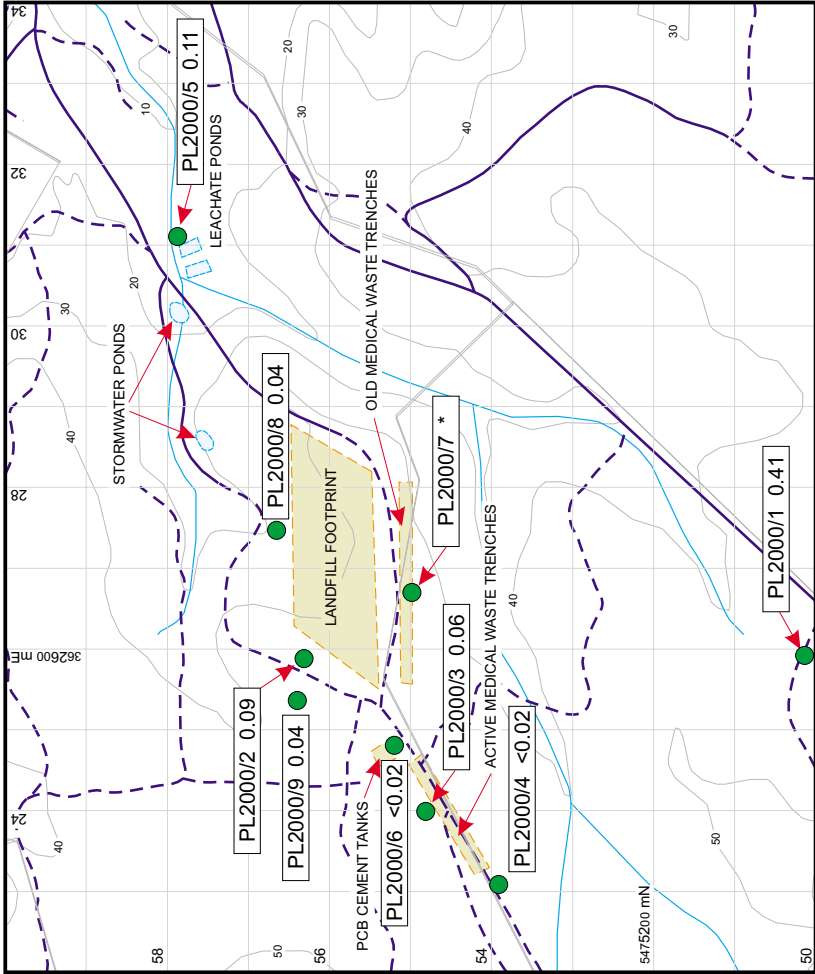
Port Latta Waste Depot  
October 2000  
Fe (µg/L)



