TECHNICAL REPORT NO 2

REVISED SOIL AND WATER MANAGEMENT PLAN

CES

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REVISED SOIL AND WATER MANAGEMENT PLAN:
PROPOSED MODIFICATION TO NORTHERN EXTENSION LANDFILL,
STAGE 2 EASTERN CREEK WASTE AND RECYCLING CENTRE,
EASTERN CREEK, NSW
PREPARED FOR NATIONAL ENVIRONMENTAL CONSULTING SERVICES PTY LTD
REPORT ID: CES000105-NEC-09-F
Revision No.1

Written by: S. Dorairaj
Field Scientists: N/A
Reviewed by: W. Morrison

Authorised by:

Dr. Michael Petrozzi

Client:
Ms. Sue Just
National Environmental Consulting Services Pty Ltd
136 Salisbury Road
Camperdown NSW 2050

Date: 26 March 2010

Telephone: 02 8569 2200 • **Fax**: 02 9552 4399 • Jones Bay Wharf 19-21 • Lower Deck • Suite 121 •
26-32 Pirrama Road • Pyrmont NSW 2009 • www.consultingearth.com.au

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REVISED SOIL AND WATER MANAGEMENT PLAN (SWMP), PROPOSED MODIFICATION TO NORTHERN EXTENSION LANDFILL, EASTERN CREEK WASTE MANAGEMENT CENTRE. PREPARED FOR NATIONAL ENVIRONMENTAL CONSULTING SERVICES.

Report ID: CES000105-NEC-09-F

EXECUTIVE SUMMARY

Consulting Earth Scientists (CES) has been engaged by National Environment Consulting Services Pty Ltd (NECS) to conduct environmental services related to a General Solid Waste (putrescible) landfill, known as Eastern Creek Waste and Recycling Centre (ECWRC). As illustrated on Figure 1, the ECWRC is located along Wallgrove Road at Eastern Creek, NSW (hereinafter ECWRC or site), and is operated by WSN Environmental Solutions (WSN). CES have assessed the likely impact of a proposed landfill extension (Cell 5) and modifications to Cells 4, 6 and 7 on surface-water resources, based on a review of the extension proposal and water-quality monitoring data provided by WSN.

The site has been in operation since 1984 and site development has been staged around Eastern Creek which bisects the ECWRC. The site layout and stages are presented on Figure 2. From 1994 to 2002, 6.26 million tonnes (Mt) of solid waste were placed within Areas 1 through 4 of the Stage 1 Area, which is located to the west of Eastern Creek. The landfilling of the Eastern Creek (EC) Stage 1 area is completed, and the active filling at the site is now being conducted in the EC Stage 2 area. The EC Stage 2 area comprises all landfill areas east of Eastern Creek. The EC Stage 2 area has been further subdivided into the Southern Area (EC Stage 2 SA) comprising Cell 1 through Cell 3 and the Northern Area (EC Stage 2 NA) comprising Cells 4, 6 and 7. Approximately 3 Mt and 1.2 Mt of waste have been placed in the EC Stage 2 SA and the EC Stage 2 NA, respectively.

WSN is considering an increase in the final waste capacity in the EC Stage 2 NA which comprises:

- construction of Cell 5 between the partially filled Cells 4 and 6

- increasing the pre-settlement final waste level in Cells 6 and 7 by 4 metres (m) to relative level (R.L.) 82.5 m above Australian Height Datum (m AHD)
- place additional waste in Cells 4, 6 and 7 that have been excavated in accordance with the existing consent
- increasing the approved waste disposal rate for the period 1 July 2010 to 30 June 2011 from 500 000 tonnes per annum (tpa) to a maximum of 550 000 tpa
- increasing the approved waste disposal rate the period 1 July 2011 to 30 June 2017 from 350 000 tpa to a maximum of 550 000 tpa
- extending the acceptance of putrescible waste from 30 June 2014 to 30 June 2017.

The current approach to soil and water management in the EC Stage 2 area involves the minimisation of erosion, separation of runoff from different catchment areas, maximisation of on-site water reuse, use of sedimentation dams designed to retain at least the 90th percentile 5 day rain event and chemical treatment prior to discharge if required.

This document provides a revised management strategy for soil and water in the EC Stage 2 area, incorporating the construction of Cell 5 in a currently vacant area. The main aspects of the strategy are summarised below:

- volume reduction through the diversion of “clean” runoff around waste cells and into Eastern Creek
- reduction in the volume of “dirty” stormwater through the progressive rehabilitation of completed areas and decommissioning of stormwater drains
- use of stormwater retained in active landfill areas for irrigation of the active tip face
- reduction in the volume of retained stormwater through on-site re-use. Treatment will be minimised by using the poorest quality water acceptable for each task
- treatment of stormwater retained in sedimentation dams if required prior to release into Eastern Creek
- minimising erosion of external surfaces through the use of mulch and cover crops.

It is anticipated that the proposed stormwater system will consistently maintain concentrations of total suspended solids in discharges from the site below the discharge criterion of 50 milligrams per Litre (mg L^{-1}) and achieve limits on pH levels.

Ongoing water-quality monitoring and data analysis detailed in the Landfill Environmental Management Plan (LEMP) for the site will provide ongoing assessment of system performance.

REVISED SOIL AND WATER MANAGEMENT PLAN (SWMP), PROPOSED MODIFICATION TO NORTHERN EXTENSION LANDFILL, EASTERN CREEK WASTE MANAGEMENT CENTRE. PREPARED FOR NATIONAL ENVIRONMENTAL CONSULTING SERVICES.

