Proposed Landfill Footprint Modification
South Cardup Landfill

West Australian Landfill Services Pty Ltd

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
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Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
06/04/06	**Referral received**	
24/04/06	**ARI Level of Assessment set and EPA report to the Minister for the Environment; Science**	

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Contents

1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to the proposal by West Australian Landfill Services Pty Ltd (WALS) to modify the footprint of the South Cardup landfill.

In 1992, Pioneer-BFI Waste Services (Pioneer-BFI) referred a proposal to the Environmental Protection Authority (EPA) to establish a landfill in South Cardup, 45 kilometres (km) south-west of the Perth CBD and 5km south of Byford. The proposal was formally assessed as a Public Environmental Review (PER) and the report, Bulletin 702, was released in 1993 (EPA, 1993). The Minister approved the proposal on the 9 May 1994, subject to Ministerial Statement 354.

The assessed proposal consisted of two stages; Stage 1 occupies a small valley to the north and north-west of the Pioneer quarry stockpile and the proposed Stage 2 site comprises a shale pit previously owned by Bristile, to the west of the Stage 1 area. The landfill commenced operations in 1999 with Stage 1 completed in January 2005.

In early 2003, the EPA was advised of a change of proponent from Pioneer-BFI to West Australian Landfill Services Pty Ltd (WALS).

In April 2003, WALS submitted a referral document proposing modification of the landfill footprint by joining the two stages together into a single mound (Figure 2). This modification included an additional footprint area of approximately 4 hectares (ha), known as Cells 7 and 8, between Stage 1 and Stage 2, and a decrease in the Stage 2 area, leading to an overall increase in landfill footprint area of 2.8 ha. Following concerns raised by members of the public regarding the integrity of the landfill, the Kwinana office of the Department of Environment (DoE) started an investigation into the site in mid 2003. The EPA advised the Minister that it would provide its advice following the completion of the DoE investigation.

Nearing the completion of the DoE investigations in September 2005, the proponent again referred the proposal to the EPA, submitting their original referral document. The EPA required extra information to update the project information. The EPA then received a revised referral document on 6 April 2006.

The referral document sets out the details of the proposal, potential environmental impacts and proposed management commitments to manage the impacts. The EPA considers that, based on the information provided in the referral document, the proposal as described can be managed in an environmentally acceptable manner, subject to the proponent's commitments and the EPA's recommended conditions being made legally binding.

The EPA has therefore determined under Section 40(1) of the Environmental Protection (EP) Act that the level of assessment for the proposal is Assessment on Referral Information (ARI), and this report provides the EPA advice and recommendations in accordance with Section 44(1).

The modification to the landfill is being assessed as a revised or further proposal. Under Section 46B(2) of the EP Act, the EPA may report on the implementation conditions of a proposal when it is assessing a revised or further proposal. The EPA has recommended a revised set of conditions under which the proposal may be implemented.

2. The proposal

The South Cardup landfill is located approximately 45km South-West of the Perth CBD and 5km South of Byford (Figure 1). The original proposal consisted of two Stages: Stage 1 occupying a small valley lying to the North and North-West of the Pioneer Quarry stockpile area and the proposed Stage 2 area, comprising a shale pit previously owned by Bristile, situated to the West of the Stage 1 area.

The revised proposal involves a modification to the landfill footprint. It proposes a reduction in the Stage 2 area by 1.2ha and an increase in footprint area of 4ha between the Stage 1 and Stage 2 areas. Cells 7 and 8 will be constructed in this new area, in addition to existing Cells 1 to 4 in Stage 1 and Cells 5 and 6 in Stage 2. The final landform will be a continuous mound with an overall increase in landfill area of 2.8ha.

Figure 2 shows the location of the individual cells in Stages 1 and 2, and the proposed additional cells 7 and 8.

The main characteristics of the proposal are summarised in the table below.

Table 1: Summary of key proposal characteristics

Element	Current	Revised
Site Area	39ha	39ha
Total Landfill Area	14.7ha	17.5ha
Total Landfill Capacity	2600ML	4800ML
Maximum Landfill Height	Stage 1 – 173m AHD Stage 2 – 140m AHD	Stage 1 and 2 - unchanged
Operational Life	Stage 1 – 5 years Stage 2 – 3 years	Stage 1 and 2 - 15 year
Nominal Waste Acceptance Rate	225,000 tonnes per annum	unchanged

The potential impacts of the proposal are discussed by the proponent in the referral document (WALS, 2006), and reviewed by the EPA in Appendix 4.

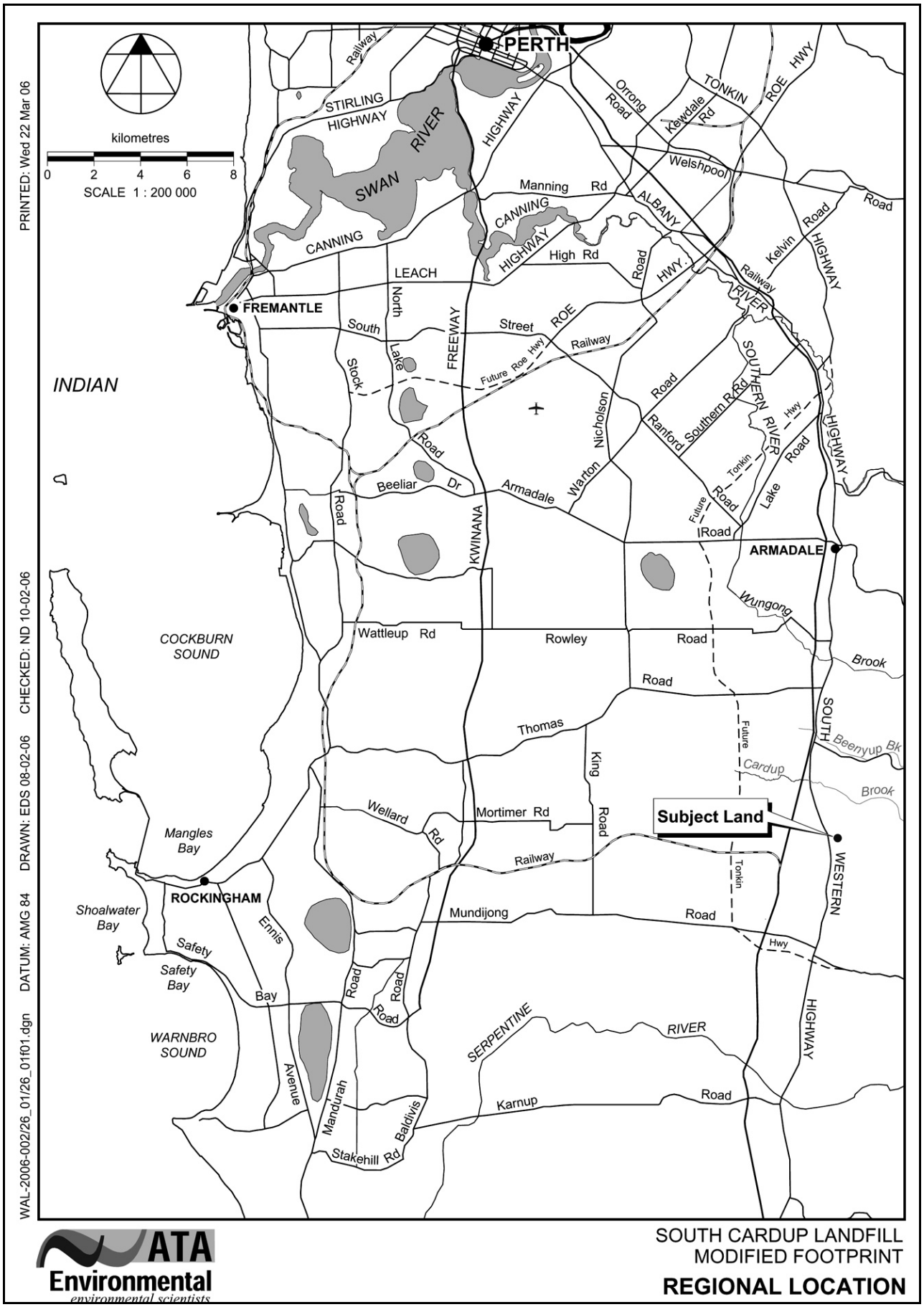

Figure 1: Location of South Cardup Landfill

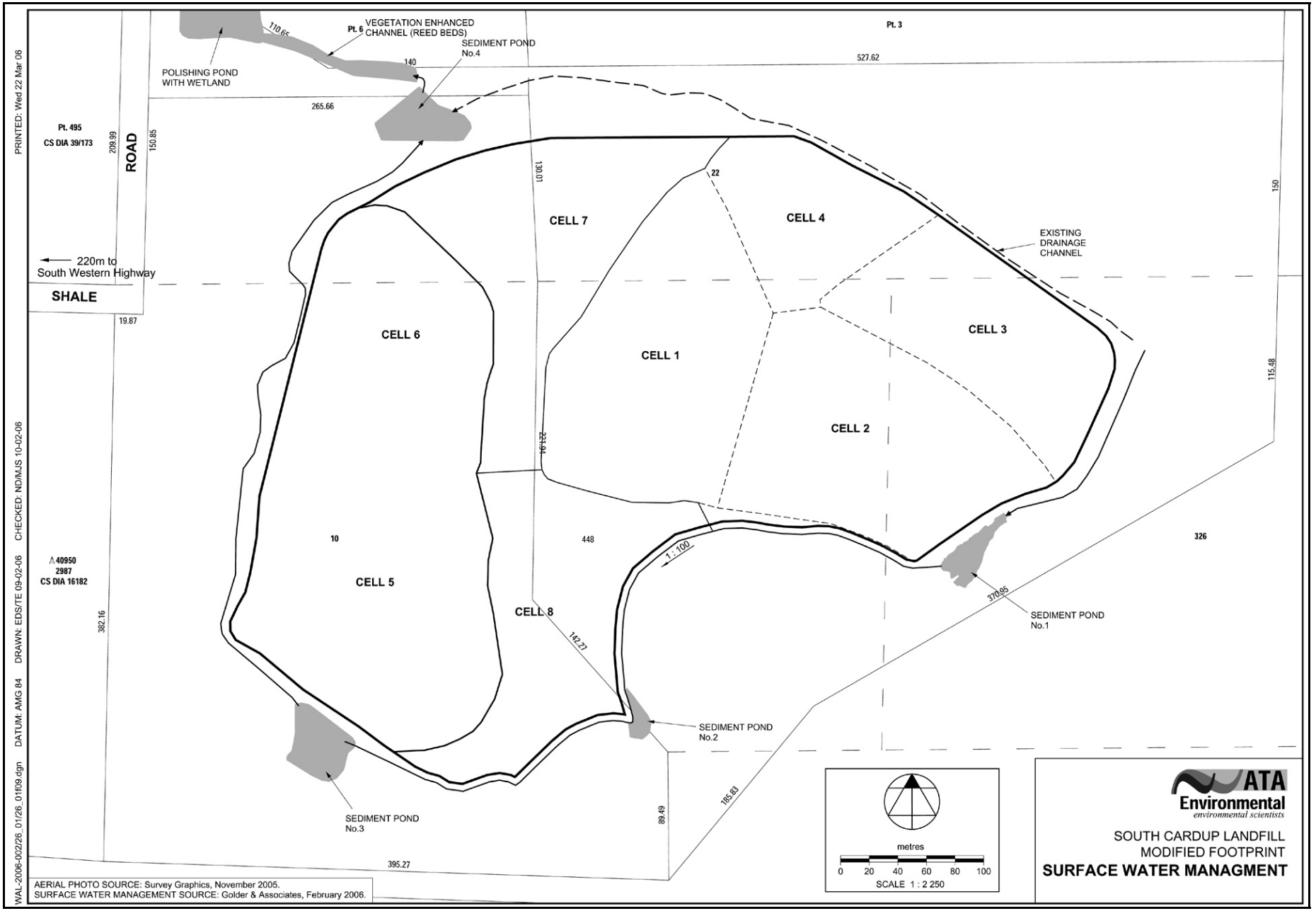

Figure 2: Landfill cell and surface water management details

3. Consultation

The proponent has undertaken extensive consultation with stakeholders over the past 3 years. Consultation occurred mainly through informal and formal meetings, telephone conversations, email correspondence and a web site. The proponent also organised and hosted visits to the site, including public open days. Consultation is described in Section 4 of the ARI and summarised in Table 2.

Table 2: Summary of Stakeholder Consultations

Date	Consultation
Early 2003	DoE, Department of Conservation and Land Management and the Shire of Serpentine-Jarrahdale consulted regarding the modified footprint proposal.
April 2003	Referral documentation submitted to the Shire and the EPA. Shire then referred proposal to the EPA, and informed WALS to advertise proposal.
June 2003	Proposal presented to the full Shire Council. Site visit organised and attended by 2 Council Officers and 5 Councillors.
18 and 19 July 2003	Public open days at landfill.
July/August 2003	Stakeholders meeting organised and attended by: • Representatives of local ratepayers Association; • Neighbouring property owner; • Council Officers and Councillors; • Staff from the DoE's Kwinana office; • The local Member for the Legislative Assembly (Martin Whitely); and • Staff from WALS.
August till late 2003	Renewal of annual landfill operating licence and Works Approval for construction of Cells 5 and 6 advertised in the press. Community appeals on both advertisements.
2004	Following appeals, Minister for the Environment determined that: • Stage 2 should be reclassified from Class III to Class II; • Surface and groundwater monitoring be increased; and • A stakeholder consultation group be established.
December 2004	The Proponent, in conjunction with DoE, set up the South Cardup Consultation Group (SCG). SCG had its first meeting on 14 December 2004.
Early 2005	Independent phone survey of 315 randomly selected residents.
July 2005	Regular fortnightly advertisements commenced in the local community paper, "The Examiner". Launched a web site on landfill operations.
25 January 2005	Briefed the SCG on the modified footprint proposal.
26 January 2006	Placed advertisement in "The Examiner" to advise the community of WALS' intention to proceed with the modified footprint proposal subject to obtaining the necessary approvals.
16 February 2006	Briefed the SCG again regarding the modified footprint proposal.

4. Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

It is the EPA's opinion that the following environmental factors relevant to the proposal require evaluation in this report:

(a) Groundwater and Surface Water

(b) Post Closure Management

Details of the relevant environmental factors and their assessment are contained in Sections 4.1 - 4.2. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors generated from the ARI document in conjunction with the proposal characteristics.

Details on the relevant environmental factors and their assessment are contained in Appendix 4. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

4.1 Groundwater and Surface Water

Description

The South Cardup landfill site lies on the western edge of the Yilgarn Block, approximately 1km east of the Darling Fault that forms the major boundary between the young Perth Basin sediments to the west and the much older hard crystalline rocks of the Darling Range. The surface geology comprises a sequence of Quaternary aged sands, silts and clays which extends to a depth of between 0.4m to the east, to over 30m in the west of the site. This veneer of sediments is underlain by shales and sandstones in the western portion of the site and by granitic bedrock to the east.

The Stage 1 area (Figure 2) is underlain by Archaean granite and dolerite dykes with a narrow width subcrop of steeply dipping sandstone. A fault transects the Stage 1 area from north west to south east, extending under the northern part of the proposed extended footprint of the landfill, and may provide local conduits for groundwater where fracturing has developed and remained open (WALS, 2003). Most of the site contains a relatively low permeability (estimated at 0.01m/day to 0.25m/day) fractured rock aquifer system, with a slightly higher permeability zone (estimated at between 0.5m/day to 2m/day) existing around the branch fault that extends under the site (Golder Associates, 2006).

The Stage 2 area (Figure 2) is underlain by the steeply dipping Armadale shale, which is weathered and poorly permeable. The bedding planes have a near vertical orientation, possibly reducing horizontal movement of groundwater through this unit. To the west of the Stage 2 area, the Armadale shale is overlain by shallow alluvium, which forms a perched aquifer. This alluvium overlies the Darling Fault and possibly provides superficial hydraulic continuity across the fault (WALS, 2003).