\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

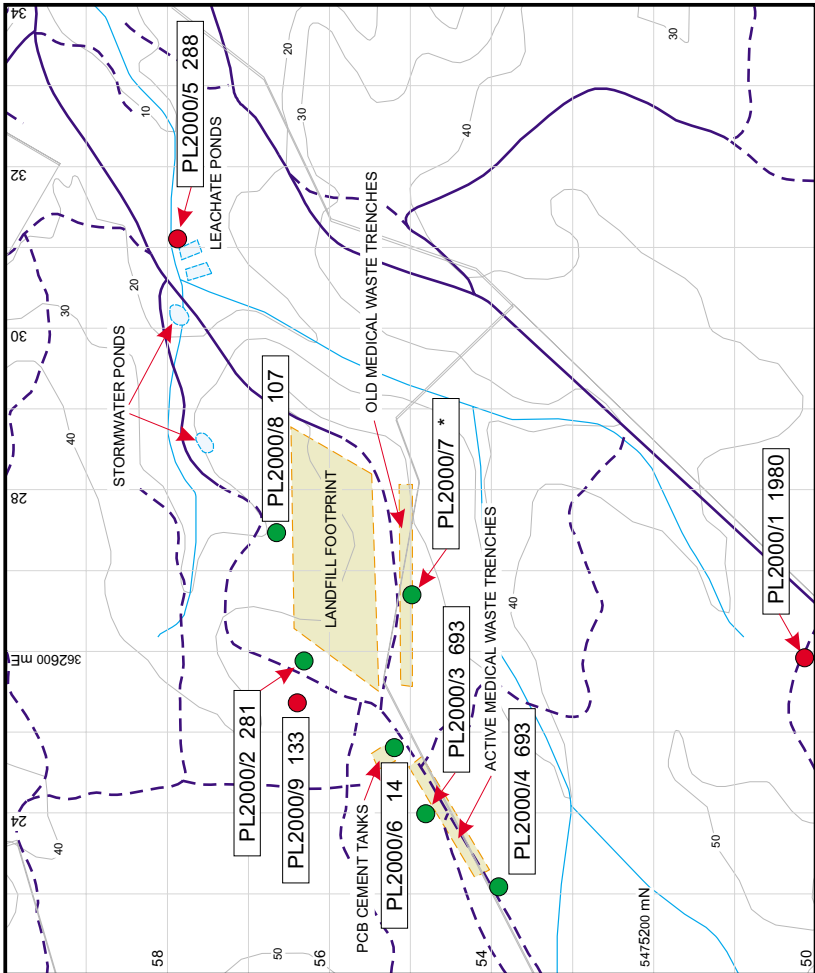


# Port Latta Waste Depot October 2000 Fluoride (mg/L)



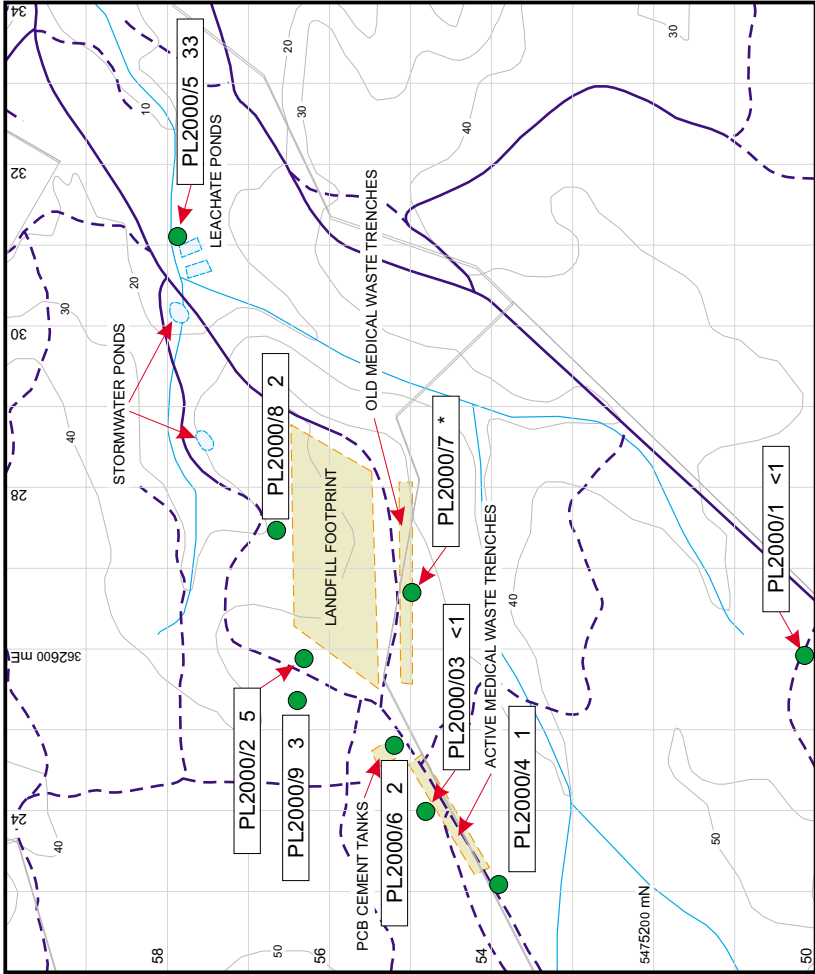
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Mn (µg/L)