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LIST OF ABBREVIATIONS

AHD	Australian Height Datum
AMG	Australian Map Grid
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
CBD	Central Business District
CES	Consulting Earth Scientists
DUAP	Department of Urban Affairs and Planning
EPA NSW	Environment Protection Authority of New South Wales
H:V	Horizontal : Vertical
LEMP	Landfill Environmental Management Plan
Mt	Million tonnes
NECS	National Environmental Consulting Services
NFR	Non-Filterable Residue
Q	Discharge or flow rate
REF	Review of Environmental Factors
SEE	Statement of Environmental Effects
SWMP	Soil and Water Management Plan
tpa	Tonnes Per Annum
t_c	Time of concentration
TKN	Total Kjeldahl Nitrogen
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WMC	Waste Management Centre
WSID	Western Sydney International Dragway
WSN	WSN Environmental Solutions

REVISED SOIL AND WATER MANAGEMENT PLAN (SWMP), PROPOSED MODIFICATION TO NORTHERN EXTENSION LANDFILL, EASTERN CREEK WASTE AND RECYCLING CENTRE. PREPARED FOR NATIONAL ENVIRONMENTAL CONSULTING SERVICES.

Report ID: CES000105-NEC-09-F

1. INTRODUCTION

Consulting Earth Scientists (CES) has been engaged by National Environment Consulting Services Pty Ltd (NECS) to conduct environmental services related to a General Solid Waste (putrescible) landfill, known as Eastern Creek Waste and Recycling Centre (ECWRC). As illustrated on Figure 1, the ERWRC is located along Wallgrove Road at Eastern Creek, NSW (hereinafter ECWRC or site), and is operated by WSN Environmental Solutions (WSN).

The site has been in operation since 1984 and site development has been staged around Eastern Creek which bisects the ECWRC. The site layout and stages are presented on Figure 2. From 1984 to 2002, 6.26 million tonnes (Mt) of solid waste were placed within Areas 1 through 4 of the Eastern Creek (EC) Stage 1 area, which is located to the west of Eastern Creek. The landfilling of the EC Stage 1 area is completed, and the active filling at the site is now being conducted in the EC Stage 2 area. The EC Stage 2 area comprises all landfill areas east of Eastern Creek. The EC Stage 2 area has been further subdivided into the Southern Area (EC Stage 2 SA) comprising Cell 1 through Cell 3 and the Northern Area (EC Stage 2 NA) comprising Cells 4, 6 and 7. Approximately 3 Mt and 1.2 Mt of waste have been placed in the EC Stage 2 SA and the EC Stage 2 NA, respectively.

WSN is considering an increase in the final waste capacity in the EC Stage 2 NA which comprises:

- construction of Cell 5 between the partially filled Cells 4 and 6
- increasing the pre-settlement final waste level in Cells 6 and 7 by 4 metres (m) to relative level (R.L.) 82.5 m above Australian Height Datum (m AHD)

- place additional waste in Cells 4, 6 and 7 that have been excavated in accordance with existing consent
- increasing the approved waste disposal rate for the period 1 July 2010 to 30 June 2011 from 500 000 tonnes per annum (tpa) to a maximum of 550 000 tpa
- increasing the approved waste disposal rate the period 1 July 2011 to 30 June 2017 from 350 000 tpa to a maximum of 550 000 tpa
- extending the acceptance of putrescible waste from 30 June 2014 to 30 June 2017.

The current document provides a revised plan for soil and water management infrastructure, originally contained in a Soil and Water Management Pan (SWMP) prepared for the site in May 2003 (Report ID: CES000105-NEC-08-F). The strategy presented in the previous SWMP (2003) has been updated to incorporate the altered surface runoff patterns resulting from proposed extensions in the EC Stage 2 NA (Figure 2). This revision has been necessitated by plans to construct Cell 5, to join the above-ground portions of Cells 4 to 7 and to construct a clean water diversion drain running peripheral to the EC Stage 2 NA. All runoff from upstream areas will be diverted to clean water drains for direct discharge to Eastern Creek.

The objectives of the plan are as follows:

- evaluate site conditions with particular emphasis on factors related to soil erosion issues and runoff characteristics
- summarise the development proposal and landfill staging
- develop an approach to soil and water management for the Eastern Creek Stage 2
- develop a soil and water management plan for each stage of landfill development. The plan has been prepared to meet or exceed the requirements outlined in the Landcom (2004) *Managing Urban Stormwater – Soils and Construction*. Based on a review of DECC (2008) *Managing Urban Stormwater- Soils and Construction – Volume 2B Waste Landfills* the plan in general meets the requirements of this document.
- evaluate system performance and monitoring requirements.

1.2 ENVIRONMENTAL REPORTS RELVANT TO THIS SCOPE OF WORK

The following environmental reports prepared by others have been relied upon by CES for the purpose of this surface water assessment:

- Aecom Australia Pty Ltd, 2009: *Proposed Modification for Northern Extension of Eastern Creek Stage 2: Stormwater and Leachate Assessment for Additional Waste,* prepared for WSN Environmental Solutions (2009 Stormwater and Leachate Report)
- Maunsell McIntyre Pty Ltd, 2000: *Eastern Creek Landfill Redevelopment and Golf Course: Flood Study Report,* prepared for Waste Service NSW, (2000 Flood Report)
- WSN Environmental Solutions, 2006: *Landfill Environmental Management Plan*, Eastern Creek Waste & Recycling Centre (2006 LEMP)
- Douglas Partners, 2000: *Assessment of Groundwater Impacts*, Eastern Creek Waste & Recycling Centre, prepared for Waste Service New South Wales (2000 Groundwater Assessment Report).