The site lies on the eastern edge of the Proclaimed Groundwater Management Area providing catchment for the Jandakot mound.

A stream passes through the landfill site, flowing in a general westerly direction. The stream drains a catchment of approximately 240ha and continues westwards of the site, crossing under the South Western highway and eventually dissipating in the sediments of the Swan Coastal Plain. Within the site boundaries the stream is ephemeral, flowing mainly in the winter months. Some water from the stream is used on downstream properties for stock watering (WALS, 2003).

As part of the Stage 1 development, the stream was diverted around the Stage 1 area, so that it now flows between the Stage 1 and Stage 2 areas and to the eastern side of Stage 1. Under the current plan for the modified footprint, the stream will be diverted around the south and west of the Stage 2 area, to allow for the development of cell 7 and cell 8 between the Stage 1 and Stage 2 areas (Figure 2). Sedimentation basins will be constructed on the creek line, in the vicinity of the southwest corner of the site, to act as retention basins to provide storage during storm events and also to trap sediment and prevent it from leaving the site (WALS, 2006).

The lining system for the proposed new cells 7 and 8 will be a composite lining system with a minimum separation distance of 2m between the base of the landfill cells and the highest predicted water table level. The proposed connection between the existing lining system and the proposed lining system will ensure that all components of the lining system are continuous along the interface (WALS, 2006) (Figure 3).

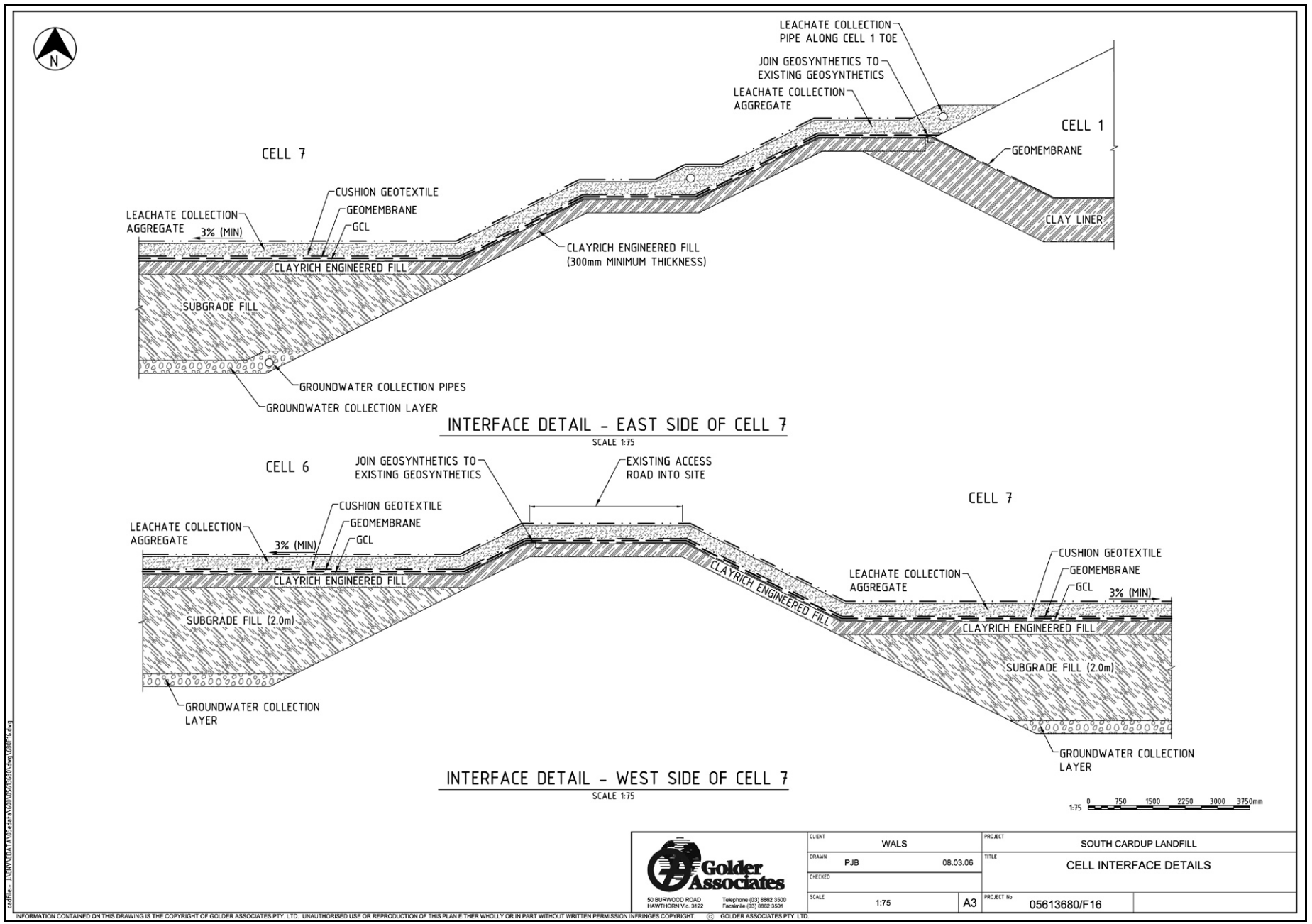

Figure 3: Cell interface details

A leachate collection system will be incorporated into the lining system, with leachate being captured by the top liner and directed to sumps. The leachate will then be pumped from the sumps to a lined leachate pond for evaporation or recirculated. An underdrainage system will be installed beneath the proposed cell 7. Separate underdrainage systems will be retained for the cells 1 to 6 to cap the highest groundwater level (WALS, 2006). Cell 8 may not require underdrainage as there is adequate separation of at least 2m to groundwater. The underdrainage will be directed into the diverted stream, which will then flow into a sedimentation pond to trap sediment and prevent it from leaving the site. Following the sedimentation pond the stream will flow through a wetland feature, which will act as a final treatment system to trap suspended sediment and nutrients before the water flows off-site.

The latest available monitoring data (December 2005), reviewed by GHD Pty Ltd (2006), showed that elevated concentrations of arsenic, dissolved methane and ammonia-nitrogen were detected in the underdrainage water exiting all cells in Stage 1. A low concentration of Benzene, Toluene, Ethylbenzene and Xylene (BTEX) was also detected in an underdrainage pipe exiting from Cell 1 and Cell 2. Further sampling on 23 January 2006 showed that BTEX was not present.

Arsenic was detected in groundwater (0.015mg/L) above drinking water guideline (0.007mg/L) in one downgradient bore at the northwestern tip of the property (GHD, 2006). Arsenic concentrations have shown a decline from the previous two monitoring events in concentrations in this monitoring bore. However it is not yet possible to determine a definitive trend in the data (GHD, 2006).

Surface water quality was within acceptable guideline values and/or were consistent with data previously recorded throughout the historical monitoring period (GHD, 2006).

Assessment

The EPA's environmental objectives for this factor are to:-

- maintain the integrity, functions and environmental values of rivers and ephemeral streams, and to ensure that alterations to surface drainage do not adversely impact native vegetation.
- maintain the quality of surface and groundwater so that existing and potential uses, including ecosystem maintenance, are protected.

Hydrogeological System

The EPA notes that, in response to advice from the EPA, the proponent has engaged Golder and Associates to carry out geotechnical investigations. Eight test pits were dug in areas of the modified footprint, namely Cells 7 and 8. General soil conditions from the test results indicated that area under proposed Cell 7 comprises sand and silty sand fill to 1.5m and granite starts from a between a depth of 1.5m to 2m (Golder, 2006). The soil is dry to moist stiff silty clay with no groundwater observed in any of the pits. The area under proposed Cell 8 generally comprises thin layer of soil over shale (Golder, 2006). The soil is classified as sandy silt to silt, dry to moist with no groundwater noted in any of the pits.

The proponent has also submitted a diagram (Figure 4) illustrating the fault line that passes beneath the modified landfill footprint.

The EPA considers, with advice from the DoE, that although the position of the fault line has been established, other potential groundwater conduits in the form of rock fractures is still unclear. The available results suggest that most of the ground has low permeability, with small areas of high permeability existing in the form of fractures and faults (Golder, 2006). There is potential for contaminated groundwater to migrate off-site through these fractures and fault. However, maintaining a 2m separation to groundwater will reduce the risk of contaminants reaching groundwater. At present there is off-site export of contaminants from the landfill.

The EPA notes that the underdrainage water quality from Cells 1 to 4 (Figure 2) of the Stage 1 landfill shows elevated concentrations of arsenic, dissolved methane and ammonia-nitrogen, and spurious low concentrations of BTEX. The EPA also notes that a review by DoE in October 2005 of the hydrogeological investigation reports conducted by independent consultants concluded that the landfill is not impacting off-site environment.

The underdrainage water is treated via two sedimentation ponds before being discharged into a local stream leaving WALS' property. Surface water quality leaving the site meets the Fresh Water or Drinking Guideline values or was consistent with data previously recorded throughout the historical monitoring period. The EPA notes on advice of DoE that surface water monitoring will be addressed in the next license reissue.

The EPA notes that arsenic was detected in on particular bore on a number of occasions, however, the most current data showed a decline from the previous two monitoring events. It is not yet possible to determine a definitive trend in the data. The concentration of arsenic detected in the groundwater monitoring bore was significantly higher than concentrations in the underdrainage water. This difference in concentrations suggests that arsenic concentrations may be influenced by off-site factors. The EPA considers that arsenic concentrations should be monitored closely to assess any trends.

The EPA also notes that the proponent, in a letter dated 8 March 2006, has committed to manage the risk of leachate flow from the new waste in Cell 7 and Cell 8 into the older waste in Cell 1 and 2 by the provision of a drainage system along the interface of the old and new waste (Figure 5). This system will capture leachate generated by the waste in the additional cells. The old waste will also be capped with a layer of clay over the daily cover of the waste, a layer of shale, followed by a layer of subsoil, topsoil and mulch (WALS, 2006).

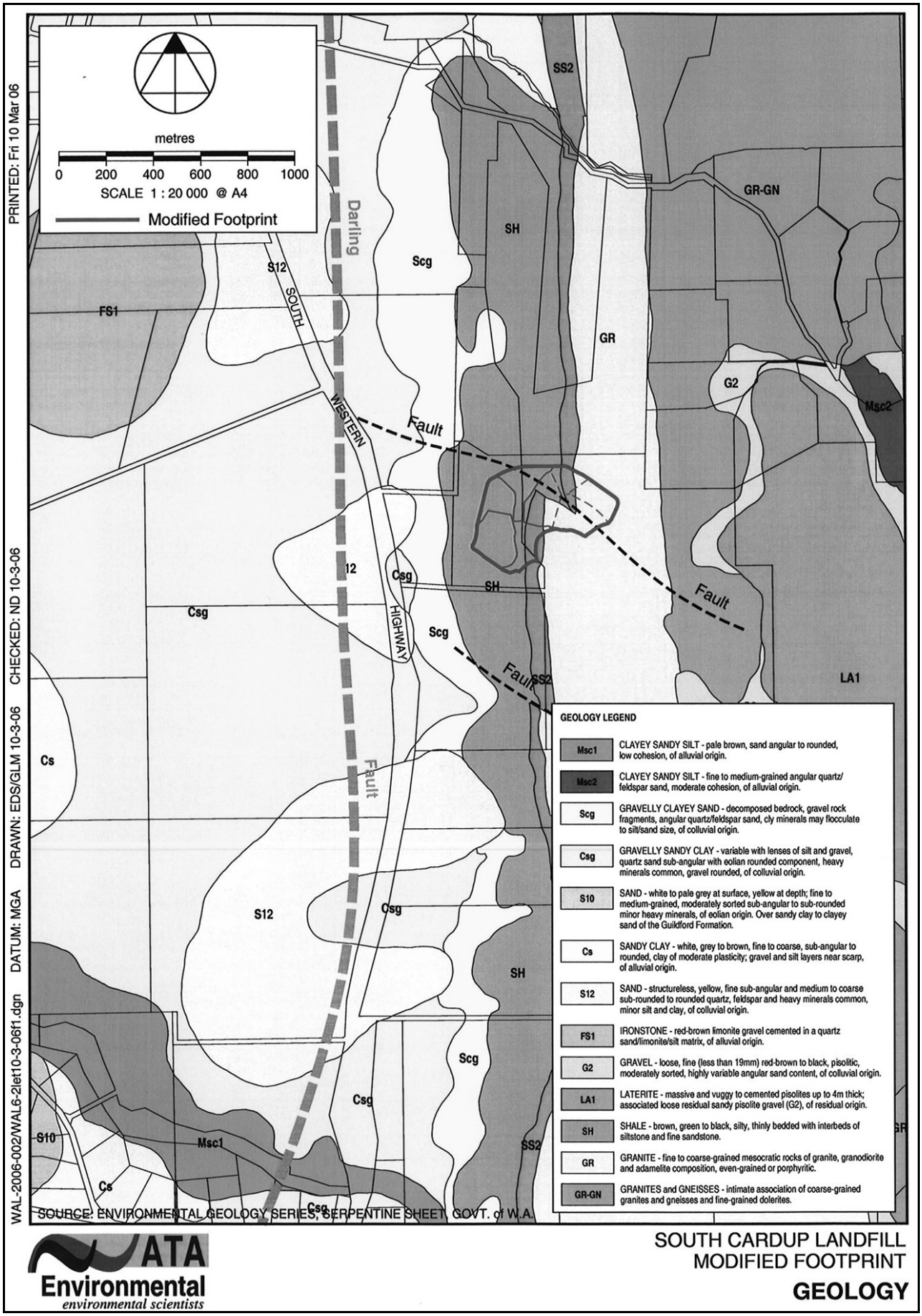

Figure 4: Fault line passing beneath modified landfill footprint

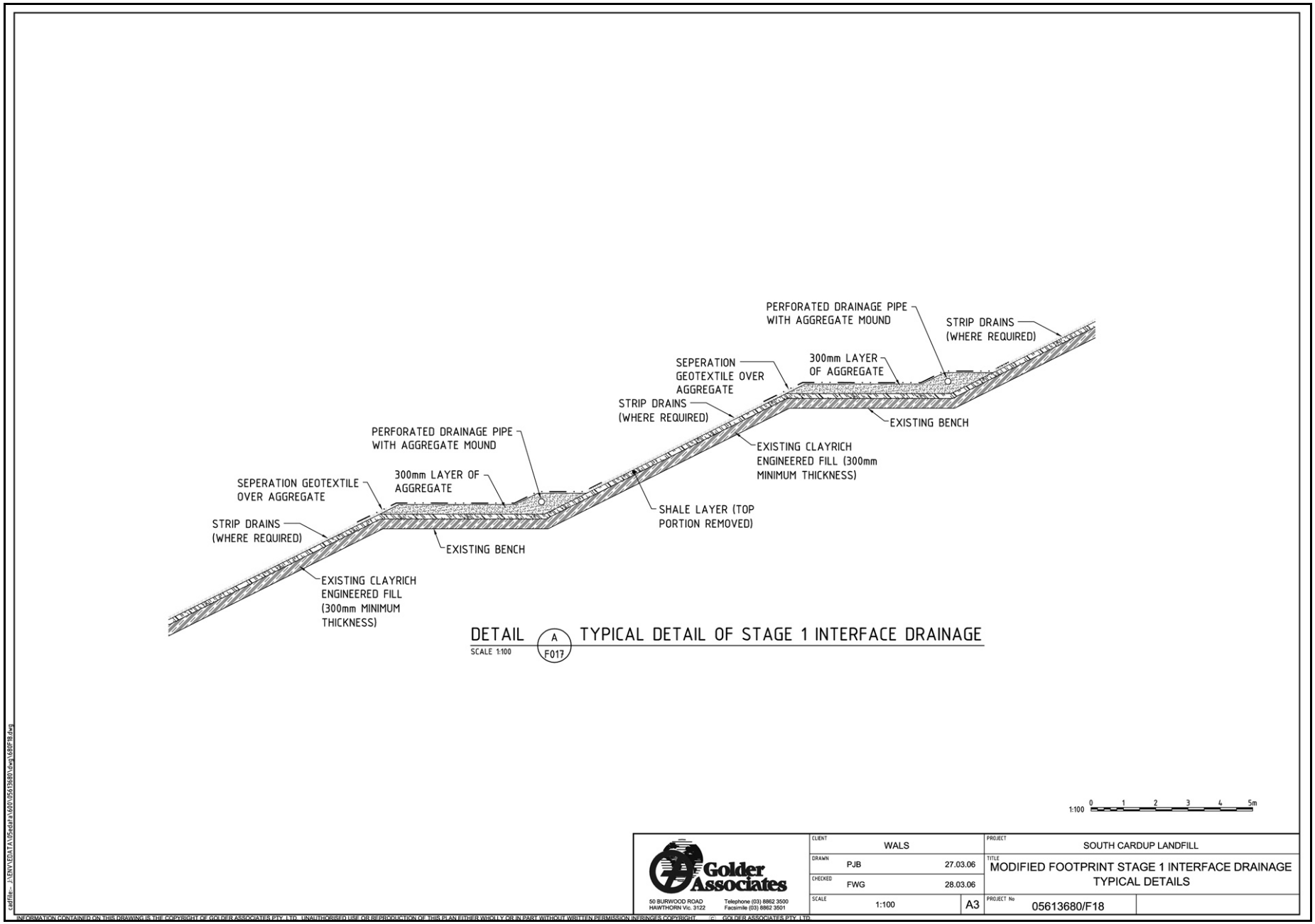

Figure 5: Leachate collection system

The EPA notes that the proposed Cells 7 and 8 will also have the following design features:

- A minimum separation distance of 2m maintained between the base of the Cells 7 and 8 to the highest predicted groundwater table, with compacted engineered fill used to raise the base of Cell 7;
- Separate underdrainage systems retained for the Cells 1 to 7, and Cell 8 if required, to cap the highest groundwater level, which will assist in identifying if any leachate is occurring and its source; and
- A composite lining system consisting of layers of geo-synthetic clay liner (GCL) and 2mm HDPE liner.