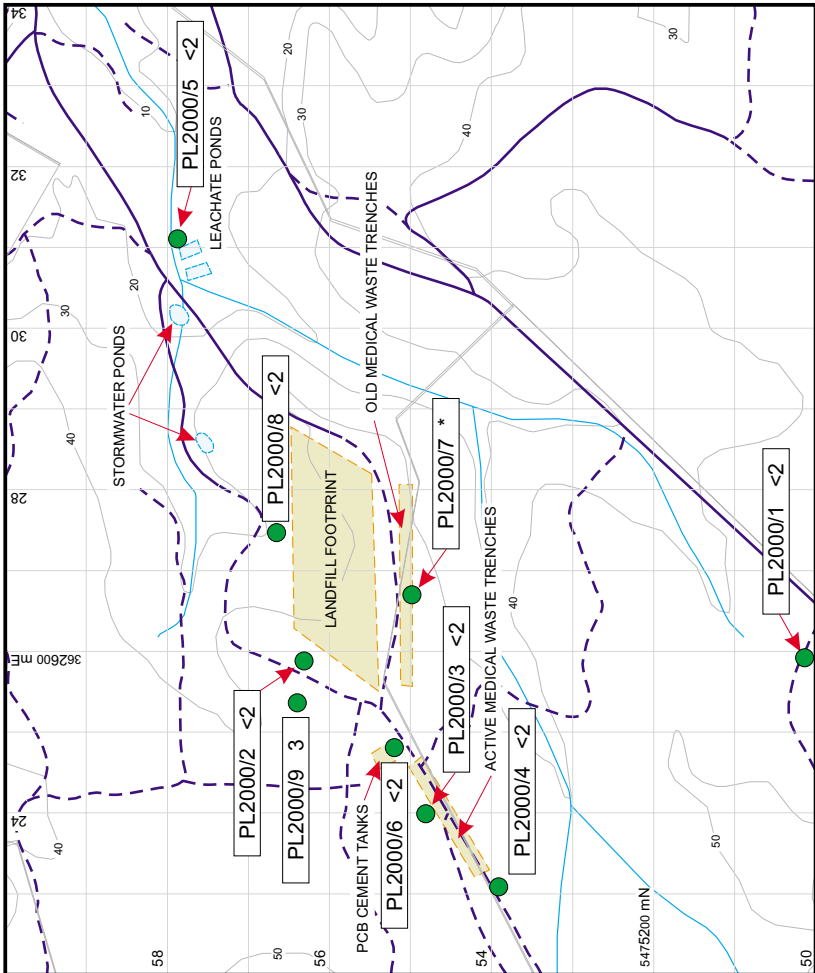
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Ni (µg/L)



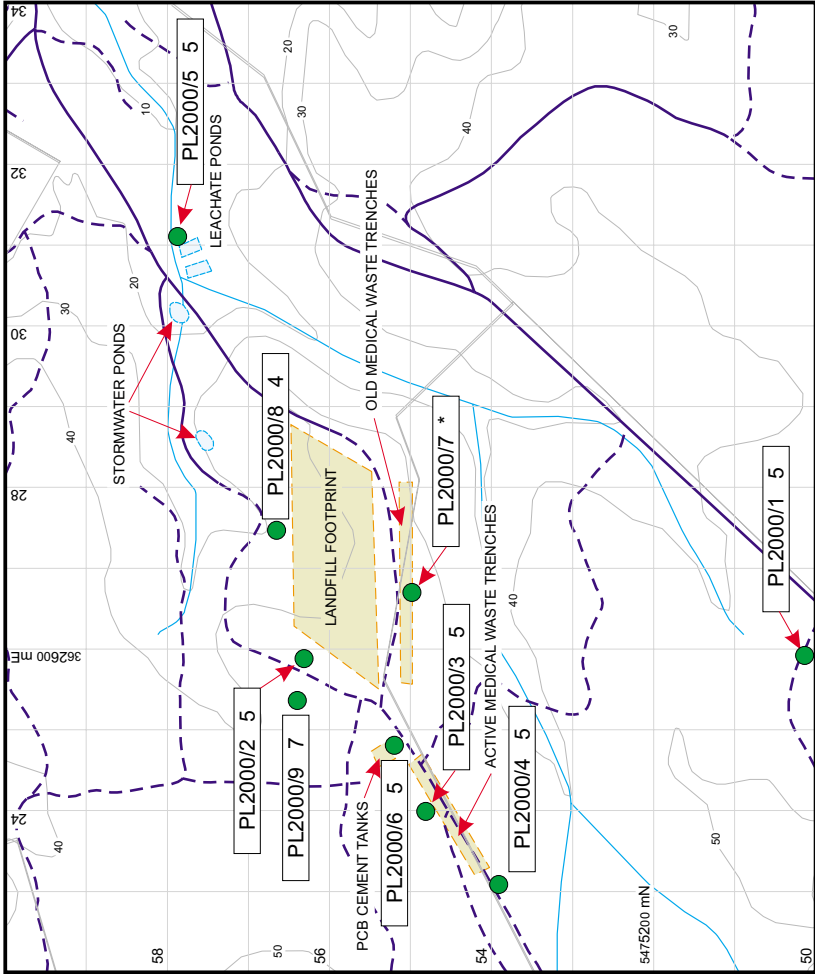
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Nitrite (µg/N-L)