1.3 RELEVANT ENVIRONMENTAL GUIDANCE

The following guidance documents have been referenced by CES during preparation of this surface water assessment:

- Australian and New Zealand Environment and Conservation Council: 2000: Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy. October 2000
- Environment Protection Authority, 1996: Environmental Guidelines: Solid Waste Landfills. EPA NSW 95/85
- Environment Protection Licence, 2009: Licence 5272, Eastern Creek Waste Management Centre, issued by Department of Environment and Climate Change, issued to Waste Recycling and Processing Corporation, Licence varied by notice 1101389, issued on 23-Jun-2009, effective 23 Jun 2009.

This plan will be incorporated into the ECWRC Landfill Environmental Management Plan (LEMP) which describes the environmental controls and monitoring required during operation of the site.

1.4 STRUCTURE OF THIS REPORT

This report commences with a summary of site conditions, the development and landfill staging, followed by a review of relevant reports. The management plan commences with an overview of the management strategy followed by management infrastructure, staging of soil and water management works and design calculations. Infrastructure is evaluated against Landcom (2004)

requirements in relation to the design criteria and size of sedimentation dams. The plan concludes with an assessment of anticipated system performance and monitoring requirements.

2. SITE CONDITIONS

Figure 2 shows that the site is bisected by Eastern Creek running in a north-south direction. The EC Stage 1 area is located in the catchments of Eastern and Reedy Creeks, while EC Stage 2 is located in the catchment of Eastern Creek only. Reedy Creek flows into Eastern Creek approximately 1.3 km downstream of the landfill. Eastern Creek in turn flows into South Creek at Vineyard which then flows into the Hawkesbury River at Windsor.

2.1 LANDUSE OF THE SITE AND SURROUNDING AREAS

The site previously formed part of an open space corridor, Zoned 5(a) (Special Uses-General Zone) under the Blacktown City Council Local Environmental Plan (LEP) 1988. In October 1989, the ECWRC and some adjoining land were excised from the LEP by the State Environmental Planning Policy (SEPP) No. 29 – Western Sydney Recreation Area. Sydney Regional Environmental Plan (SREP) No. 31 Regional Parklands was gazetted on 8 June 2001 and subsequently replaced by the SEPP Western Sydney Parklands 2009 which applies to both the EC Stage 1 and Stage 2.

ECWRC is operated as a General Solid Waste landfill. As such, the facility accepts council, household and commercial waste for disposal. Additionally activities on the site include facilities for collection of recyclables, excavation and stockpiling of cover material, green waste composting, environmental monitoring and environmental management. The areas surrounding the site are generally zoned for rural and semi-rural land use. Exceptions include a solid waste Class 2 landfill operating on the Austral Bricks property located along the southern boundary of the ECWRC, and the Western Sydney International Dragway (WSID) abutting the eastern boundary of the EC Stage 2 area.

2.2 SITE LEVEL AND FLOODING

The natural ground level in the extension area is located between 60 and 48 m above AHD at the upstream and downstream ends respectively. Modelled 1 in 100 year Annual Recurrence Interval (ARI) flood levels (Maunsell McIntyre, 2000) at cross sections located on Eastern Creek adjacent to the southern, central and northern sections of the extension area respectively were 54.5, 47.1 and 45.9 m AHD. Therefore, the area of the proposed extension appears to be located above the 1 in 100 year ARI flood levels and does not present a significant risk of flooding.

2.3 RAW WATER QUALITY AND DISCHARGE LIMITS

A review of water-quality data for ECWRC is presented in CES (2009). Overflows from existing dams at ECWRC were monitored on 17 occasions in the last four years. The catchment of Eastern Creek, upstream of the ECWRC is occupied by agricultural properties, low-density residential areas, manufacturing industries and a General Solid Waste (non-putrescible) landfill located on the adjacent Austral Bricks site. Over the last four years under dry-weather conditions background water quality in Eastern Creek, upstream of the landfill at SW001, was characterised as follows (Table 1):

- electrical conductivity (EC) concentrations in the range of 292 to 1864 micro-Siemens per centimetre (µS cm^{-1})
- pH values in the range of 6.76 to 9.43
- ammonia concentrations in the range of <0.01 to 0.67 mg L^{-1}
- biological oxygen demand (BOD) concentrations in the range of <1 to 7 mg L^{-1}
- total suspended solids (TSS) concentrations in the range of 2 to 740 mg L^{-1}.

Monitoring data for overflows from existing sedimentation dams (Dams 201, 202 and 203), are presented in Tables 2 to 4. The dam locations are presented on Figure 3. Overall the historical dataset of overflow events at Dams 201 and 202 suggested that the commencement of filling operations in the EC Stage 2 NA has not adversely impacted the quality of water being discharged into Eastern Creek during overflow conditions. Rather the results from Dam 201 in particular suggest that the commencement of filling in the EC Stage 2 NA, and the associated stormwater controls have slightly improved the quality of overflow discharge into Eastern Creek from the EC Stage 2 area. CES (2009) reported that overflows from the existing operation have higher suspended sediment concentrations than occur in Eastern Creek upstream of the landfill. However, overflows into Eastern Creek from ECWRC only occur under wet weather conditions and are likely to be diluted by peak flows from upstream catchment areas at the time of discharge.

The CES 2009 document provides the full presentation, which concluded that existing soil and water controls are effective in preventing the contamination of surface runoff leaving the site. Water quality in Eastern Creek downstream of the ECWRC does not appear to be impacted by leachate or sediment generated during the filling operations in the EC Stage 2 NA. As the current proposal seeks to increase the level of soil and water controls in the EC Stage 2 NA, CES considers that construction and filling of Cell 5 and the placement of additional waste in Cells 4, 6 and 7 are not likely to adversely impact the quality of surface runoff leaving the site, or water quality in Eastern Creek.

3. STAGING OF PROPOSED DEVELOPMENT

As demonstrated in Figure 2, the proposed extension (Cell 5) is located wholly within the EC Stage 2 NA of the ECWRC, and occupies an area of approximately 3 ha. As illustrated on Figure 4, proposed Cell 5 is bounded to the east and west respectively by Ferrers Road and Eastern Creek, and to the north and south respectively by Cell 4 and Cell 6.