The drainage and capping systems should minimise the potential for any leachate from the new waste to flow into the Stage 1 cells. The EPA notes that the new cells are to be constructed to a standard suitable for Class III waste.

The EPA considers that the risk of contaminants migrating to the high permeability groundwater areas has been minimised with the appropriate design of the liners, capping, underdrainage and leachate collection systems. The risk of offsite impacts from the contaminant by transport through these high permeability areas can also be reduced through an appropriate monitoring and management program, which can be required under Part V of the EP Act.

The notes that the proponent has provided a preliminary contingency plan to manage contaminated ground and underdrainage water and that, on the advice of DoE, the operation and monitoring of the landfill can be managed under Part V of the EP Act.

Summary

Having particular regard to the:

- Geotechnical investigations conducted by Golder and Associates;
- Advice and review of consultants' reports from DoE;
- Engineering and geotechnical design of the proposed landfill cells;
- Latest available surface and ground water results from GHD;
- Monitoring plan of WALS; and
- Requirements under Part V of the EP Act,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

4.2 Post Closure Management

Description

The current site operates under the terms of a Landscape Management Plan that describes how each stage of the landfill will be capped and rehabilitated to produce a stable vegetated landform that blends with the surrounding areas (WALS, 2006). Rehabilitation of Stage 1, which has reached final design height and been capped and covered with topsoil, will commence during this winter.

The modified footprint proposal has been developed so that there is no increase in the maximum design height and results in shallower slopes on the embankments (WALS, 2006). This modification should result in a more stable final landform, simplify the process of rehabilitation and allow a better cover of vegetation to be achieved more quickly.

The Landfill Decommissioning and Post-Closure (LDPC) Management Plan sets out the proposed process by which operational landfill areas will be progressively shut down and managed beyond the active life of the landfill.

The following table sets out the main activities within this management plan:-

No.	Item	Comment
1	Final waste placement	Selected waste placement within 5m of landfill external profile.
2	Landfill profile	Maximise airspace and achieve manageable, sustainable slopes.
3	Closure- Leachate extraction and management	Cap landfill as soon as possible. Evaporation in summer. Recirculation in winter.
4	Closure - Landfill gas extraction and management	Progressive installation of gas extraction network. Final drilling of extraction wells in completed landfill. Initial flaring of landfill gas, then power generation once sufficient gas is generated.
5	Closure – Landfill capping	Cap landfill as soon as possible. Current clay cap. Monitoring capping technology, and change current capping method if deemed suitable.
6	Closure – Site rehabilitation	Rehabilitation of the whole site. Removal of man-made improvements and rehabilitate with natural vegetation.
7	Post closure management	Leachate management and monitoring. Landfill gas extraction, power generation/flaring and monitoring. Waste settlement monitoring. Cap and vegetation maintenance. Surface water system maintenance. Surface and groundwater monitoring. Weed control and site revegetation.
8	Assurances & Post Closure Management Plan Funding	Decommissioning and post closure funding $1.69 per tonne received. Independent risk assessment determines bank guarantee amount to cover emergency contingencies and long-term risks associated with the landfill operation. Certificate of Compliance from DoE and independent audit report deems site inert prior to transfer of land.
9	Reporting	Annual reports to Department of Environment and Shire of Serpentine Jarrahdale, copies to relevant stakeholders.

The details of post-closure activities are discussed by the proponent in Appendix 8 of the referral document (WALS, 2006).

Assessment

The EPA's environmental objective for this factor is to:-

- ensure that landfills are rehabilitated to minimise the seepage of water into the landfill and maximise the collection and oxidation of landfill gas from the landfill;
- ensure that as far as practicable, the post-closure landform is stable, and is integrated into the surrounding environment;
- establish a self-sustaining vegetation cover of local species for the landfill; and
- manage the site after closure so that environmental protection and monitoring systems are maintained until the landfill has stabilised.

The EPA notes on advice from the DoE that while landfilling ceased on Stage 1 in March 2005, rehabilitation is not likely to commence until winter 2006, which is a significant delay. The EPA considers that to minimise dust and visual impacts the landfill rehabilitation should be progressive, where practicable, and not be delayed until the end of each stage.

The EPA notes the proponent's commitment to the rehabilitation and post-closure management of the landfill site, in particular leachate management, monitoring of surface and groundwater quality, and financial assurance. This commitment is outlined in the Landfill Decommissioning and Post-Closure (LDPC) Management Plan issued in November 2004, revised in January 2005. Advice from DoE suggests that active management of the landfill could be necessary for several decades (30-50 years) after closure.

The "Post Closure – Monitoring of Surface and Groundwater Quality" section of the LDPC Management Plan outlines the proposed post closure monitoring program for surface and groundwater. As arsenic and dissolved methane have been detected in the latest round of monitoring data, these two parameters should be added to the six-monthly surface and groundwater post-closure monitoring program.

In addition, weekly or monthly monitoring of the surface water discharge off-site, particularly for Total Suspended Solids (TSS) and Total Dissolved Solids (TDS), should be undertaken prior to the establishment of vegetation to ensure minimal erosion occurs.

The EPA considers any potential offsite contamination past the active landfill lifespan can be managed with ongoing post closure monitoring of the ground and surface water and with the provision of the financial guarantee for proponent to bear costs associated with post closure monitoring and management of the landfill until the landfill stabilises. The EPA recommends a condition requiring the proponent to update and regularly revise the LDPC Management Plan for the landfill (Condition 7, Appendix 3)

Summary

Having particular regard to the:

- Proponent's LDPC Management Plan; and
- Advice from DoE;

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor, provided that a suitable LDPC Management Plan is developed in consultation with the DoE, DoW and Shire of Serpentine-Jarrahdale, and implemented to the satisfaction of the EPA.

5. Conditions and Commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

5.1 Proponent's commitments

The proponent's commitments as set out in the Referral document and subsequently modified, as shown in Appendix 3, should be made enforceable. These include:

- Preparing and implementing a Flora, Fauna and Vegetation Management Plan that addresses management of the regionally significant vegetation found to the west of the landfill site and other locally significant vegetation;

The EPA notes that the proponent has also made commitments as set out in the Referral document to prepare and implement an Environmental Management Plan, which will include:

- Surface and Groundwater Management Plan;
- Waste Acceptance Management Plan;
- Air Emissions and Dust Management Plan;
- Solid and Liquid Waste Management Plan; and
- Hydrocarbon and Hazardous Material Handling Plan.

Pollution management is regulated under Part V of the EP Act. These commitments can be listed as management actions that are not auditable by DoE.

Revised Commitments

As part of the original assessment of the South Cardup Landfill site, a list of 79 commitments was recommended. The EPA recommends that this list of commitments be revised under the assessment of this modified footprint proposal. Most commitments are management actions and/or can be managed under Part V of the EP Act. A summary of the revision and recommendations is outlined in Appendix 2: Revised Proponent Commitments.

5.2 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by WALS to modify the footprint of the South Cardup landfill, by joining Stages 1 and 2 together into a single mound is approved for implementation. The original proposal to construct the South Cardup landfill was formally assessed as a Public Environmental Review (PER) and the report, Bulletin

702, was released in September 1993 (EPA, 1993). The Minister approved the proposal on the 9 May 1994, subject to Ministerial Statement 354. Recommended changes to conditions in Ministerial Statement 354 are collated in Appendix 2.

The proponent shall continue to implement the original approved proposal with the exception of matters superseded by this revised modified footprint proposal.

The conditions applied to the revised proposal are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) that the proponent shall fulfill the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3;

(b) a requirement to develop, and implement to the satisfaction of the EPA, a Closure Management Plan, in consultation with the DoE, DoW and Shire of Serpentine-Jarrahdale, at least 2 years prior to closure that includes but not limited to:
   - The progressive establishment and maintenance of shallow rooted native vegetation, local to the area that blends in with the surroundings, on completion of each landfill cell. Vegetation choice should also be made in consultation with CALM;
   - Choice of capping materials that are consistent with Best Practice Guidelines, which shall include a low permeability layer, followed by a sub-soil layer and a final layer of soil suitable for vegetation establishment;
   - Ongoing operational practice to ensure the final landfill surface will be constructed to a predetermined crossfall to enhance surface runoff while safeguarding against erosion and to ensure that final contours of the site will blend into the surrounding environment;
   - Monitoring and management of ground and surface water; and
   - Response, mitigation and contingency measures to be implemented if ground and surface water quality is affected to an unacceptable level as determined by the EPA.

6. Other Advice

Current leachate management practice

The EPA recommends that the current leachate management practice is reviewed under the provisions of Part V of the EP Act. At present leachate is recycled to Stage 1 of the landfill in winter, while it is evaporated from the leachate ponds in summer. The recycling of leachate into the waste helps maintain the generation of methane and speeds up the decomposition of the waste. However, as it appears that there is a leakage in Stage 1, the amount of leachate recycled and the prevention of channelling within the waste need to be managed. Addition of excess leachate should be avoided.

Financial assurance

The EPA notes that Ministerial Statement 354, issued for the implementation of the original South Cardup landfill project, included a commitment by the proponent to provide a financial assurance to the Shire of Serpentine-Jarrahdale. The assurance was to cover emergency contingencies and long-term wishes for the project.

The EPA supports the provision of a financial assurance to the Shire for this purpose. However, a more appropriate mechanism for the requirement of the financial assurance would be a condition on the planning approval issued by the Shire. Therefore this commitment has not been included in the recommended condition statement.

Adequate buffer zone

The EPA notes that an application has been made to the Shire of Serpentine-Jarrahdale to rezone land to the southwest of the landfill from urban deferred to urban. The Shire should note that a 500m buffer is recommended between Class II / III landfills and residential areas.

Rezoning of this area may allow residential development to encroach into the recommended buffer zone.

7. Conclusions

The EPA has considered the proposal by to West Australian Landfill Services Pty Ltd (WALS) to modify the footprint of the South Cardup landfill, by joining Stages 1 and 2 together into a single mound. This included an additional footprint area of approximately 4 ha between Stage 1 and Stage 2, as well as a decrease in the Stage 2 area leading to an overall increase in landfill footprint area of 2.8 ha.

The EPA considers that the risk of groundwater contamination is low with the appropriate design of the liners and leachate management and can be managed through appropriate monitoring program and contingency plans and through Part V of the EP Act.

In terms of post closure management, the EPA considers that the long-term management of the landfill can be managed through the implementation of a suitable Landfill Decommissioning and Post-Closure Management Plan and proponent's commitments, which include financial assurances.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation of the recommended conditions and proponent's commitments set out in Section 5.

8. Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is for the modification of the footprint of the South Cardup landfill by joining Stages 1 and 2 into a single mound by the addition of Cells 7 and 8 to increase the landfill footprint area by 2.8ha;
2. That the Minister considers the report on the relevant environmental factors as set out in Section 4;

3. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 3, including the proponent's commitments; and
4. That the Minister imposes the conditions and procedures recommended in Appendix 3 of this report.

Appendix 1

References

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Appendix 2

Table of Revised Proponent Commitments and Conditions

Revised Conditions

No	Conditions	Status
1	Proponent Commitments	Addressed in revised Condition 2
2	Subsequent Stages	Not required as Stage 3 will not be implemented
3	Implementation	Addressed in revised Condition 1
4	Environmental Management Programme	Managed under Part V of the Environmental Protection (EP)Act
5	Environmental Waste Acceptance Criteria	Completed. Managed under Part V of the Environmental Protection (EP)Act
6	Noise Limits	Managed under WA Environmental Protection (Noise) Regulations 1997
7	Control and Management of the Site	Managed under Part V of the Environmental Protection (EP)Act
8	Long-term Environmental Integrity of the Site	Addressed in revised Condition 7
9	Proponent	Addressed in revised Condition 3
10	Time Limit on Approval	Addressed in revised Condition 4
11	Compliance Auditing	Addressed in revised Condition 5