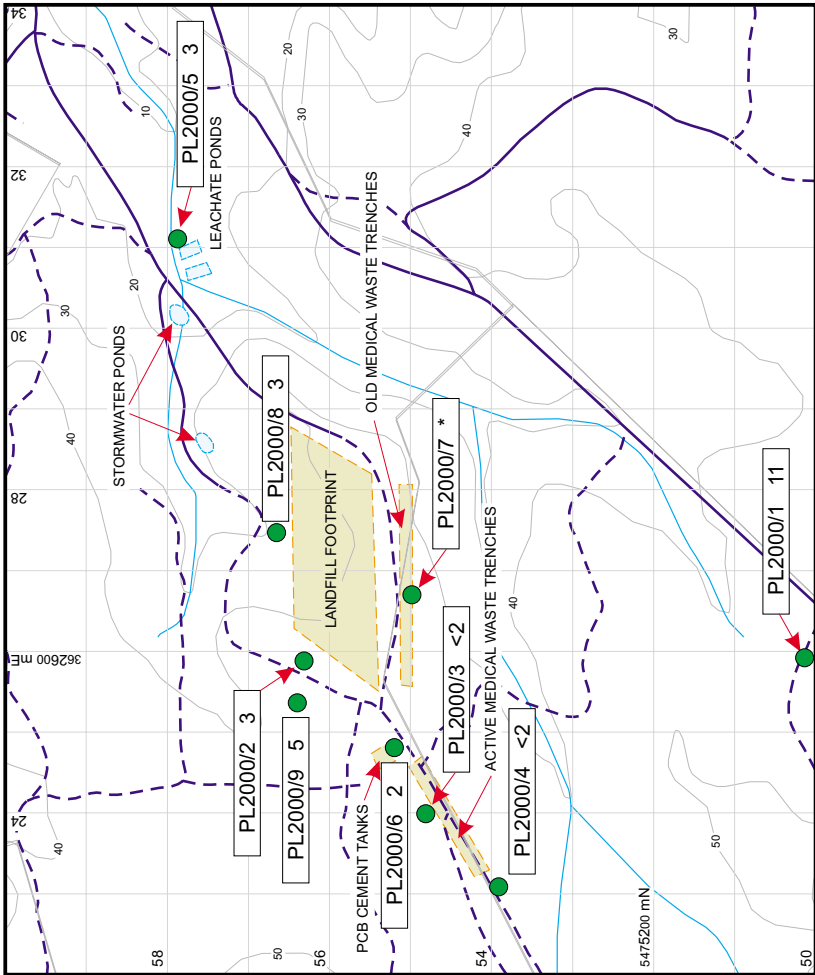
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Nitrate + Nitrite (µg-N/L)