3.1 STAGING OF PROPOSED DEVELOPMENT

Landfilling is ongoing within the EC Stage 2 NA, with Cells 4 and 6 already partially filled and Cell 7 is being filled. Figure 4 presents the proposed EC Stage 2 NA cell layout, and Table 5 provides order of the proposed filling programme based on the assumption that filling takes place at 550 000 tpa. The current proposal increases the allowable filling rates to between 500 000 to 600 000 tpa. Upon completion, the capacity of the EC Stage 2 NA under the current proposal will increase to approximately 4.5 Mt of waste. The landfill activities will be undertaken in several phases over a 7 year period depending on the filling rates adopted.

Figure 5 presents the desired outcome for the final landform including proposed Cell 5, as well as the proposed surface water management details. Figure 6 presents a cross-section of the final landform, and depicts the intention to maximise available air space in the EC Stage 2 NA by connecting the above ground sections of Cells 4 to 7, and completing this area as one continuous mound. The duration of landfilling will be dependent on the nature of the material being disposed. However, CES understands that prior to the placement of waste above ground level in any of the existing EC Stage 2 NA cells, the plan for landfilling intends to construct and fill Cell 5 and Cell 7 up to the surrounding ground level. The sediment basin and high flow channel around Cell 4, as shown in Figure 4, intended to divert water from Ferrers Road and the WSID, will be established prior to the placement of fill in Cell 5.

3.2 CELL 5 PREPARATION AND CONSTRUCTION

Preparation of the Cell 5 footprint for landfilling will involve:

- vegetation removal (re-vegetation process includes cleared vegetation to be processed and used on site)
- stripping of topsoil (to be stockpiled for use in revegetation)
- stripping/ removal of clay (to be stored on site for reuse)
- excavation of brown shale (material is saleable)
- excavation of blue shale (stockpiled on site for use as daily cover or for engineering purposes, or sold for bulk filling or brick manufacture)

- surface water run-off and storm water management.

As presented on Figure 6, WSN have proposed a sedimentation (detention) basin with buried low level pipe and ground level flow channels whose purpose is to divert surface water run-off from the Cell 5 footprint to Eastern Creek.

3.2.1 Cell 5 Preparation

Preparation of a cell for filling consists of one or more of the following activities:

- bund wall construction
- haul road construction
- leachate management (clay lining, leachate collection drains and leachate risers)
- temporary sedimentation dams
- stormwater diversion
- protection of rehabilitated areas
- stockpiling of excavated shale.

Proposed measures for bund wall and haul road construction are discussed below as they relate specifically to cell preparation works. The remaining activities, which are of greater importance during cell construction are discussed in Section 5.

3.2.1.1 Bund Wall Construction

Prior to placing fill materials in Cell 5, external bund walls will be constructed at the boundaries. Each bund wall will be constructed with a basal width of 2 to 3 m utilising excavated cover material. External bund walls will be permanent and constructed to conform to final landform contours with allowance for clay cap and growing medium. The outside batter of these walls will have a nominal gradient of 4:1 (H:V).

3.2.1.2 Haul Road Construction

Within the EC Stage 2 area, temporary haul roads are to be constructed as necessary around the completed cells to provide access to active filling areas. The temporary roads will be constructed from fill materials. In areas of waste, the haul roads will be constructed from compacted waste overlain by 300 mm of clean fill.

The existing haul road from the ECWRC entry gate to the EC Stage 2 area has been sealed, and a bridge has been constructed over Eastern Creek. To protect the gas pipeline, which is located

adjacent to the power easement a culvert has been constructed as a crossing over the pipeline. The reduced level of the road bridge is 55 m AHD, offering approximately 3 m clearance over the banks of Eastern Creek (52.2 m AHD). The design allows more than 1 m clearance over 1 in 100 year flood levels (flood level modelling is discussed in Section 2.1).

4. EXISTING SURFACE WATER AND SOIL MANAGEMENT SYSTEM

Landfill operations are currently in progress in the EC Stage 2 NA under the existing development consent (Figure 2), specifically Cells 4 and 6 are partially filled, Cell 7 is being filled and the proposed area for Cell 5 is currently occupied by what was originally a temporary dam, and grassland. Soil and water management measures designed as part of the original development consent for EC Stage 2 have been implemented. A summary of management infrastructure currently in place is presented below:

- sedimentation dams to contain runoff from stockpiles and the active landfill areas
- perimeter drains around the active landfill areas
- dish drains and low, vegetated bund walls around the EC Stage 2 NA to divert runoff from the surrounding catchment entering the landfill
- adequate pumping capacity to remove retained stormwater in excavations to the main sedimentation dam within a 24 hour period after rainfall. Water retained for longer than 24 hours is managed as leachate
- arrangements to collect waste contact water in the active landfill for irrigation onto the tip face
- transport of stored runoff to the truck wheelwash facility as required
- pumps to transfer water from dams to a water cart
- adequate arrangements to spray-irrigate retained stormwater (retained for less than 24 hours in the excavation) to suppress dust emissions
- perimeter “dirty” water drains around the landfill stages and stockpiles to collect and transfer stormwater to sedimentation dams
- silt fences around the perimeter of the stockpiles
- silt-fence check dams in stockpile perimeter drains to remove sediments from runoff prior to reaching the dams.

5. MANAGEMENT PLAN

The following section describes the proposed management strategy and infrastructure for soil and water in the proposed extension area.