Revised Commitments

No	Commitments	Status
General Commitments		
1	The Proponent will adhere to the proposal as described in the Public Environmental Review (PER) and as assessed by the Environmental Protection Authority (EPA), and will fulfil the commitments made therein and summarized below.	Deleted from revised commitments
2	The Proponent will develop, operate and manage the proposed sanitary landfill to the satisfaction of all relevant Government agencies including the following: • EPA; • Health Department; • Water Authority; • Department of Conservation and Land Management; and • Shire of Serpentine-Jarrahdale.	Deleted from revised commitments
3	As the proposed landfill is intended as a secure facility for the disposal of municipal, commercial and industrial waste only, the Proponent will ensure that hazardous, liquid and soluble chemical waste or other forms of intractable wastes will be excluded from the site.	Deleted from revised commitments
4	The Proponent will provide a contribution of $20 000 towards the provision of a transfer station at the existing Mundijong landfill to obviate the need for direct public access to the tipping face of the Southern Landfill.	Completed – Contribution of $75 000 made.
Industrial Waste		
5	The Proponent will submit an assessment procedure that determines the acceptability (or otherwise) of various classes and types of industrial waste at this facility for approval by the Health Department of Western Australia and the Environmental Protection Authority. Only industrial waste that meets the acceptability requirements will be disposed of at the landfill. Forming part of the screening program will be elutriation and flash point testing and the installation of radiation detection equipment.	Managed under Part V of the Environmental Protection (EP) Act 1986
Design Features		
6	The landfill will be designed and constructed in accordance with accepted engineering practice fro landfills, to the satisfaction of the Shire of Serpentine-Jarrahdale. Where necessary, slope stability analyses of constructed walls and bunds will be undertaken to verify their integrity.	Managed under Part V of the EP Act 1986
7	The Proponent will progressively develop the landfill as a series of cells. The first cell will be sized to accommodate two years' refuse, followed by cells	Managed under Part V of the

	sized to accommodate one years' refuse, in accordance with the staging plan included in the PER.	EP Act 1986
8	The Proponent will maintain a vegetated buffer zone with a minimum of 50m in wirdth around the perimeter of the landfill site. The buffer zone will be comprehensively landscaped and will contain a perimeter fence and a firebreak track. A landscaping plan shall be prepared, which shall be developed to achieve the following objectives: (i) that initial planting is undertaken between the landfill and neighbouring properties, and the landfill and the South-Western Highway in the planting season before or immediately following the commencement of site development earthworks, whichever is the earlier; and (ii) to provide vegetative cover on the bund walls and other earth structures as soon as practical following construction or final contouring, to minimise visual impact; (iii) to allow integration with the longer term Post-Closure Plan. The landscaping plans will be submitted to the Shire of Serpentine-Jarrahdale for approval withint six months of the granting of all the necessary approvals to commence landfilling operations. All initial plantings will be maintained at all times. Failed plantings will be replaced immediately to the satisfaction of the Shire of Serpentine-Jarrahdale.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
9	The Proponent will implement site security measures to control vandalism, theft and illegal dumping, including the construction of a 1.8m high wire mesh with lockable gates around the landfill facilities.	Managed under Part V of the EP Act 1986
Development and Operational Features – Site Preparation		
10	The Proponent will ensure that prior to the commencement of construction of the landfill cells, the final excavated surface is graded to allow gravity drainage across each of the landfill cells.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
11	During the development of landfill cells, the Proponent will ensure that a 1m thick compacted clay liner wil be constructed over the excavated surface. A 300mm drainage blanket will be installed on the upper surface of the clay liner as part of the process of constructing the liner (refer to Commitment 17)	
12	The Proponent will ensure that clay sources used in construction of the landfill cells will meet the following specifications, under laboratory conditions: • In situ permeability of 1 x 10^{-9}m/s or less when clay is placed and compacted; and • Gypsum content of less that 1%.	Managed under Part V of the EP Act 1986
13	The Proponent will engage specialist geotechnical consulting engineers to perform Quality Assurance/Quality Control (QA/QC) in the selection of clay and construction of the clay liner. A QA/QC report will be prepared for the clay liner of each cell for submission to the EPA and Health Department of Western Australia which certifies that the liner has been constructed to meet the permeability requirements with materials that have been tested and found suitable.	Managed under Part V of the EP Act 1986
14	The Proponent will ensure that, during development of the landfill cells, the liner will be constructed and compacted in thin layers (no more than 300 mm loose thickness) and density and moisture content will be controlled by continuous compaction testing.	Managed under Part V of the EP Act 1986

15	The Proponent will ensure that, prior to deposition of refuse within a landfill cell, a starter embankment of 2 m in height will be constructed around the perimeter of the liner to prevent leachate and stormwater from leaving the active cell. Construction techniques and controls for the starter embankment will be similar to those applying to the clay liner.	Managed under Part V of the EP Act 1986
16	The Proponent will ensure that, on completion of the clay liner and starter embankment, a 300mm thick sand or gravel cover (the drainage blanket will be placed to provide protection against cracking of the clay material resulting in desiccation.	Managed under Part V of the EP Act 1986
17	In the event that a suitable clay source for construction of the basal liner of a landfill cell or cells and the starter embankment, is not accessible, the Proponent will utilize a synthetic barrier membrane to seal the landfill cell or cells. In this event, the Proponent will submit a supplementary report to the EPA and Health Department specifying the liner system to be used and explaining the leachate collection system to be installed. This report would be submitted to the EPA and Health Department prior to commencement of construction of the cell or cells in which the alternative lining system was to be installed, and construction of the cell or cells will not commence until the EPA and Health Department are satisfied that the systems proposed as acceptable. The Proponent will endeavour to place a layer of refuse over the completed drainage blanket at the earliest opportunity to provide additional protection against dehydration of the clay liner.	Managed under Part V of the EP Act 1986
Development and Operational Features – Leachate Collection		
18	The Proponent will ensure that a leachate collection system comprising a 300mm deep permeable (permeability rating of 1×10^{-1} cm/s or more) drainage blanket is placed immediately above the basal clay liner. A series of drains consisting of high strength drain coil pipe will be installed in this layer, leading to a collection sump within each stage of the landfill. Leachate will be pumped from the sump to permanent leachate treatment tanks. The system will be designed to the satisfaction of the relevant authorities.	Managed under Part V of the EP Act 1986
19	The Proponent will ensure that leachate collection drains will gravity feed to a sump (lined with HDPE and filled with 20mm gravel screenings) located within each stage of the landfill constructed integrally with the clay liner. The design storage volume of the sump will be determined by suitable modelling, to the satisfaction of the Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
20	The Proponent will ensure that leachate will be recirculated through the refuse through a series of slotted pipes buried during landfilling or by trickle irrigation of the internal surfaces of the active landfill cell.	Managed under Part V of the EP Act 1986
21	The Proponent will ensure that prior to depositing refuse in a newly constructed cell the leachate collection pipes are connected into the existing leachate collection system serving the completed cells allowing flow to the leachate sump within each Stage of the landfill.	Managed under Part V of the EP Act 1986
22	The Proponent will initially construct a permanent leachate treatment tank(s) to service all landfill cells within Stages 1 and 2. A second permanent leachate treatment tank will be constructed for Stage 2. The leachate treatment tank(s) will be covered and bunded appropriately. The leachate treatment tank(s) will be sized according to the results of the computer modelling to estimate leachate generation.	Managed under Part V of the EP Act 1986
23	As part of the normal site operational practice, the Proponent will pump leachate from the leachate sump of each Stage as required to the leachate treatment tank, or recirculate the leachate throught the landfill as described earlier. Leachate within the treatment tank may be returned to the active landfill cell during dry periods for disposal through recirculation, or transferred to tanker trucks for off-site disposal.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.

Development and Operational Features – Placement and Compaction of Refuse		
24	During operation of the site, the Proponent will ensure that refuse will be progressively placed and compacted into thin layers to maximize the compacted refuse density.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
25	During operation of the site, the Proponent will ensure 'Daily' cover (clean soil or other suitable material) is applied over the exposed surfaces at the active landfill area in layers (not less than 150mm in the case of soil) so that there will be no exposed garbage at the end of the day. The Proponent will apply 'Intermediate' cover to the top of the active landfill area and to surfaces which will be exposed to the environment for periods greater than six weeks in layers of not less than 300mm.	Managed under Part V of the EP Act 1986
Development and Operational Features – Cell Completion		
26	The Proponent will ensure that, upon completion of refuse deposition, landfill cells will be covered with a 300mm layer of low permeability clay over the Intermediate cover. A further 300mm layer of sub-soil and a final 100mm layer of soil suitable for vegetation establishment will be placed over the low permeability clay layer.	Included in the Closure Management Plan as part of conditions
27	The Proponent will ensure that, as part of on-going operational practice, the final landfill surface will be constructed to a predetermined crossfall to enhance surface runoff while safeguarding against erosion and to ensure that final contours of the site will blend into the surrounding environment.	Included in the Closure Management Plan as part of conditions
28	The Proponent will ensure that, on completion of each landfill cell, shallow rooted native vegetation (in accordance with advice from the Department of Conservation and Land Management and the Shire of Serpentine-Jarrahdale) will be established and maintained.	Included in the Closure Management Plan as part of conditions
Development and Operational Features – Surface Water Runoff		
29	During the active operation of a landfill cell, all surface water runoff from within the active cell will be treated as leachate and the Proponent will ensure that it will be collected and disposed of through the leachate drainage system.	Managed under Part V of the EP Act 1986
30	The Proponent will ensure that a site drainage system will direct runoff water from areas outside the landfill boundary, undeveloped areas within the landfill boundary and from the rehabilitated surfaces of completed landfill cells, away from the active tipping areas. Water from this system will not have contacted refuse, and therefore it will be uncontaminated and may directly discharge into the stream.	Managed under Part V of the EP Act 1986
Development and Operational Features – Road Construction and Maintenance		
31	The Proponent will ensure that, from the outset of the landfill operation, all roads to be used by visitors to the site will be sealed (up to the gatehouse).	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1. The DoE advises that this commitment is completed.
32	The Proponent will ensure that surface runoff from internal roads within the	Managed under

	landfill site will not contact refuse and will be directed to the on-site sedimentation pond.	Part V of the EP Act 1986
33	The Proponent will ensure that a water tanker will be permanently on-site and available for dust suppression on all unsealed trafficked areas during dry periods or as required.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
Development and Operational Features – Wheel Cleaning Facilities		
34	As part of the initial site development, the Proponent will ensure that a wheel cleaning drive through is installed on the egress from the landfill cell area to dislodge debris and sediment from vehicle wheels. Debris collected in the sump will be regularly removed and disposed of within the active landfill cell. Contaminated water within the drive-through will be treated as leachate.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1. The DoE advises that this commitment is completed.
Management of Environmental Impacts – Water Resources		
35	The Proponent will ensure that an underdrain is constructed beneath the low permeability liner where required to collect and divert water egressing from the fractured granite to the sedimentation pond.	Managed under Part V of the EP Act 1986
Management of Environmental Impacts – Odours		
36	The Proponent will ensure that particularly odorous refuse will only be accepted at the landfill by prior arrangement and that any such material received will be covered immediately.	Managed under Part V of the EP Act 1986
Management of Environmental Impacts – Litter		
37	The Proponent will ensure that any landfill related litter along the site access routed within a 2km radius of the site is removed at least weekly.	Managed under Part V of the EP Act 1986
38	The Proponent will ensure that, as part of normal operational practices, portable litter control screens will be placed in the vicinity of the active tipping face to intercept any material blown from the tipping face.	Managed under Part V of the EP Act 1986
39	The Proponent will ensure that, as part of normal operational practices, any litter blown from the tipping face and intercepted by the portable screens, the site security fence or perimeter vegetation will be collected daily and returned to the tipping face.	Managed under Part V of the EP Act 1986
Management of Environmental Impacts – Noise		
40	The Proponent will ensure that all vehicles and machines operating at the landfill site and which are under its control will be fitted with effective exhaust system silencers.	Managed under WA Environmental Protection (Noise) Regulations 1997
41	The Proponent will limit the daily hours of operation of the landfill between 0600 and 1800 hours Monday to Saturday and 1000 and 1600 hours on Sundays.	Not required as commitment is part of proposal and therefore needs to be implemented as

		required in Condition 1-1.
Management of Environmental Impacts – Dust		
42	The Proponent will, during initial site development and as part of normal operational practices, ensure the stabilization by vegetation or other means of disturbed areas not immediately needed for landfill operations.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
43	As part of normal operational practices, the Proponent will ensure that any unsealed trafficked areas are watered as necessary to lay dust.	
44	As part of normal operational practices, the Proponent till ensure that: • Active tipping area will be dampened (either by leachate irrigation or water application) as necessary to lay dust; and • Overburden, cover material stockpiles will be stabilized with temporary cover vegetation, mulching, watering or other technique to suppress dust generation.	
Management of Environmental Impacts – Pests		
45	The Proponent will ensure that, as part of normal operational practices, any large appliances, crates etc, placed in the active tipping area will be specifically crushed before covering with refuse and cover material, and that any tyres dumped, unless shredded or split, will be spread out and carefully covered.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
46	The Proponent will implement supplementary control measures directed towards specific pest species on an as required basis in conjunction with and to the satisfaction of the EPA, Water Authority, Department of Conservation and Land Management, Shire of Serpentine-Jarrahdale or other regulatory authority.	
Management of Environmental Impacts – Landfill Gas Management		
47	Prior to the commencement of tipping operations, the Proponent shall prepare a methane gas management plan which addresses monitoring, collection, disposal and potential beneficial uses of landfill gas to the satisfaction of the EPA and the Health Department of Western Australia. Initially, gas will be disposed of by flaring. When monitoring results indicate that action to manage landfill gas emissions is warranted, the Proponent will implement the methane gas management plan to the satisfaction of the EPA on advice of the Health Department of Western Australia. The Proponent will liaise with the relevant authorities regarding beneficial uses of landfill gas over the operating and post-closure life of the landfill.	Managed under Part V of the EP Act 1986
Management of Environmental Impacts – Fire		
48	The Proponent will ensure that, from the outset of the landfill operation, site operational and management practices will not include utilization of fire except for the controlled flaring of landfill gas.	Managed under Part V of the EP Act 1986
49	The Proponent will ensure that from the outset of the landfill operation, adequate manpower and machinery resources to combat any fires which may occur within the landfill site will be maintained on-site during operating hours.	Managed under Part V of the EP Act 1986
50	The Proponent will make the water tanker truck available to the Shire of Serpentine-Jarrahdale or the Bush Fires Board to assist in fighting fires subject to the proximity of the problem and the Proponents needs at that time.	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
Environmental Monitoring – Water Resources		
51	The Proponent will progressively construct a series of dedicated groundwater monitoring bores to specifications acceptable to the EPA and the Geological Survey Division of the Department of Minerals and Energy. It is anticipated that monitor bored will need to be installed on the basis of geological considerations to ensure effective groundwater monitoring along sections of the	Managed under Part V of the EP Act 1986

	site boundary down hydraulic gradient from areas used for landfilling.	
52	On commissioning of each monitor bore and prior to the commencement of tipping, groundwater will be sampled and analysed for a range of potential contaminants to provide background information on groundwater quality. Parameters determined will include pH, salinity (as TSD), redox potential, major ions, nutrients, total organic carbon, and heavy metals to the satisfaction of the EPA on advice from the Chemistry Centre and the Water Authority of Western Australia	Managed under Part V of the EP Act 1986
53	The Proponent will implement a programme of regular sampling from the monitor bores. This programme will be determined by the site hydrogeological considerations and to the satisfaction of the EPA and other relevant authorities, although, initially, sampling on a three-monthly basis is envisaged. Water samples collected will be analysed for a select range of parameters. These will include pH, salinity (as TDS), zinc, total organic carbon, five-day biochemical oxygen demand, ammonia-nitrogen, and total alkalinity to the satisfaction of the EPA on advice from the Chemistry Centre and the Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
54	The Proponent will sample privately owned bored on selected properties in the vicinity of the landfill, initially on an annual basis, and analyse samples for a select range of parameters. These will include pH, salinity (as TDS), and ammonia-nitrogen to the satisfaction of the EPA on advice from the Chemistry Centre and the Water Authority of Western Australia.	Not an enforceable commitment as sampling of privately owned bores is beyond proponent's control.
55	Groundwater samples will be collected and analysed in accordance with recognized standard procedures, and to the satisfaction of the EPA and Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
56	If monitoring indicates that groundwater quality is being affected to an unacceptable degree, as determined by the EPA, the Proponent shall prepare a strategy for clean-up of groundwater contamination, to the satisfaction of the EPA on advice of the Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
57	The Proponent shall implement the strategy for clean-up of groundwater contamination required by Commitment 56 (above) to the satisfaction of the EPA on advice from the Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
58	Should groundwater analyses indicate contamination by landfill leachate, the Proponent will immediately undertake further sampling and analysis for a more extensive range of parameters in consultation with, and to the satisfaction of, the EPA and the Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
59	Any complaint about a deterioration in groundwater quality reasonably attributable to the landfill operation will be immediately investigated by the Proponent in consultation with, and to the satisfaction of, the EPA and the Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
60	The Proponent will implement a programme of regular water sampling of the sedimentation pond, into which groundwater collected by the landfill underdrain flows. Water samples collected will be analysed for the same parameters as for samples taken from the groundwater monitoring wells to the satisfaction of the EPA on advice from the Chemistry Centre and the Water Authority of Western Australia.	Managed under Part V of the EP Act 1986
61	As soon as leachate is detected in the leachate collection sump, and thereafter in conjunction with the groundwater monitoring programme, samples will be collected and analysed for comparison with anticipated leachate chemistry. Continuing sampling and analysis will be co-ordinated with the groundwater monitoring programme, and analysitcal results will be included in the periodic performance reports.	Managed under Part V of the EP Act 1986
Environmental Monitoring – Other Environmental Monitoring		