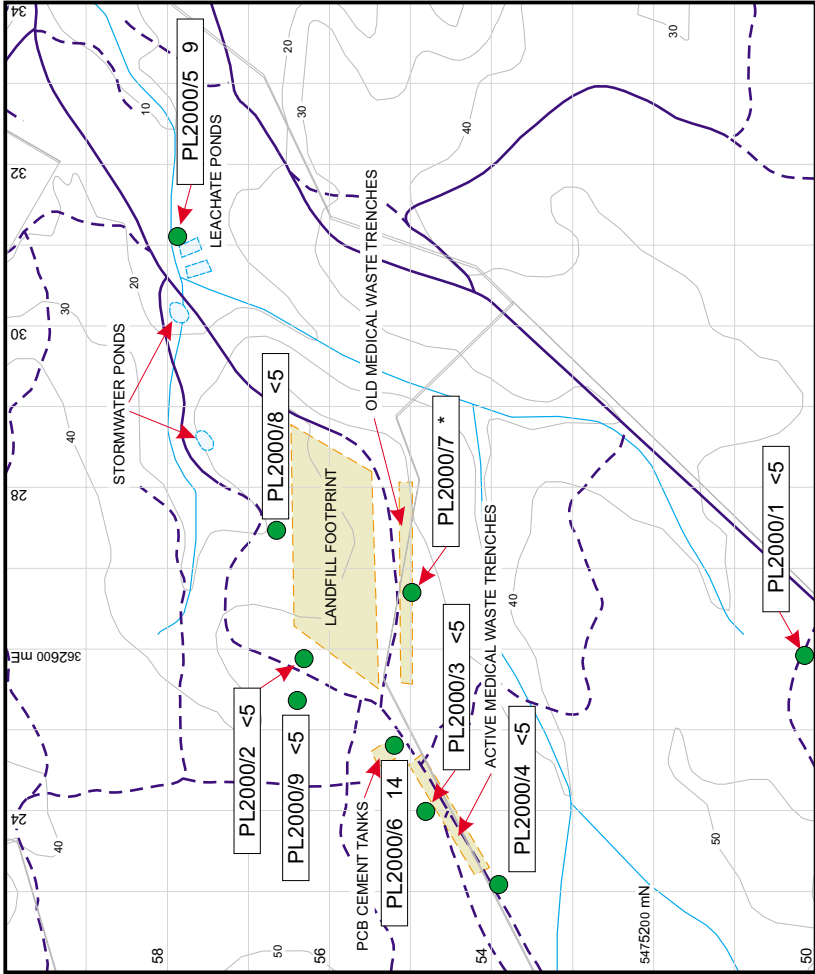
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Ortho-P (µg-P/L)



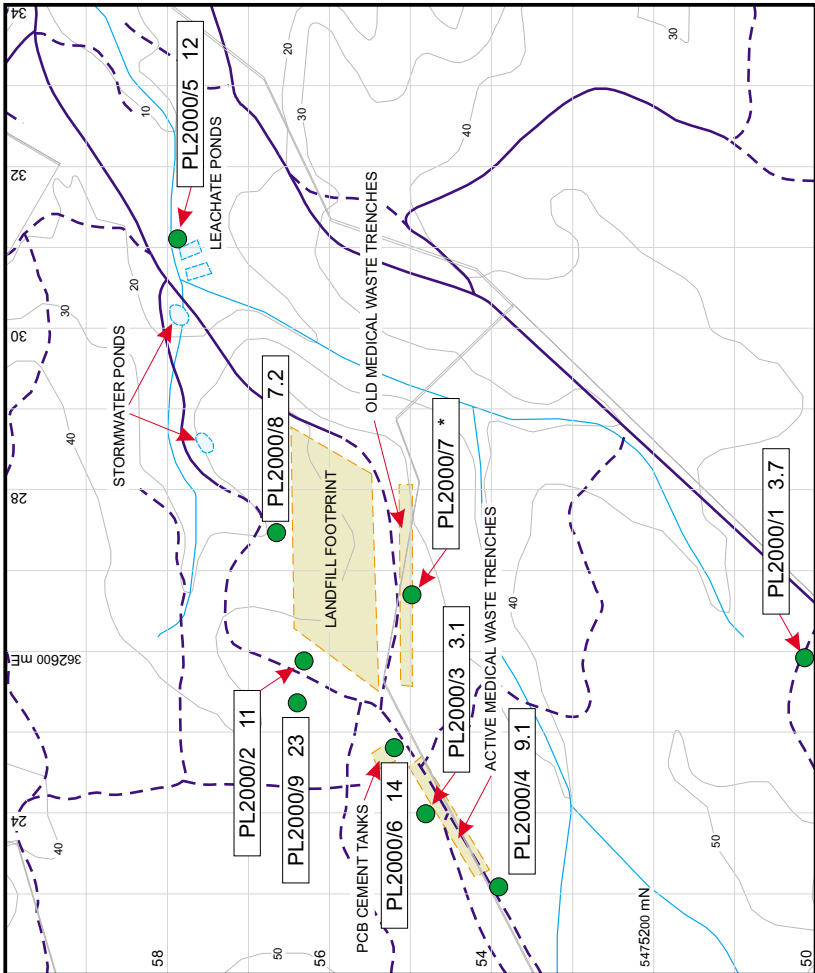
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Pb (µg/L)