5.1 MANAGEMENT STRATEGY

The proposed stormwater management strategy is based on the following principles:

1. volume reduction through the diversion of "clean" runoff around waste cells into Eastern Creek
2. reduction in the volume of "dirty" stormwater through the progressive rehabilitation of completed areas and decommissioning of stormwater drains
3. irrigation of stormwater retained in active landfill areas onto the active tip face and for general dust suppression
4. treatment of stormwater retained in sedimentation dams as required prior to release into Eastern Creek
5. minimising erosion of external surfaces through the use of mulch and cover crops
6. reduction in the volume of retained stormwater through on-site re-use. Treatment will be minimised by using the poorest quality water acceptable for each task.

Surface runoff from the area east of ECWRC (i.e. Ferrers Road and the WSID) will be diverted around the EC Stage 2 NA cells, adjacent to the existing overhead power easement, and discharged into Eastern Creek. WSN has constructed a temporary retention basin at the western end of the existing drainage channel to collect additional water for on-site use if required.

5.2 MANAGEMENT INFRASTRUCTURE

Infrastructure for soil and water management consists of the items listed below. Each aspect of the infrastructure is discussed in subsequent sections and the main features are displayed on Figure 5.

- silt fences around the perimeter of any stockpiles
- silt-fence check dams in stockpile perimeter drains to remove sediments from runoff prior to reaching the dams
- a low (0.5 to 1.0 m high) bund wall will be constructed in the floor of the Cell 5 to separate waste contact water from stormwater

- collection and use of waste contact water in the active landfill for irrigation onto the tip face
- adequate pumping capacity to remove retained stormwater in the excavation to sediment dam 202 within a 24-hour period after rainfall. A water cart may be used for this purpose
- perimeter "dirty" water drains, which have been installed around the active landfill areas in EC Stage 2, will be extended across Cell 5 with each stage of landfill expansion
- the existing dish drains and low, vegetated bund walls will be extended around Cell 5 to divert clean runoff from the catchment surrounding the landfill
- use of a sedimentation basin (existing Dam 203) for stormwater runoff from Cells 6 and 7
- sedimentation basin (nominated as Dam 202) as shown on Figure 3 will be used to collect stormwater runoff from Cell 4 and Cell 5
- maintenance of the proposed detention basin between the existing Ferrers Road culvert and the eastern walls of Cell 4 and Cell 5, for the collection of runoff from an unnamed tributary of Eastern Creek
- maintenance of the new low flow piped drainage system from the southern end of the new sedimentation basin, running along the northern side of the power easement, to enable surface runoff discharge into Eastern Creek near the bridge crossing
- maintenance of the new weir drain with low vegetated bund walls above the buried piped drainage system to divert overflow from the proposed detention basin to discharge into Eastern Creek
- maintenance of existing stormwater drains to divert surface runoff upslope of Cell 6 and Cell 7 along the northern boundary of the ECWRC
- adequate arrangements to retain stormwater in sedimentation dams for use in dust suppression
- treatment of stored runoff if necessary to meet licence limits, prior to discharge to Eastern Creek.

5.2.1 Erosion Control Measures

Erosion control measures on active landfill areas will only be required when the landfill emerges above the existing natural ground level. Prior to this time, rainfall in excavated cells will be collected and irrigated onto the active tip face or used for dust suppression. Mulch or cover crops will be applied to external landfill batters built to final landform contours in order to minimise erosion. Silt fences will also be constructed along the base of slopes, as each lift of waste is placed above grade. Silt fences will also be erected around the base of stockpiles. Stockpiles and exposed areas will be stabilised with vegetation or mulch if the area is not planned to be reworked for a period of 90 days.

5.2.2 Stormwater Collection and Transport

The proposed stormwater collection and transport system proposed for Cell 5, as shown on Figure 5, consists of an external bund wall around the final footprint of the landfill cells in order to divert "clean" runoff entering the areas of filling. This water will be discharged directly into Eastern Creek. Perimeter drains for the collection of surface runoff from completed landfill areas ("dirty" water) will be constructed between the landfill and the clean water diversion drains. "Dirty" water drains will divert runoff into sedimentation dams for treatment as required prior to discharge.

In the EC Stage 2 NA, it is intended that stormwater collection drains will be progressively decommissioned by filling with Virgin Excavated Natural Material (VENM) and revegetated when vegetation on completed landfill stages becomes established. Decommissioning of parts of stormwater drains will only occur when it has been demonstrated that catchment vegetation is at least 90% established.

5.2.3 Sedimentation Dams

Sedimentation dams line the western side of the EC Stage 2. The CES (2009) Leachate Management and Groundwater Impacts report has verified that the existing sedimentation dams 201 and 203 have the capacity to accommodate runoff from Cells 4 to 7, including the required settling zone for the 1 in 20 year ARI storm event. Thus additional sedimentation dams have not been planned for the proposed Cell 5 extension.

5.2.4 Stormwater Retained in Excavations and Landfill Areas

Stormwater retained in excavated cells and competed landfill areas (i.e. 'dirty' water) will be segregated from waste contact water by means of temporary, low (0.5 to 1.0 m) bund walls. Waste contact water will be treated as leachate, and will either be collected for spray irrigation onto the tip face to assist compaction and wetting of the waste, or tankered off site for disposal.

Retained stormwater that does not come into contact with waste will be treated as stormwater, provided that it is removed from the cell or landfill area within 24 hours. Retained stormwater will be pumped into sedimentation dams for use in dust suppression or treatment if necessary prior to discharge to Eastern Creek. Stormwater retained in the pit for longer than 24 hours will be regarded as leachate and treated in the same manner as waste contact water above.

5.2.5 Treatment of Stored Runoff

Reuse of stormwater retained in excavations and sedimentation dams will be maximised during daily operations. If however discharge into Eastern Creek is required, then prior treatment should occur as necessary to meet the requirements of the Environment Protection Licence for the site. Current requirements of the licence are for discharge water to have a TSS concentration of less than 50 mg L^{-1}, ammonia concentration of less than 0.9 mg L^{-1} and pH to be between 6.5 and 8.5.