62	From the outset of the landfill operation, the Proponent will maintain a complaints register in which details of any complaints from local residents, within the Serpentine-Jarrahdale municipality about the landfill operation will be recorded to the satisfaction of the EPA.	Managed under Part V of the EP Act 1986
63	The Proponent will monitor the activity of Silver Gulls at the landfill site, from the outset of landfilling operations, in consultation with, and to the satisfaction of, the Department of Conservation and Land Management.	Not required as not an issue.
64	Following the installation of the landfill gas extraction system, the Proponent will measure landfill gas flow rates at six-monthly intervals. Results will be forwarded directly to the EPA and will also be incorporated into the periodic performance reports.	Managed under Part V of the EP Act 1986
Performance Reporting		
65	The Proponent will submit annual performance reports to the EPA, Health Department and the Shire of Serpentine-Jarrahdale within three months following each anniversary of the commencement of the landfilling operation. These reports will address such matters as: • the stage reached in the various operational and management programmes being implemented; • results from monitoring programmes instituted, including the complaints register, and the response to any complaints received; • modifications to the various programmes that have been implemented in response to monitoring results; and • any unforseen or extraordinary event associated with the landfill that has adversely affected off-site environmental quality (and the Proponent's response to that event) occurring during the preceding twelve months. The final report submitted during a reporting period will provide a detailed review of performance over the entire period and of any modifications to operational and management programmes intended.	Included as part of condition 5.
66	The Proponent will respond, through an interactive process with the EPA, Health Department and the Shire of Serpentine- Jarrahdale, to any issues those agencies may raise following receipt of the performance reports.	Deleted from revised commitments
67	At the same time that periodic performance reports are submitted to the EPA, Health Department and Shire of Serpentine-Jarrahdale, the Proponent will make the reports available to relevant community organizations within the Shire of Serpentine-Jarrahdale.	Included as part of condition 5.
68	Any unforeseen of extraordinary events associated with the landfill that adversely affect off-site environmental quality, and the Proponent's response to any such even will be reported immediately (by the Proponent) to the EPA, Health Department and Shire of Serpentine-Jarrahdale.	Managed under Part V of the EP Act 1986
Contingency Planning		
69	The Proponent will submit, for review by and approval from the Shire of Serpentine-Jarrahdale prior to commencement of landfilling activities, a contingency plan for emergency situations after consultation with the Shire of Serpentine-Jarrahdale, EPA, Health Department of Western Australia, Bush Fires Board, Water Authority of Western Australia and the Department of Conservation and Land Management.	Completed. Included as part of condition 7.
70	The Proponent will respond to any unforeseen contingency associated with the landfill and which is producing a demonstrable and unacceptable off-site impact in consultation with the EPA, Health Department of Western Australia, the Shire of Serpentine-Jarrahdale, and to the satisfaction of the Minister for the Environment as appropriate.	Managed under Part V of the EP Act 1986
Management Following Closure		

71	The Proponent recognizes that certain management responsibilities will continue following closure of the landfill site and will ensure that such responsibilities will be discharged in consultation with the relevant regulatory authorities (presently the EPA and the Health Department of Western Australia).	Not required as commitment is part of proposal and therefore needs to be implemented as required in Condition 1-1.
72	The Proponent shall be responsible for construction, operation, decommissioning and post-closure management of the site until such time as the waste has fully degraded, to the satisfaction of the EPA.	
73	Within two years after the date of commencement of construction, the Proponent shall prepare a draft decommissioning and post-closure management plan, to the satisfaction of the EPA.	Completed.
74	At least two years prior to closure, the Proponent shall prepare the final decommissioning and post-closure management plan, to the satisfaction of the EPA.	Included in the Closure Management Plan as part of conditions
75	The Proponent shall implement the final decommissioning and post-closure management plan required by Commitment 74, to the satisfaction of the EPA.	Included in the Closure Management Plan as part of conditions
Financial Assurances		
76	Within six months of commencement of landfilling operations, the Proponent will establish financial assurances in favour of the Shire of Serpentine-Jarrahdale to cover emergency contingencies and long-term risks in a form and to an amount acceptable to the EPA, Health Department of Western Australia and the Shire of Serpentine-Jarrahdale.	Can be better managed as a condition on the planning approval issued by the Shire of Serpentine-Jarrahdale.
77	The amount of the financial assurances shall be reviewed every five years by the EPA in consultation with the Shire of Serpentine-Jarrahdale and the Health Department of Western Australia.	
78	Company guarantees, if offered by the Proponent, shall be supported by annual audited account from each guaranteeing entity.	
79	The preparation of the legal agreement relating to the financial assurances shall be executed by the Proponent's solicitors at the Proponent's expense.	

Appendix 3

Recommended Environmental Conditions and Proponent's Consolidated Commitments

RECOMMENDED CONDITIONS AND COMMITMENTS

STATEMENT THAT A REVISED PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

SOUTHERN LANDFILL PROJECT, SOUTH CARDUP
STAGES 1 & 2
MODIFIED FOOTPRINT

Proposal: The footprint modification of the South Cardup landfill, as documented in schedule 1 of this statement.

Stage 2 of the landfill will be reduced by 1.2 hectares, while additional landfill cells, totalling 4 hectares, will be included in the modified footprint. The cells are located in between the Stage 1 and 2 landfills and will lend to an overall increase of 2.8 hectares from the original landfill footprint.

Proponent: West Australian Landfill Services Pty Ltd

Proponent Address: 116 Kurnall Road, WELSHPOOL WA 6106

Assessment Number: 1634

Previous Assessment Number: 741

Previous Statement Number: 354 (published 9 May 1994)

Report of the Environmental Protection Authority: Bulletin 1218

Previous Report of the Environmental Protection Authority: Bulletin 702

The conditions and procedures of this statement supersede the conditions and procedures of Statement No. 354 in accordance with section 45B of the Environmental Protection Act 1986.

The revised proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Proposal Description

1-1 The proponent shall implement the proposal as documented and described in schedule 1 of this statement subject to the conditions and procedures of this statement.

Published on

2 Proponent Environmental Management Commitments

2-1 The proponent shall fulfill the environmental management commitments contained in schedule 2 of this statement.

3 Proponent Nomination and Contact Details

3-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal.

3-2 The proponent shall notify the Chief Executive Officer of the Department of Environment (CEO) of any change of the name and address for the serving of a notice or other correspondence within 30 days of such change.

4 Time Limit of Authorisation

4-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void within five years after the date of this statement if the proposal to which this statement refers is not substantially commenced.

4-2 The proponent shall provide the CEO with written evidence which demonstrates that the proposal has substantially commenced on or before the expiration of five years from the date of this statement.

5 Compliance Reporting

5-1 The proponent shall submit to the CEO Compliance Reports in accordance with a schedule approved by the CEO.

5-2 The Compliance Report shall be prepared in accordance with the CEO's guidelines entitled Compliance Monitoring Guidelines for Proponents, and the Compliance Report shall:

1. describe and provide evidence of the status of the implementation of the proposal;
2. include evidence of compliance with the conditions, procedures and commitments of this statement;
3. provide a review of the effectiveness of corrective and preventative actions contained in the environmental management plans and programs;
4. provide verifiable evidence of the fulfilment of requirements specified in the environmental management plans and programs;
5. identify all confirmed non-conformities and non-compliances and describe the related corrective and preventative actions taken; and
6. identify potential non-conformities and non-compliances and provide evidence of how these are being assessed for corrective action.

5-3 The proponent shall make compliance reports publicly available on request.

6 Performance Review

6-1 The proponent shall submit a Performance Review report every five years after the start of production to the CEO, which addresses:

1. the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives;
2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;
3. significant improvements gained in environmental management, including the use of external peer reviews;
4. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and
5. the proposed environmental objectives over the next five years, including improvements in technology and management processes.

7 Landfill Decommissioning and Post-closure Management Plan.

7-1 The proponent shall update the existing Landfill Decommissioning and Post-closure Management Plan to include the modifications made to the landfill.

7-2 At least two years prior to the anticipated date of closure, or at a time approved by the Environmental Protection Authority, the proponent shall submit a Closure Management Plan designed to ensure that the site is left in an environmentally acceptable condition prepared on advice of the Environmental Protection Authority, for approval of the Department of Environment.

The Landfill Decommissioning and Post-closure Management Plan shall address:

1. The progressive establishment and maintenance of shallow rooted native vegetation, local to the area that blends in with the surroundings, on completion of each landfill cell. Vegetation choice should also be made in consultation with the Department of Conservation and Land Management;
2. Choice of capping materials that are consistent with Best Practice Guidelines, which shall include a low permeability layer, followed by a sub-soil layer and a final layer of soil suitable for vegetation establishment;
3. Ongoing operational practice to ensure the final landfill surface will be constructed to a predetermined crossfall to enhance surface runoff while safeguarding against erosion and to ensure that final contours of the site will blend into the surrounding environment;
4. Monitoring and management of ground and surface water; and
5. Response, mitigation and contingency measures to be implemented if ground and surface water quality is affected to an unacceptable level as determined by the Environmental Protection Authority.

7-3 The proponent shall implement the Landfill Decommissioning and Post-closure Management Plan required by conditions 7-1 and 7-2 until such time as the Minister for the Environment determines, on advice of the Environmental Protection Authority, that the proponent's post-closure responsibilities are complete.

7-4 The proponent shall make the Closure Management Plan required by conditions 7-1 and 7-2 publicly available.

Notes

1. The CEO may seek the advice of the Environmental Protection Authority, government agencies and relevant parties, as necessary, for the preparation of written notice to the proponent.

2. The proponent shall relinquish the nomination following the procedure under section 38(6a) of the *Environmental Protection Act 1986*.

3. The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the *Environmental Protection Act 1986*.

Schedule 1

The Proposal (Assessment No. 1634)

The proposal is to modify the footprint of the existing South Cardup landfill by reducing the size of the Stage 2 landfill area by 1.2 hectares and including an area of approximately 4 hectares between the existing footprints between the Stage 1 and Stage 2 areas, including the Sedimentation Dam. The net increase in landfill footprint is 2.8 hectares.

The modified footprint is shown in Figure 2 (attached).

The proponent will also continue to implement the proposal described in the Southern Landfill South Cardup Public Environmental Review document (March 1993) prepared by AGC Woodward-Clyde Pty Limited, except for modifications as described in the revised proposals, Proposed Landfill Footprint Modification South Cardup Landfill (April 2003) and South Cardup Landfill Modified Footprint Supporting Documentation (February 2006), both prepared by ATA Environmental Pty Ltd.

The main characteristics of the original and modified footprint proposals are summarised in Table 1 below.

Table 1 - Key Proposal Characteristics (Assessment No. 1634)

Element	Current	Proposed Modified Footprint
Site Area	39ha	39ha
Landfill Area	Stage 1 – 6.9ha Stage 2 – 7.8ha Total 14.7ha	Combined total – 17.5ha
Landfill Airspace Capacity	Stage 1 – 1.6Mm^3 Stage 2 – 1.0 Mm^3 Total 2.6 Mm^3	Combined total – 4.8 Mm^3
Maximum Landfill Heights	Stage 1 – 173 mAHD Stage 2 – 140 mAHD	Unchanged
Operating Hours for Waste Acceptance	6:00 – 17:00 Monday to Friday 7:00 – 12:00 Saturday 7:00 – 14:00 Public Holidays (excluding Good Friday & Christmas Day)	Unchanged
Operational Life (total)	Stage 1 – 5 years Stage 2 – 3 years Total 8 years	Combined total – 15 years
Nominal Waste Acceptance Rate	225,000 tonnes per year (current)	Unchanged – possible reduction due to future recycling activities.

Abbreviations:

ha – hectares
Mm^3 – mega cubic metres
mAHD – metres Australian height datum

Figures (attached)

1. Location of South Cardup Landfill
2. Landfill cell and surface water management details
3. Cell interface details
4. Fault line passing beneath modified landfill footprint
5. Leachate collection system