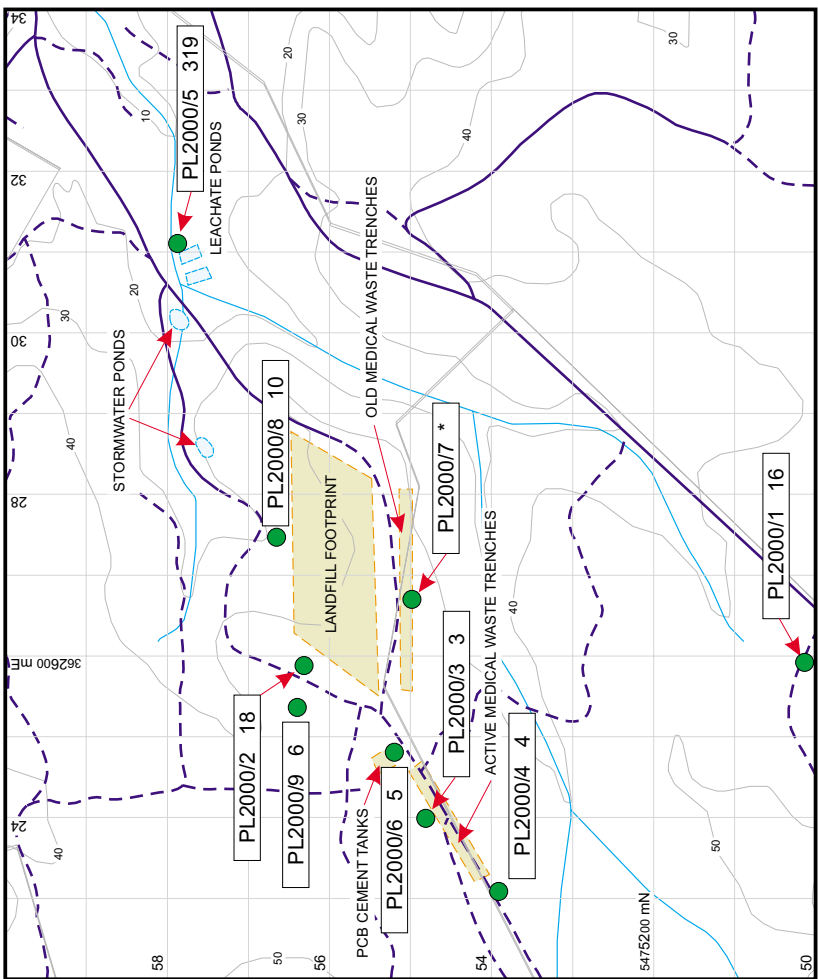
\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Sulphate (mg/L)



\* Hole PL2000/7 contains no installation and was backfilled with bentonite.

# Port Latta Waste Depot October 2000 Zn (µg/L)



\* Hole PL2000/7 contains no installation and was backfilled with bentonite.