5.3 STAGING OF SOIL AND WATER MANAGEMENT PLAN

The stages of landfill development are outlined in Section 3. The proposed soil and water management strategy essentially comprises use of existing and established infrastructure with some additional features. The additional features required are listed below and will require construction prior to the commencement of excavation in Cell 5:

- the new sedimentation basin adjacent to the Ferrers Road culvert
- the buried low-flow piped drainage system diverting flow from the proposed detention basin into Eastern Creek
- the vegetated drain at ground level diverting overflow from the proposed detention basin into Eastern Creek
- external bund walls around the perimeter of Cell 5
- drains for both clean and dirty runoff around the perimeter of Cell 5
- remodelling of existing drains around the perimeters Cells 4, 6 and 7 if required to convey additional cell runoff.

5.4 DESIGN CALCULATIONS

Design calculations for sedimentation dams and drainage channels are presented below.

5.4.1 Stormwater Collection and Diversion Drains

As discussed in Section 5.2, drains will be constructed around Cell 5 to divert “clean” runoff from the upstream catchment around the landfill and stockpile areas into Eastern Creek. Separate drains will be constructed to collect runoff from landfill and stockpile areas.

The 1 in 20 year ARI flow from the time of concentration event was adopted as the design capacity of stormwater collection and diversion drains at the site. Stormwater collection and

diversion drains will be turf-lined earthen channels except where channels are excavated into bedrock. Channel lining methods (i.e. turf or synthetic reinforced turf) have been selected based on design velocities contained in Landcom (2004) guidelines.

Design criteria for turf-lined channels are summarised in Table 6. These design criteria will also be adopted for any channels excavated into bedrock, with the exception that if any bedrock is encountered these channels will not be lined with turf.

Drain dimensions were calculated at the following locations in accordance with design criteria defined in Table 6:

- dirty water drain around perimeter of Cells 6 and 7
- dirty water drain around perimeter of Cell 5
- dirty water drain around perimeter of Cell 4
- clean water diversion drain around the perimeter of the EC Stage 2 NA.

Dimensions for stormwater drains are summarised in Table 7. An additional 0.2 – 0.5 m of freeboard should be included during drain construction to provide surplus flow capacity.

5.4.2 WSID Runoff Diversion Drain

Design of the overflow drain that will divert runoff from the realigned Ferrers Road and the WSID has been commissioned by WSN. A base width of 3 – 5 m with batter constructed at a 3:1 (H:V) grade has been proposed. A relatively deep cut is required at the eastern end of the drain in order to facilitate drainage from the existing drainage line.

5.4.3 Sedimentation Dams

As discussed in Section 5.2, the proposed extension will use only the two existing sedimentation dams for the EC Stage 2 NA. Should any additional dams be required the design calculations for sedimentation dams and drainage channels must consider the maximum catchment area at any stage during the development. Consistent with Landcom (2004) requirements, design criteria for any future sedimentation dams are presented in Table 8.

The Landcom (2004) guidelines recommend that the 75th percentile, 5 day rain event be used to design Type D basins (fine grained soils with >10% dispersible clays). To date the 90th percentile has been adopted for all existing dams on the EC Stage 2 area and therefore exceeds Landcom (2004) requirements.

5.4.4 Active or Passive Sedimentation

Stormwater retained in sedimentation dams will be treated if necessary prior to discharge. The system will be designed to produce treated stormwater with TSS concentrations of less than 50 mg L^{-1}, an ammonia concentration of 0.9 mg L^{-1} and neutral pH.

The total capacity of sedimentation dams on the EC Stage 2 NA is estimated to be 14.9 ML (Aecom 2009), and has been assessed to be sufficient to accommodate runoff from the total EC Stage 2 NA. In reality, the dams are unlikely to receive runoff from the entire northern area at any stage during the operation, due to the staging of filling works and decommissioning of drainage from completed stages once vegetation becomes established.

5.4.5 Energy Dissipation

Existing dam spillways are lined with gabion mattress or pressure-grouted concrete mattress. Outlet channels are lined with turf or turf reinforced with UV stabilised mesh. Any future dam spillways should incorporate these design features.

5.5 ANTICIPATED SYSTEM PERFORMANCE

The existing sedimentation basins are designed to remove particles larger than 0.06 mm diameter during peak flow resulting from the 20 year ARI storm event. Particles of this size represent approximately 85% of the particle-size distribution of source material at the site. While source material (landfill cover) does not reflect the size distribution of suspended sediment load it may be concluded that the basins will remove a large percentage of the TSS load. It is anticipated that treatment will consistently yield TSS concentrations of less than 50 mg L^{-1}, ammonia concentrations of less than 0.9 mg L^{-1} and neutral pH levels in water discharged from the site.

The quality of water passing through the high flow drain adjacent to the transmission line easement will be determined principally by the design, management and operation of the WSID and Ferrers Road.

5.6 MONITORING AND REPORTING REQUIREMENTS

A water-quality monitoring programme is specified in the Landfill Environmental Management Plan (LEMP) for ECWRC which should continue to be implemented during and after Cell 5 construction.

All existing dams are equipped with a marker to indicate when cleaning is required and monitoring of sediment levels in the dams should continue to be undertaken in accordance with the LEMP. Stored sediments should continue to be removed once the storage zone has been filled.

If water from the sediment dams requires discharge into Eastern Creek then the performance of any treatment system used should be monitored by the collection of samples for laboratory analysis.