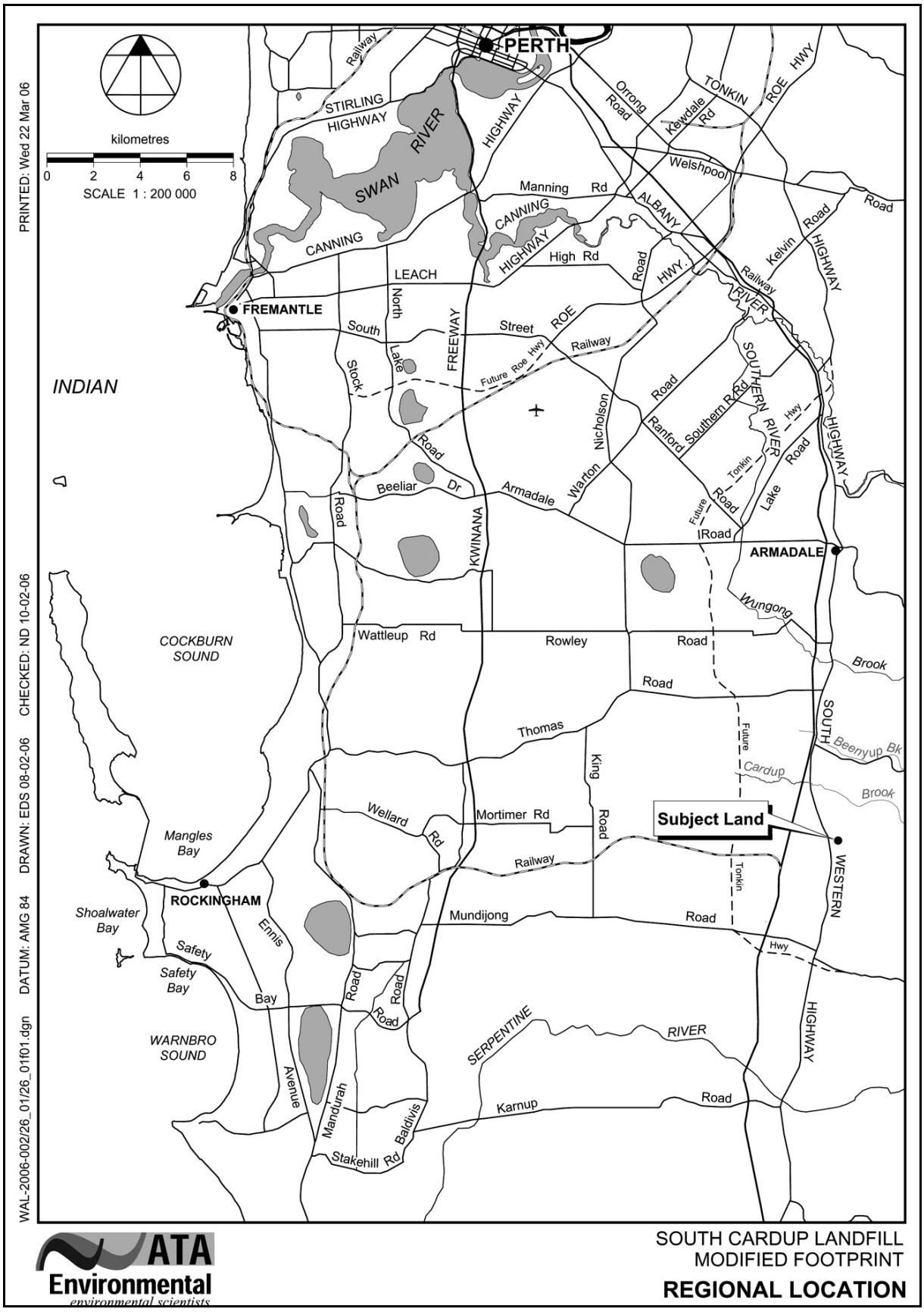

Figure 1: Location of South Cardup Landfill

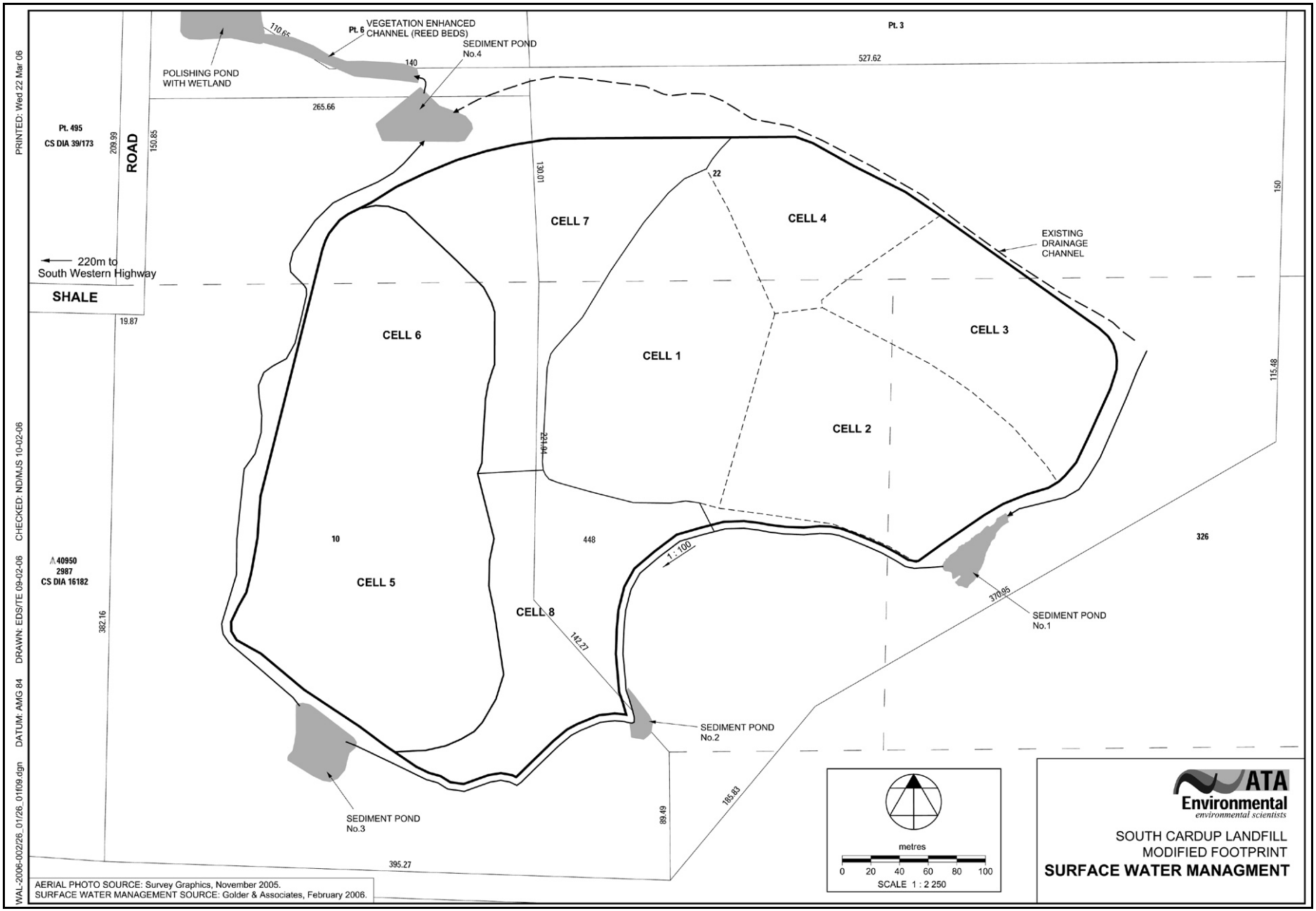

Figure 2: Landfill cell and surface water management details

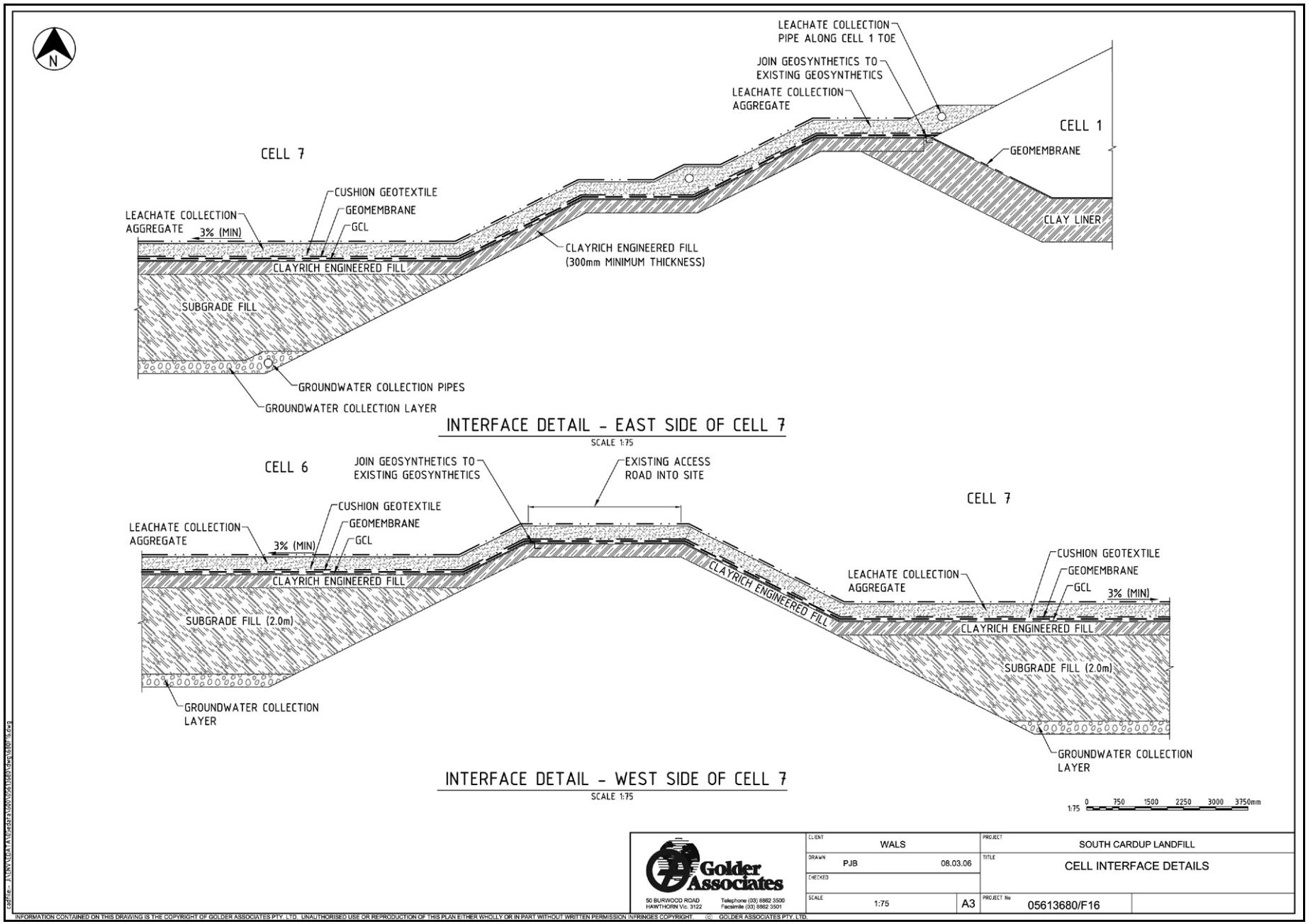

Figure 3: Cell interface details

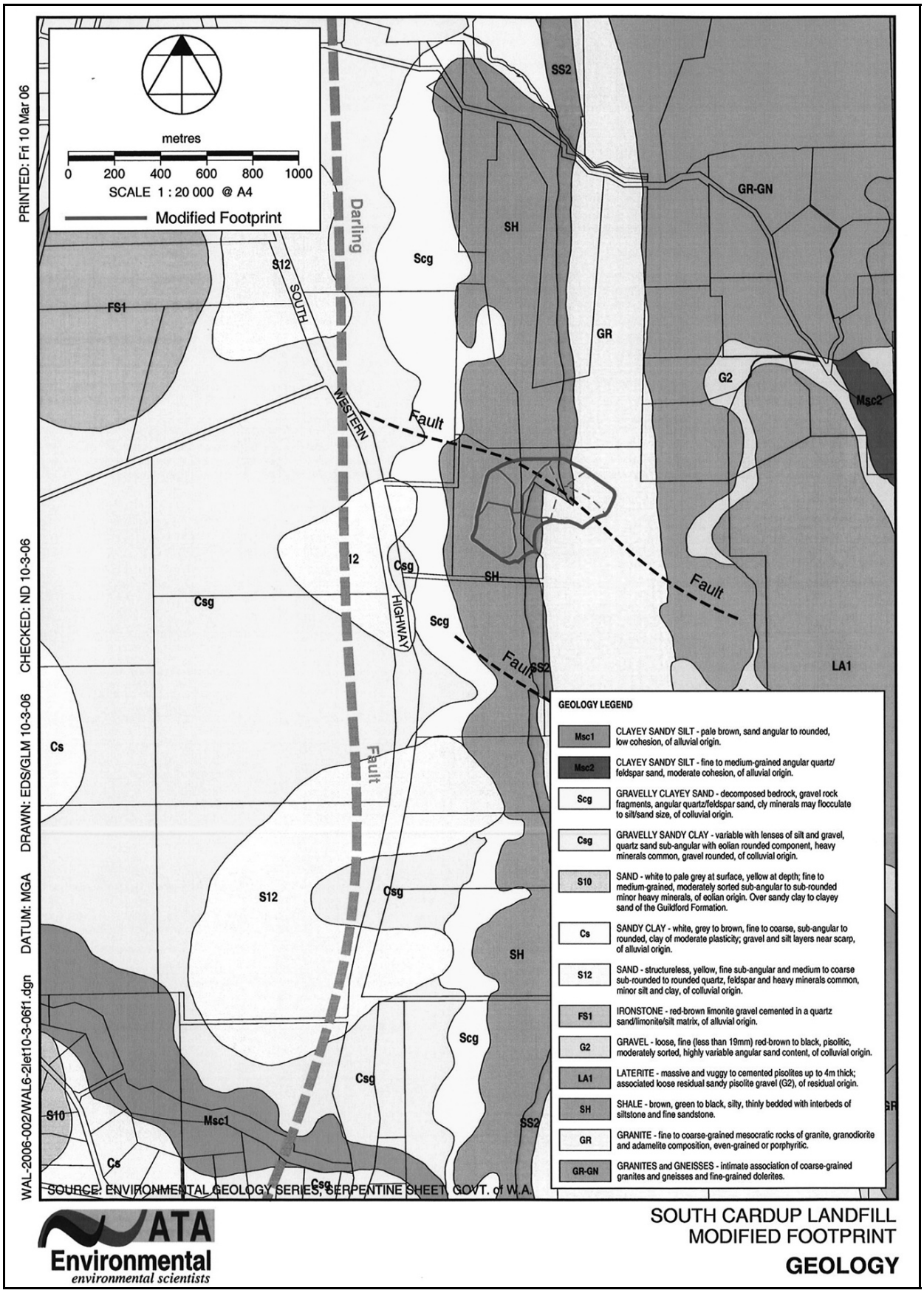

Figure 4: Fault line passing beneath modified landfill footprint

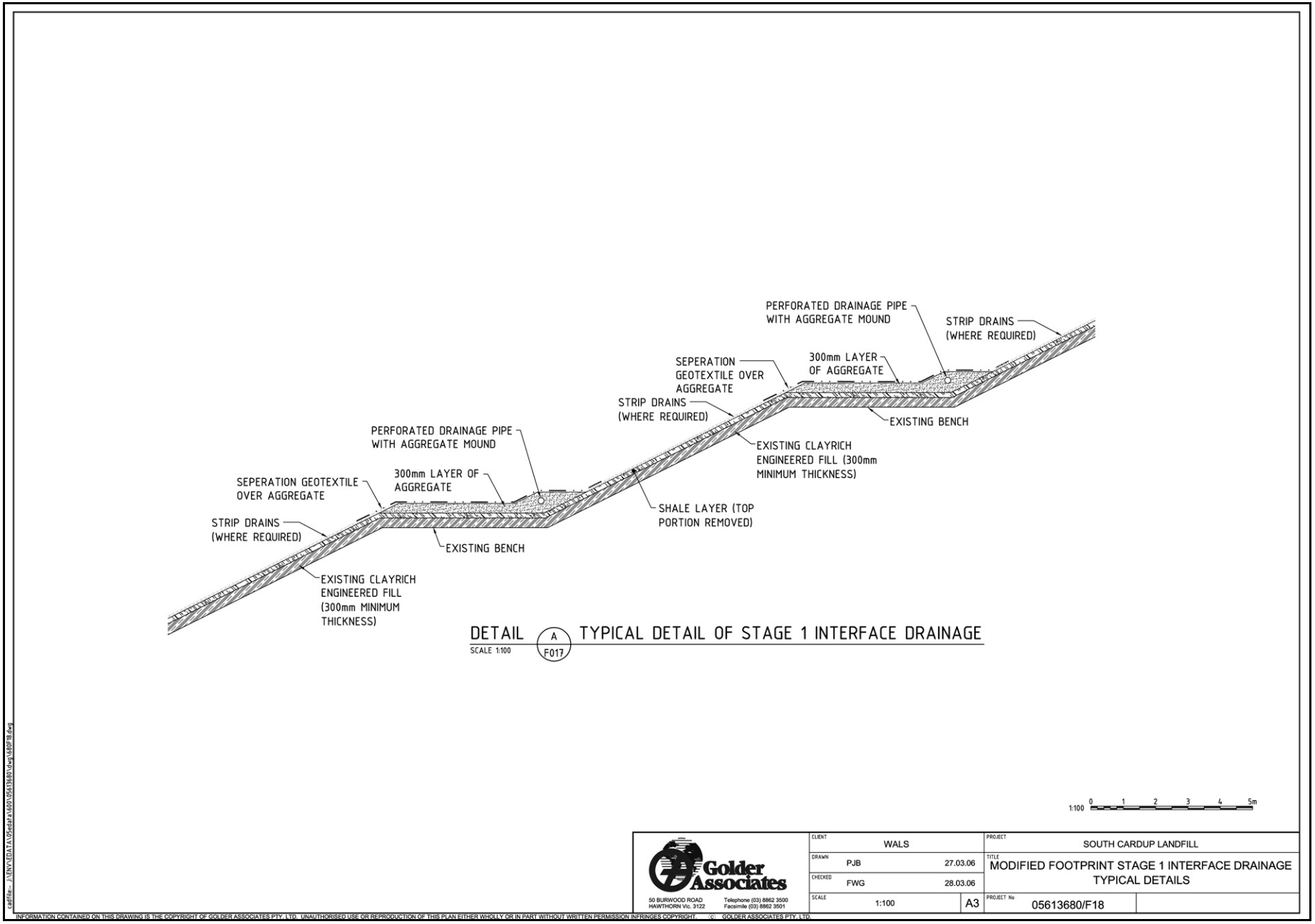

Figure 5: Leachate collection system

Schedule 2

Proponent
Environmental Management Commitments

April 2006

SOUTHERN LANDFILL PROJECT, SOUTH CARDUP STAGES 1 & 2 MODIFIED FOOTPRINT

(Assessment No. 1634)

WEST AUSTRALIAN LANDFILL SERVICES PTY LTD

PROPONENT'S ENVIRONMENTAL MANAGEMENT COMMITMENTS

SOUTH CARDUP LANDFILL MODIFIED FOOTPRINT, WEST AUSTRALIAN LANDFILL SERVICES PTY LTD (Assessment No. 1634)

No.	Topic	Action	Objectives	Timing	Advice
1.	Flora and Fauna	Prepare and implement a Flora, Fauna and Vegetation Management Plan which addresses the management and protection of regionally and locally significant vegetation found in the landfill site.	To ensure the protection and proper management of surrounding vegetation.	Prior to submission of Works Approval for the construction of the modified footprint	Department of Conservation & Land Management

Appendix 4

Review of the Environmental Impacts of the South Cardup Landfill Modified Footprint

Preliminary Environmental Factors	Proposal Characteristics	Potential Impacts	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Flora and Vegetation	Clearing of approximately 1.2 ha, partially vegetated with vegetation associated with the Darling Scarp Vegetation Complex immediately adjacent to two approved landfill cells.	• Clearing of small area of locally significant remnant vegetation • No impacts on DRF	The footprint has been modified from original proposal to minimize impacts on regionally and locally significant remnant vegetation. The Forrestfield Complex vegetation area located directly to the east of the modified footprint will be conserved and preserved as a natural bushland area. Ongoing rehabilitation will eventually result in a vegetated corridor linking established vegetation communities to the east and west of the site. The factor of "Flora and Vegetation" is not considered to be a significant environmental factor.
Fauna	Clearing of approximately 1.2 ha next to current operating landfill and already disturbed area.	• Minimal impact on fauna	The factor of "Fauna" is not considered to be a significant environmental factor.
POLLUTION			
Surface water	Diversion of existing drainage around the modified footprint and filling of the Sedimentation Dam located between existing Stage 1 and Stage 2 landfills. The storage dam located at the northwestern tip of the property boundary will be enlarged to act as a sediment and surge dam.	• Potential contamination of surface water from landfill operations • Potential offsite migration of surface water contaminants	Latest available monitoring data shows that the impacts of the current landfill on the water quality of the surface water is negligible. However data suggests contamination of the underdrainage water which discharges into an ephemeral stream, therefore there is a potential of surface water contamination. **The factor of "Surface Water" is considered to be a significant environmental factor.**

Groundwater	Installation of low permeability liners and underdrainage system. A minimum separation of 2m will be maintained between base of landfill cells and highest predicted groundwater table. Existing leachate management practices will continue.	• Contamination of groundwater under landfill – potential offsite migration of surface and groundwater water through surface drainage and/or faulting system	Latest available monitoring data shows that the groundwater in the underdrainage pipes from Stage 1 landfill has elevated concentrations of ammonia-nitrogen, arsenic, BTEX, dissolved methane and manganese. Several bores downgradient of landfill also detected elevated concentrations of ammonia-nitrogen, arsenic, manganese and cadmium. **The factor of "Groundwater" is considered to be a significant environmental factor**
Air quality – dust	Continued implementation of the existing dust management measures	• Potential impacts from daily cover of landfill and vehicle movements on unsealed roads • Unlikely that dust levels will significantly increase	The factor of "Air Quality – Dust" is not considered to be a significant environmental factor.
Air quality – odour	Continued implementation of the existing odour management measures	• Unlikely that odour will have a significant impact on surrounding	The factor of "Air Quality – Odour" is not considered to be a significant environmental factor.
Noise	Continued implementation of the existing noise management measures	• Unlikely that noise emissions will have the potential to exceed statutory levels.	The factor of "Air Quality – Odour" is not considered to be a significant environmental factor.
Greenhouse gases	Extension of current landfill gas system to incorporate modified footprint	• The total emission does not trigger the value within the established Commonwealth & State policies	The factor of "Greenhouse Gases" is not considered to be a significant environmental factor.
Waste disposal (landfill management)	Continued implementation of the Environmental Management Plans relating to the management of landfill activities		The factor of "Waste Disposal (Landfill Management)" is not considered to be a significant environmental factor.
Amenity – fire, litter, pest	Continued implementation of the existing fire, litter and pest management measures		The factor of "Amenity – Fire, Litter, Pest" is not considered to be a significant environmental factor.
SOCIAL SURROUNDINGS			
Heritage	No significant sites found in area of modified footprint.		The factor of "Heritage" is not considered to be a significant environmental factor.

Visual amenity	One final mound, maximum height of 170m, instead of two mounds. No increase in maximum height. Landscape Management Plan will be updated to accommodate modified footprint and surface profile. WALS has also commited to plan up to 1000 shrubs/trees per annum for first five years after approval. Rehabilitation of Stage 1 landfill site has commenced.	• Area denuded of vegetation visible from the South Western Highway	Visual impacts are temporary. The Landscape Management Plan aims to rehabilitate the landfill to produce a stable vegetated landform that blends into the surrounding area. The factor of "Visual Amenity" is not considered to be a significant environmental factor.
Public consultation	Ongoing public consultation since the first advertisement of the modified footprint proposal in 2003. Examples include landfill public open days, formal and informal stakeholder meetings, telephone conversations, e-mail correspondence and website.		
OTHER			
Post Closure Rehabilitation	Landfill decommissioning and post closure management plan has been developed	• Impacts on ground and surface water from leachate generation after decommissioning of landfill • Visual impacts	The landfill will continue to generate leachate well beyond its active lifespan. A long term commitment to monitor and manage leachate is required from the proponent, even more so with the proposed additional amount of waste added onto the landfill. After its active lifespan, the landfill also has to be rehabilitated and revegetated to minimize the visual impacts and to promote biodiversity in the area. **The factor of "Post Closure Rehabilitation" is considered to be a significant environmental factor**
Geotechnical suitability of site	Geotechnical investigations indicated that the site is geotechnically suitable for construction of the modified footprint.	• Potential impacts on public safety • Potential impacts on revegetation and rehabilitation efforts	The factor of "Geotechnical Suitability of Site" is not considered to be a significant environmental factor.

Appendix 5

Ministerial Statement 354 (May 1994) - Conditions and Commitments Attached to the original South Cardup Landfill Project

Ass #	741
Bull #	702
State #	354

WESTERN AUSTRALIA

MINISTER FOR THE ENVIRONMENT

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

SOUTHERN LANDFILL PROJECT, SOUTH CARDUP
STAGES 1 & 2 (741)

PIONEER - BFI WASTE SERVICES

This proposal may be implemented subject to the following conditions:

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Public Environmental Review and in response to issues raised following public submissions, provided that the commitments are not inconsistent with the conditions or procedures contained in this statement. These commitments are consolidated in Environmental Protection Authority Bulletin 702 as Appendix 1. (A copy of the consolidated commitments is attached).

2 Subsequent Stages

2-1 Stages 1 and 2 only may be implemented. The proponent shall refer to the Environmental Protection Authority plans for Stage 3 or subsequent stages of landfill construction and operations at or adjacent to the site.

3 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

3-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

4 Environmental Management Programme

Surface water and a stream with a 240 ha catchment must be diverted around the refuse to minimize generation of leachate and to protect downstream water quality.

Published on
9 MAY 1994

12th FLOOR, DUMAS HOUSE, 2 HAVELOCK STREET, WEST PERTH, 6005 TELEPHONE (09) 321 2222 FAX (09) 322 5149

4-1 Prior to commencement of landfill operations in each stage, the proponent shall prepare an Environmental Management Programme which includes, but is not limited to consideration of the following:

(1) the detention time of the sedimentation pond (with reference to the effects on discharge water quality);

(2) the size and construction of the stream diversion channels;

(3) the need for compensating basins to control flood peaks resulting from the works; and

(4) a short-term monitoring programme to demonstrate that the works are effective.

to the requirements of the Environmental Protection Authority on advice of the Water Authority of Western Australia and the Shire of Serpentine-Jarrahdale.

4-2 Prior to commencement of landfill operations in each stage, the proponent shall implement the Environmental Management Programme required by condition 4-1.

5 Environmental Waste Acceptance Criteria

Wastes will be tested to ensure that the landfill design is suitable for the waste.

5-1 Prior to commencement of landfill operations, the proponent shall prepare an assessment procedure that determines the acceptability (or otherwise) of various classes and types of waste which takes into account protection of the environment, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority and the Health Department of Western Australia.

6 Noise Limits

The proponent should conduct operations so that noise emissions do not unreasonably impact on the surroundings.

6-1 The proponent shall ensure that noise emissions do not exceed:

- 40 dB $L_{A10,\ 1\ hour}$ slow and 50 dB $L_{A\ max}$ slow between 2200 hours and 0700 hours on any day when measured on any noise-sensitive premises;
- 45 dB $L_{A10,\ 1\ hour}$ slow and 55 dB $L_{A\ max}$ slow between 1900 hours and 2200 hours on any day, and between 0700 hours and 1900 hours on Sundays and gazetted public holidays, when measured on any noise-sensitive premises;
- 50 dB $L_{A10,\ 1\ hour}$ slow and 70 dB $L_{A\ max}$ slow between 0700 hours and 1900 hours on Monday to Saturday inclusive, when measured on any noise-sensitive premises; and
- 65 dB L_A slow when measured at or near the boundary of premises that are not noise-sensitive premises (other industries);

where such emissions would result in the noise level present at the affected premises exceeding the ambient noise level present at any time by more than 5 dB L_A slow.

6-2 The proponent shall ensure that noise emissions from those activities which are of concern to occupiers of noise-sensitive premises do not exhibit tones, amplitude and frequency modulation, and impulsiveness of a nature which increases the intrusiveness of the noise.

6-3 The proponent shall conduct noise surveys and assessments in consultation with the Environmental Protection Authority.

7 Control and Management of the Site

The Executive Director, Public Health will be responsible for ensuring appropriate management of the refuse site.

7-1 The proponent shall conform to the requirements of the Executive Director, Public Health with regard to the design, construction and on-going management of the waste disposal site.

8 Long-term Environmental Integrity of the Site

The environmental integrity of the site should be ensured by appropriate mechanisms to address unexpected pollution, post-closure management and contingencies.

8-1 Prior to commencement of landfill operations, the proponent shall ensure that mechanisms are identified and implemented to guarantee the long-term environmental integrity and performance of the site to the requirements of the Minister for Health and the Minister for the Environment.

9 Proponent

These conditions legally apply to the nominated proponent.

9-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

10 Time Limit on Approval

The environmental approval for the proposal is limited.

10-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced. Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period, to the Minister for the Environment by way of a request for a change in the condition under Section 46 of the Environmental Protection Act. (On expiration of the five year period, further consideration of the proposal can only occur following a new referral to the Environmental Protection Authority.)

11 Compliance Auditing

In order to ensure that environmental conditions and commitments are met, an audit system is required.

11-1 The proponent shall prepare periodic "Progress and Compliance Reports", to help verify the environmental performance of this project, in consultation with the Environmental Protection Authority.

Procedure

1 The Environmental Protection Authority is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of either the Minister for the Environment or any other government agency.

2 If the Environmental Protection Authority, other government agency or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.

Kevin Minson MLA
MINISTER FOR THE ENVIRONMENT

- 5 MAY 1994

PROPONENT'S COMMITMENTS

SOUTHERN LANDFILL PROJECT
SOUTH CARDUP
STAGES 1 & 2 (741)

PIONEER - BFI WASTE SERVICES

COMMITMENTS

The Proponent, Pioneer-BFI Waste Services, provides the following commitments concerning the construction, operation and management of the proposed sanitary landfill on Lot 8 and Part Lots 6 and 3 South Cardup.

1 General Commitments

(1) The Proponent will adhere to the proposal as described in the Public Environmental Review (PER) and as assessed by the Environmental Protection Authority (EPA), and will fulfil the commitments made therein and summarized below.

(2) The Proponent will develop, operate and manage the proposed sanitary landfill to the satisfaction of all relevant Government agencies including the following:

- EPA;
- Health Department;
- Water Authority;
- Department of Conservation and Land Management; and
- Shire of Serpentine-Jarrahdale.

(3) As the proposed landfill is intended as a secure facility for the disposal of municipal, commercial and industrial waste only, the Proponent will ensure that hazardous, liquid and soluble chemical waste or other forms of intractable wastes will be excluded from the site.

(4) The Proponent will provide a contribution of $20 000 towards the provision of a transfer station at the existing Mundijong landfill to obviate the need for direct public access to the tipping face of the Southern Landfill.

2 Industrial Waste

(5) The Proponent will submit an assessment procedure that determines the acceptability (or otherwise) of various classes and types of industrial waste at this facility for approval by the Health Department of Western Australia and the Environmental Protection Authority. Only industrial waste that meets the acceptability requirements will be disposed of at the landfill. Forming part of the screening program will be elutriation and flash point testing and the installation of radiation detection equipment.

3 Design Features

(6) The landfill will be designed and constructed in accordance with accepted engineering practice for landfills, to the satisfaction of the Shire of Serpentine-

Jarrahdale. Where necessary, slope stability analyses of constructed walls and bunds will be undertaken to verify their integrity.

(7) The Proponent will progressively develop the landfill as a series of cells. The first cell will be sized to accommodate two years' refuse, followed by cells sized to accommodate one year's refuse, in accordance with the staging plan included in the PER.

(8) The Proponent will maintain a vegetated buffer zone with a minimum of 50 m in width around the perimeter of the landfill site.

The buffer zone will be comprehensively landscaped and will contain a perimeter fence and a firebreak track.

A landscaping plan shall be prepared, which shall be developed to achieve the following objectives:

(i) that initial planting is undertaken between the landfill and neighbouring properties, and the landfill and the South-Western Highway in the planting season before or immediately following the commencement of site development earthworks, whichever is the earlier; and

(ii) to provide vegetative cover on the bund walls and other earth structures as soon as practical following construction or final contouring, to minimise visual impact;

(iii) to allow integration with the longer term Post-Closure Plan.

The landscaping plans will be submitted to the Shire of Serpentine-Jarrahdale for approval within six months of the granting of all the necessary approvals to commence landfilling operations.

All initial plantings will be maintained at all times. Failed plantings will be replaced immediately to the satisfaction of the Shire of Serpentine-Jarrahdale.

(9) The Proponent will implement site security measures to control vandalism, theft and illegal dumping, including the construction of a 1.8 m high wire mesh with lockable gates around the landfill facilities.

4 Development and Operational Features

Site Preparation

(10) The Proponent will ensure that prior to the commencement of construction of the landfill cells, the final excavated surface is graded to allow gravity drainage across each of the landfill cells.

Cell Sealing

(11) During the development of landfill cells, the Proponent will ensure that a 1 m thick compacted clay liner will be constructed over the excavated surface. A 300 mm drainage blanket will be installed on the upper surface of the clay liner as part of the process of constructing the liner (refer to Commitment 17).

(12) The Proponent will ensure that clay sources used in construction of the landfill cells will meet the following specifications, under laboratory conditions:

- in situ permeability of 1×10^{-9} m/s or less when clay is placed and compacted; and
- gypsum content of less than 1%.

(13) The Proponent will engage specialist geotechnical consulting engineers to perform Quality Assurance/Quality Control (QA/QC) in the selection of clay and construction of the clay liner. A QA/QC report will be prepared for the clay liner of each cell for submission to the EPA and Health Department of Western Australia which certifies that the liner has been constructed to meet the permeability requirements with materials that have been tested and found suitable.

(14) The Proponent will ensure that, during development of the landfill cells, the liner will be constructed and compacted in thin layers (no more than 300 mm loose thickness) and density and moisture content will be controlled by continuous compaction testing.

(15) The Proponent will ensure that, prior to deposition of refuse within a landfill cell, a starter embankment of 2 m in height will be constructed around the perimeter of the liner to prevent leachate and stormwater from leaving the active cell. Construction techniques and controls for the starter embankment will be similar to those applying to the clay liner.

(16) The Proponent will ensure that, on completion of the clay liner and starter embankment, a 300 mm thick sand or gravel cover (the drainage blanket) will be placed to provide protection against cracking of the clay material resulting in desiccation.