Samples should be collected from each dam prior to discharge, in the three month period following the establishment of Cell 5 drainage infrastructure. Once sufficient data becomes available, rating relationships will then be developed to estimate TSS concentrations from field measurements of turbidity. Electrical conductivity, ammonia, DO and pH should also be measured prior to discharge. Stored water should be discharged directly into Eastern Creek if discharge criteria are satisfied (Section 2.2). Back-up laboratory samples should be collected. Treated water should be recirculated in dams, through the treatment process, until quality objectives are met.

Soil and water management infrastructure for the extension site has been designed to ensure that all discharges from the landfill comply with discharge criteria nominated in Section 2.2. Overflows from the dam will only occur during rain events that exceed the 90th percentile, 5 day rain event.

6. CONCLUSIONS

WSN operates a Solid Waste Class 1 (putrescible), known as Eastern Creek Waste and Recycling Centre (ECWRC) on Wallgrove Road at Eastern Creek. This plan provides a revised management strategy for soil and water in the EC Stage 2 area of the site, allowing for proposed extensions in the Northern Area (NA) which comprise:

- construction of Cell 5, a new cell, in the area between the partially filled Cells 4 and 6
- increasing the pre-settlement final waste level in Cells 6 and 7 by 4 metres (m) to relative level (R.L.) 82.5 m above Australian Height Datum (m AHD)
- place additional waste in Cells 4, 6 and 7 that have been excavated in accordance with existing consent
- increasing the approved waste disposal rate for the period 1 July 2010 to 30 June 2011 from 500 000 tonnes per annum (tpa) to a maximum of 550 000 tpa
- increasing the approved waste disposal rate the period 1 July 2011 to 30 June 2017 from 350 000 tpa to a maximum of 550 000 tpa
- extending the duration over which putrescible waste can be accepted at the landfill from 30 June 2014 to 30 June 2017.

The main aspects of the revised strategy are summarised below:

- volume reduction through the diversion of “clean” runoff around waste cells and into Eastern Creek
- reduction in the volume of “dirty” stormwater through the progressive rehabilitation of completed areas and decommissioning of stormwater drains
- irrigation of stormwater retained in active landfill areas onto the active tip face
- reduction in the volume of retained stormwater through on-site re-use. Treatment will be minimised by using the poorest quality water acceptable for each task
- treatment of stormwater retained in sedimentation dams if required prior to release into Eastern Creek
- minimising erosion of external surfaces through the use of mulch and cover crops.

It is anticipated that the proposed stormwater system will consistently maintain concentrations of TSS in discharges from the site below the discharge criterion of 50 mg L^{-1} and achieve limits on pH levels. Ongoing water-quality monitoring and data analysis detailed in the EA will provide ongoing assessment of system performance.

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FIGURES

N

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TITLE	CES PROJECT ID	SCALE	SIZE
Figure 1: Site Location Map	CES000105-NEC	Not to scale	A4

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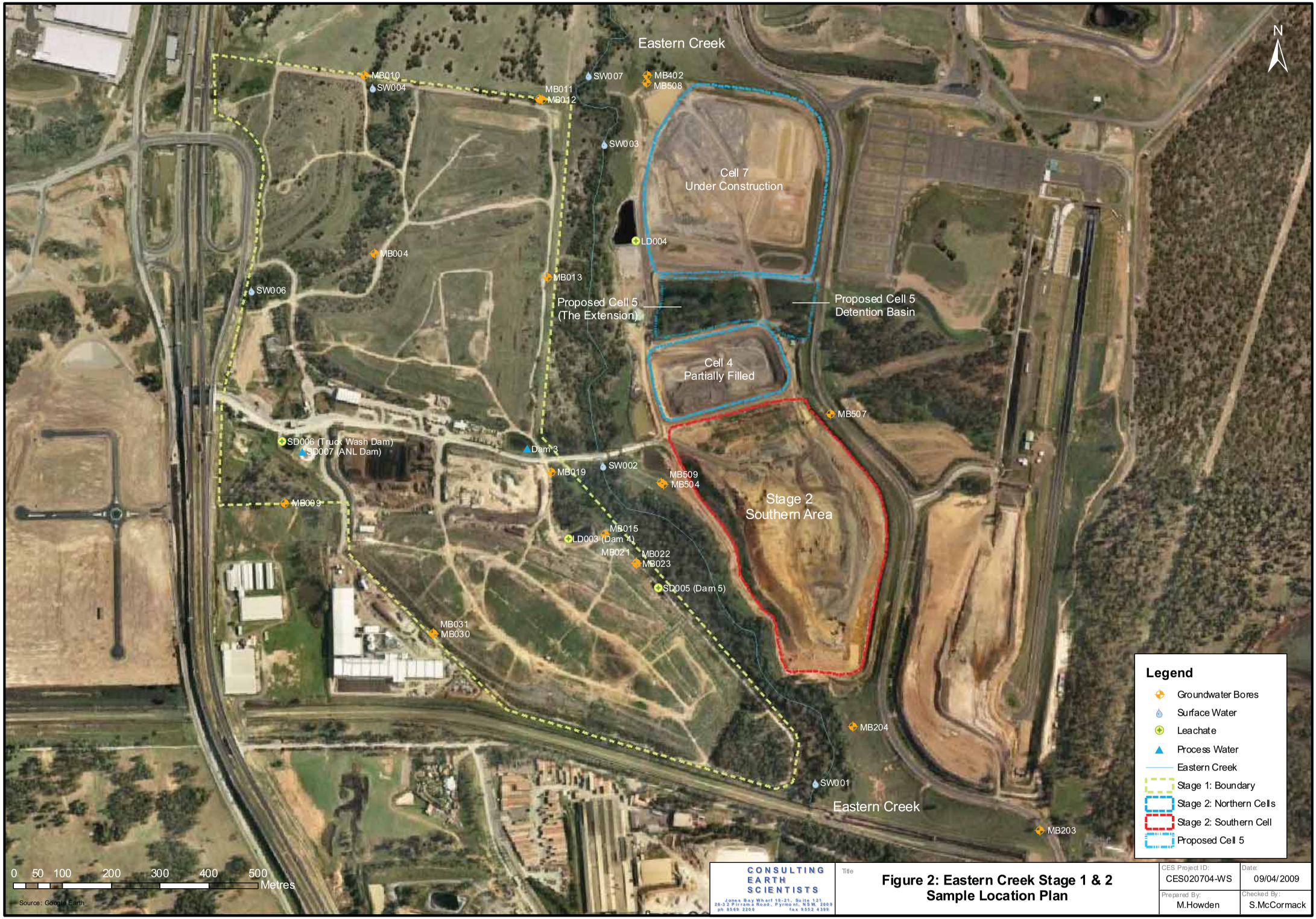
1/111 Moore St, Leichhardt NSW 2040
ph: 02 8585 4888 fax: 02 9550 9566