(17) In the event that a suitable clay source for construction of the basal liner of a landfill cell or cells and the starter embankment, is not accessible, the Proponent will utilize a synthetic barrier membrane to seal the landfill cell or cells. In this event, the Proponent will submit a supplementary report to the EPA and Health Department specifying the liner system to be used and explaining the leachate collection system to be installed. This report would be submitted to the EPA and Health Department prior to commencement of construction of the cell or cells in which the alternative lining system was to be installed, and construction of the cell or cells will not commence until the EPA and Health Department are satisfied that the systems proposed are acceptable.

The Proponent will endeavour to place a layer of refuse over the completed drainage blanket at the earliest opportunity to provide additional protection against dehydration of the clay liner.

Leachate Collection

(18) The Proponent will ensure that a leachate collection system comprising a 300 mm deep permeable (permeability rating of 1×10^{-1} cm/s or more) drainage blanket is placed immediately above the basal clay liner. A series of drains consisting of high strength drain coil pipe will be installed in this layer, leading to a collection sump within each stage of the landfill. Leachate will be pumped from the sump to permanent leachate treatment tanks. The system will be designed to the satisfaction of the relevant authorities.

(19) The Proponent will ensure that leachate collection drains will gravity feed to a sump (lined with HDPE and filled with 20 mm gravel screenings) located within each stage of the landfill constructed integrally with the clay liner. The design storage volume of the sump will be determined by suitable modelling, to the satisfaction of the Water Authority of Western Australia.

(20) The Proponent will ensure that leachate will be recirculated through the refuse through a series of slotted pipes buried during landfilling, or by trickle irrigation of the internal surfaces of the active landfill cell.

(21) The Proponent will ensure that prior to depositing refuse in a newly constructed cell the leachate collection pipes are connected into the existing leachate collection system serving the completed cells allowing flow to the leachate sump within each Stage of the landfill.

(22) The Proponent will initially construct a permanent leachate treatment tank(s) to service all landfill cells within Stages 1 and 2. A second permanent leachate treatment tank will be constructed for Stage 3. The leachate treatment tank(s) will be covered and bunded appropriately. The leachate treatment tank(s) will be sized according to the results of the computer modelling to estimate leachate generation.

(23) As part of the normal site operational practice, the Proponent will pump leachate from the leachate sump of each Stage as required to the leachate treatment tank, or recirculate the leachate through the landfill as described earlier. Leachate within the treatment tank may be returned to the active landfill cell during dry periods for disposal through recirculation, or transferred to tanker trucks for off-site disposal.

Placement and Compaction of Refuse

(24) During operation of the site, the Proponent will ensure that refuse will be progressively placed and compacted into thin layers to maximize the compacted refuse density.

(25) During operation of the site, the Proponent will ensure 'Daily' cover (clean soil or other suitable material) is applied over the exposed surfaces at the active landfill area in layers (not less than 150 mm in the case of soil) so that there will be no

exposed garbage at the end of the day. The Proponent will apply 'Intermediate' cover to the top of the active landfill area and to surfaces which will be exposed to the environment for periods greater than six weeks in layers of not less than 300 mm.

Cell Completion

(26) The Proponent will ensure that, upon completion of refuse deposition, landfill cells will be covered with a 300 mm layer of low permeability clay over the Intermediate cover. A further 300 mm layer of sub-soil and a final 100 mm layer of soil suitable for vegetation establishment will be placed over the low permeability clay layer.

(27) The Proponent will ensure that, as part of on-going operational practice, the final landfill surface will be constructed to a predetermined crossfall to enhance surface runoff while safeguarding against erosion and to ensure that final contours of the site will blend into the surrounding environment.

(28) The Proponent will ensure that, on completion of each landfill cell, shallow rooted native vegetation (in accordance with advice from the Department of Conservation and Land Management and the Shire of Serpentine-Jarrahdale) will be established and maintained.

Surface Water Runoff

(29) During the active operation of a landfill cell, all surface water runoff from within the active cell will be treated as leachate and the Proponent will ensure that it will be collected and disposed of through the leachate drainage system.

(30) The Proponent will ensure that a site drainage system will direct runoff water from areas outside the landfill boundary, undeveloped areas within the landfill boundary and from the rehabilitated surfaces of completed landfill cells, away from the active tipping areas. Water from this system will not have contacted refuse, and therefore it will be uncontaminated and may directly discharge into the stream.

Road Construction and Maintenance

(31) The Proponent will ensure that, from the outset of the landfill operation, all roads to be used by visitors to the site will be sealed (up to the gatehouse).

(32) The Proponent will ensure that surface runoff from internal roads within the landfill site will not contact refuse and will be directed to the on-site sedimentation pond.

(33) The Proponent will ensure that a water tanker will be permanently on-site and available for dust suppression on all unsealed trafficked areas during dry periods or as required.

Wheel Cleaning Facilities

(34) As part of the initial site development, the Proponent will ensure that a wheel cleaning drive through is installed on the egress from the landfill cell area to dislodge debris and sediment from vehicle wheels. Debris collected in the sump will be regularly removed and disposed of within the active landfill cell. Contaminated water within the drive-through will be treated as leachate.

5 Management of Environmental Impacts

Water Resources

Commitments regarding Cell Sealing and Leachate Collection also pertain.

(35) The Proponent will ensure that an underdrain is constructed beneath the low permeability liner where required to collect and divert water egressing from the fractured granite to the sedimentation pond.

Odours

Commitments regarding Cell Sealing, Leachate Collection and Water resources also pertain.

(36) The Proponent will ensure that particularly odorous refuse will only be accepted at the landfill by prior arrangement and that any such material received will be covered immediately.

Litter

Commitments regarding Placement and Compaction of Refuse also pertain.

(37) The Proponent will ensure that any landfill related litter along the site access routes within a 2 km radius of the site is removed at least weekly.

(38) The Proponent will ensure that, as part of normal operational practices, portable litter control screens will be placed in the vicinity of the active tipping face to intercept any material blown from the tipping face.

(39) The Proponent will ensure that, as part of normal operational practices, any litter blown from the tipping face and intercepted by the portable screens, the site security fence or perimeter vegetation will be collected daily and returned to the tipping face.

Noise

Commitments regarding Design Features (perimeter buffers and earth bunds) also pertain.

(40) The Proponent will ensure that all vehicles and machines operating at the landfill site and which are under its control will be fitted with effective exhaust system silencers.

(41) The Proponent will limit the daily hours of operation of the landfill between 0600 and 1800 hours Monday to Saturday and 1000 and 1600 hours on Sundays.

Dust

Commitments regarding Design Features (perimeter buffers and earth bund), Road Construction and Maintenance, and Wheel Cleaning Facilities also pertain.

(42) The Proponent will, during initial site development and as part of normal operational practices, ensure the stabilization by vegetation or other means of disturbed areas not immediately needed for landfill operations.

(43) As part of normal operational practices, the Proponent will ensure that any unsealed trafficked areas are watered as necessary to lay dust.

(44) As part of normal operational practices, the Proponent will ensure that:

- active tipping area will be dampened (either by leachate irrigation or water application) as necessary to lay dust; and
- overburden, cover material stockpiles will be stabilized with temporary cover vegetation, mulching, watering or other technique to suppress dust generation.

Pests

Commitments regarding Placement and Compaction of Refuse also pertain.

(45) The Proponent will ensure that, as part of normal operational practices, any large appliances, crates etc, placed in the active tipping area will be specifically crushed before covering with refuse and cover material, and that any tyres dumped, unless shredded or split, will be spread out and carefully covered.

(46) The Proponent will implement supplementary control measures directed towards specific pest species on an as required basis in conjunction with and to the satisfaction of the EPA, Water Authority, Department of Conservation and Land Management, Shire of Serpentine-Jarrahdale or other regulatory authority.

Landfill Gas Management

(47) Prior to the commencement of tipping operations, the Proponent shall prepare a methane gas management plan which addresses monitoring, collection, disposal and potential beneficial uses of landfill gas to the satisfaction of the Environmental Protection Authority and the Health Department of Western Australia.

Initially, gas will be disposed of by flaring. When monitoring results indicate that action to manage landfill gas emissions is warranted, the Proponent will implement the methane gas management plan to the satisfaction of the Environmental Protection Authority on advice of the Health Department of Western Australia. The

Proponent will liaise with the relevant authorities regarding beneficial uses of landfill gas over the operating and post-closure life of the landfill.

Fire

Commitments regarding Placement and Compaction of Refuse, Landfill Gas Collection, and Landfill Gas also pertain.

(48) The Proponent will ensure that, from the outset of the landfill operation, site operational and management practices will not include utilization of fire except for the controlled flaring of landfill gas.

(49) The Proponent will ensure that from the outset of the landfill operation, adequate manpower and machinery resources to combat any fires which may occur within the landfill site will be maintained on-site during operating hours.

(50) The Proponent will make the water tanker truck available to the Shire of Serpentine-Jarrahdale or the Bush Fires Board to assist in fighting fires subject to the proximity of the problem and the Proponents needs at that time.

Social Impacts

Effectively all Commitments given pertain directly or indirectly to the amelioration of social impacts.

6 Environmental Monitoring

Water Resources

(51) The Proponent will progressively construct a series of dedicated groundwater monitoring bores to specifications acceptable to the EPA and the Geological Survey Division of the Department of Minerals and Energy. It is anticipated that monitor bores will need to be installed on the basis of geological considerations to ensure effective groundwater monitoring along sections of the site boundary down hydraulic gradient from areas used for landfilling.

(52) On commissioning of each monitor bore and prior to the commencement of tipping, groundwater will be sampled and analysed for a range of potential contaminants to provide background information on groundwater quality. Parameters determined will include pH, salinity (as TDS), redox potential, major ions, nutrients, total organic carbon, and heavy metals to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(53) The Proponent will implement a programme of regular sampling from the monitor bores. This programme will be determined by the site hydrogeological considerations and to the satisfaction of the EPA and other relevant authorities, although, initially, sampling on a three-monthly basis is envisaged. Water samples collected will be analysed for a select range of parameters. These will include pH,

salinity (as TDS), zinc, total organic carbon, five-day biochemical oxygen demand, ammonia-nitrogen, and total alkalinity to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(54) The Proponent will sample privately owned bores on selected properties in the vicinity of the landfill, initially on an annual basis, and analyse samples for a select range of parameters. These will include pH, salinity (as TDS), and ammonia-nitrogen to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(55) Groundwater samples will be collected and analysed in accordance with recognized standard procedures, and to the satisfaction of the EPA and the Water Authority of Western Australia.

(56) If monitoring indicates that groundwater quality is being affected to an unacceptable degree, as determined by the Environmental Protection Authority, the Proponent shall prepare a strategy for clean-up of groundwater contamination, to the satisfaction of the Environmental Protection Authority on advice of the Water Authority of Western Australia.

(57) The Proponent shall implement the strategy for clean-up of groundwater contamination required by Commitment 56 (above) to the satisfaction of the Environmental Protection Authority on advice from the Water Authority of Western Australia.

(58) Should groundwater analyses indicate contamination by landfill leachate, the Proponent will immediately undertake further sampling and analysis for a more extensive range of parameters in consultation with, and to the satisfaction of, the EPA and the Water Authority of Western Australia.

(59) Any complaint about a deterioration in groundwater quality reasonably attributable to the landfill operation will be immediately investigated by the Proponent in consultation with, and to the satisfaction of, the EPA and the Water Authority of Western Australia.

(60) The Proponent will implement a programme of regular water sampling of the sedimentation pond, into which groundwater collected by the landfill underdrain flows. Water samples collected will be analysed for the same parameters as for samples taken from the groundwater monitoring wells to the satisfaction of the Environmental Protection Authority on advice from the Chemistry Centre and the Water Authority of Western Australia.

(61) As soon as leachate is detected in the leachate collection sump, and thereafter in conjunction with the groundwater monitoring programme, samples will be collected and analysed for comparison with anticipated leachate chemistry. Continuing sampling and analysis will be co-ordinated with the groundwater monitoring programme, and analytical results will be included in the periodic performance reports.

Other Environmental Monitoring

(62) From the outset of the landfill operation, the Proponent will maintain a complaints register in which details of any complaints from local residents, within the Serpentine-Jarrahdale municipality about the landfill operation will be recorded to the satisfaction of the EPA.

(63) The Proponent will monitor the activity of Silver Gulls at the landfill site, from the outset of landfilling operations, in consultation with, and to the satisfaction of, the Department of Conservation and Land Management.

(64) Following the installation of the landfill gas extraction system, the Proponent will measure landfill gas flow rates at six-monthly intervals. Results will be forwarded directly to the EPA and will also be incorporated into the periodic performance reports.

7 Performance Reporting

(65) The Proponent will submit annual performance reports to the EPA, Health Department and the Shire of Serpentine-Jarrahdale within three months following each anniversary of the commencement of the landfilling operation. These reports will address such matters as:

- the stage reached in the various operational and management programmes being implemented;
- results from monitoring programmes instituted, including the complaints register, and the response to any complaints received;
- modifications to the various programmes that have been implemented in response to monitoring results; and
- any unforeseen or extraordinary event associated with the landfill that has adversely affected off-site environmental quality (and the Proponent's response to that event) occurring during the preceding twelve months.

The final report submitted during a reporting period will provide a detailed review of performance over the entire period and of any modifications to operational and management programmes intended.

(66) The Proponent will respond, through an interactive process with the EPA, Health Department and the Shire of Serpentine-Jarrahdale, to any issues those agencies may raise following receipt of the performance reports.

(67) At the same time that periodic performance reports are submitted to the EPA, Health Department and Shire of Serpentine-Jarrahdale, the Proponent will make the reports available to relevant community organizations within the Shire of Serpentine-Jarrahdale

(68) Any unforeseen or extraordinary events associated with the landfill that adversely affected off-site environmental quality, and the Proponent's response to any such event will be reported immediately (by the Proponent) to the EPA, Health Department, and Shire of Serpentine-Jarrahdale.

8 Contingency Planning

(69) The Proponent will submit, for review by and approval from the Shire of Serpentine-Jarrahdale prior to commencement of landfilling activities, a contingency plan for emergency situations after consultation with the Shire of Serpentine-Jarrahdale, Environmental Protection Authority, Health Department of Western Australia, Bush Fires Board, Water Authority of Western Australia and the Department of Conservation and Land Management.

(70) The Proponent will respond to any unforeseen contingency associated with the landfill and which is producing a demonstrable and unacceptable off-site impact in consultation with the EPA, Health Department of Western Australia, the Shire of Serpentine-Jarrahdale, and to the satisfaction of the Minister for the Environment as appropriate.

9 Management Following Closure

(71) The Proponent recognizes that certain management responsibilities will continue following closure of the landfill site and will ensure that such responsibilities will be discharged in consultation with the relevant regulatory authorities (presently the EPA and the Health Department of Western Australia).

(72) The Proponent shall be responsible for construction, operation, decommissioning and post-closure management of the site until such time as the waste has fully degraded, to the satisfaction of the Environmental Protection Authority.

(73) Within two years after the date of commencement of construction, the Proponent shall prepare a draft decommissioning and post-closure management plan, to the satisfaction of the Environmental Protection Authority.

(74) At least two years prior to closure, the Proponent shall prepare the final decommissioning and post-closure management plan, to the satisfaction of the Environmental Protection Authority.

(75) The Proponent shall implement the final decommissioning and post-closure management plan required by Commitment 74, to the satisfaction of the Environmental Protection Authority.

10 Financial Assurances

(76) Within six months of commencement of landfilling operations, the Proponent will establish financial assurances in favour of the Shire of Serpentine-Jarrahdale to cover emergency contingencies and long-term risks in a form and to an amount acceptable to the Environmental Protection Authority, Health Department of Western Australia and the Shire of Serpentine-Jarrahdale.

(77) The amount of the financial assurances shall be reviewed every five years by the Environmental Protection Authority in consultation with the Shire of Serpentine-Jarrahdale and the Health Department of Western Australia.

(78) Company guarantees, if offered by the Proponent, shall be supported by annual audited accounts from each guaranteeing entity.

(79) The preparation of the legal agreement relating to the financial assurances shall be executed by the Proponent's solicitors at the Proponent's expense.