DATE	PREPARED BY	CHECKED BY
03/08/2009	SD	MS



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Jones Bay Wharf 19-21, Suite 121
26-32 Pirrama Road, Pyrmont, NSW, 2009
ph 8569 2200 fax 9552 4399

Title

Figure 2: Eastern Creek Stage 1 & 2 Sample Location Plan

CES Project ID:	Date:
CES020704-WS	09/04/2009
Prepared By: M.Howden	Checked By: S.McCormack

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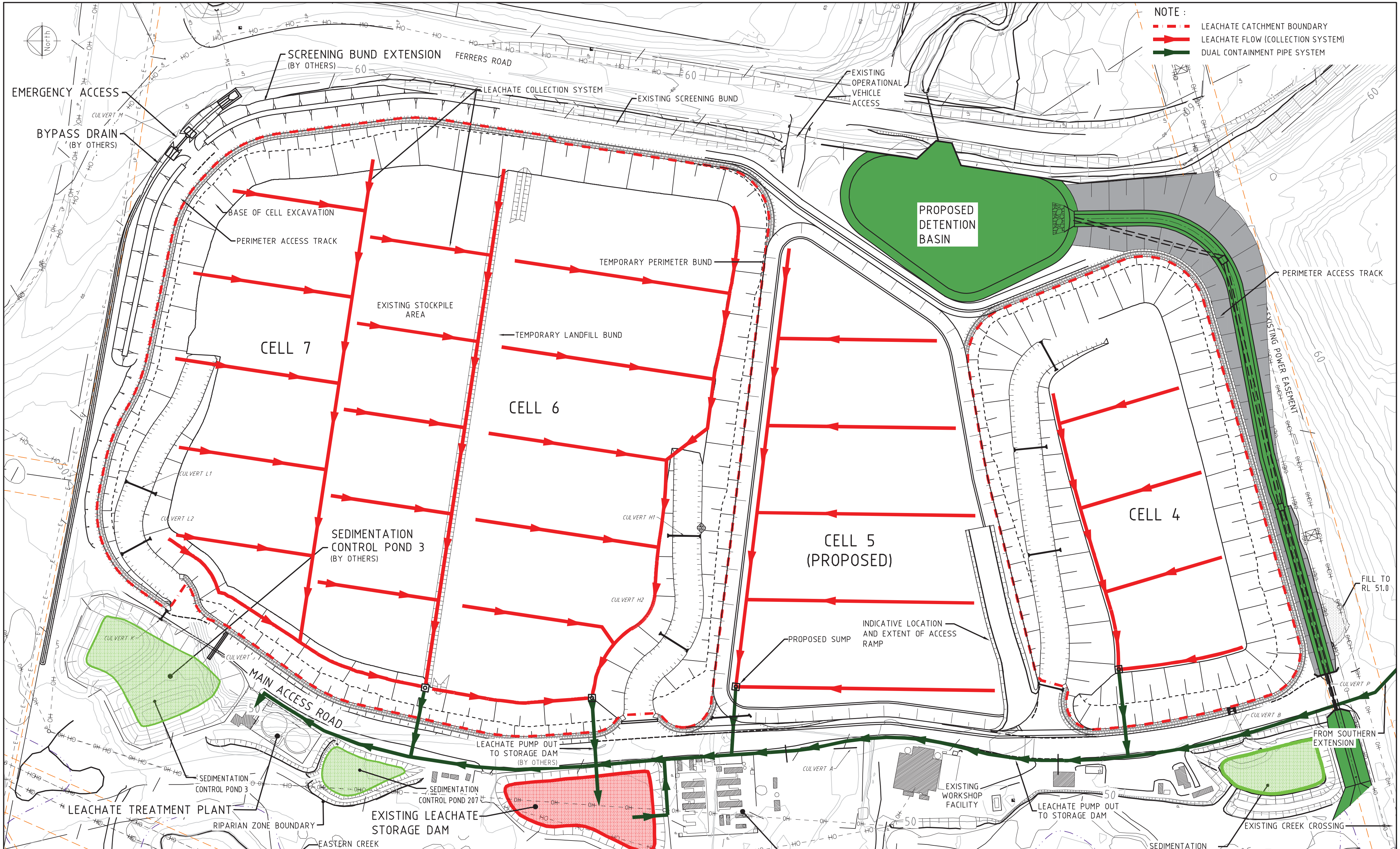
26-32 Pirrama Road, Pyrmont, NSW, 2009
ph 8569 2200 fax 9552 4399

Title

Figure 3: Dam Location's

CES Project ID:	Date:
CES020704-WS	29/9/2009
Prepared By: S.Burnett	Checked By: A.McNeill



PRELIMINARY CONCEPT DESIGN

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EASTERN CREEK LANDFILL - NORTHERN CELLS
LEACHATE MANAGEMENT SYSTEM

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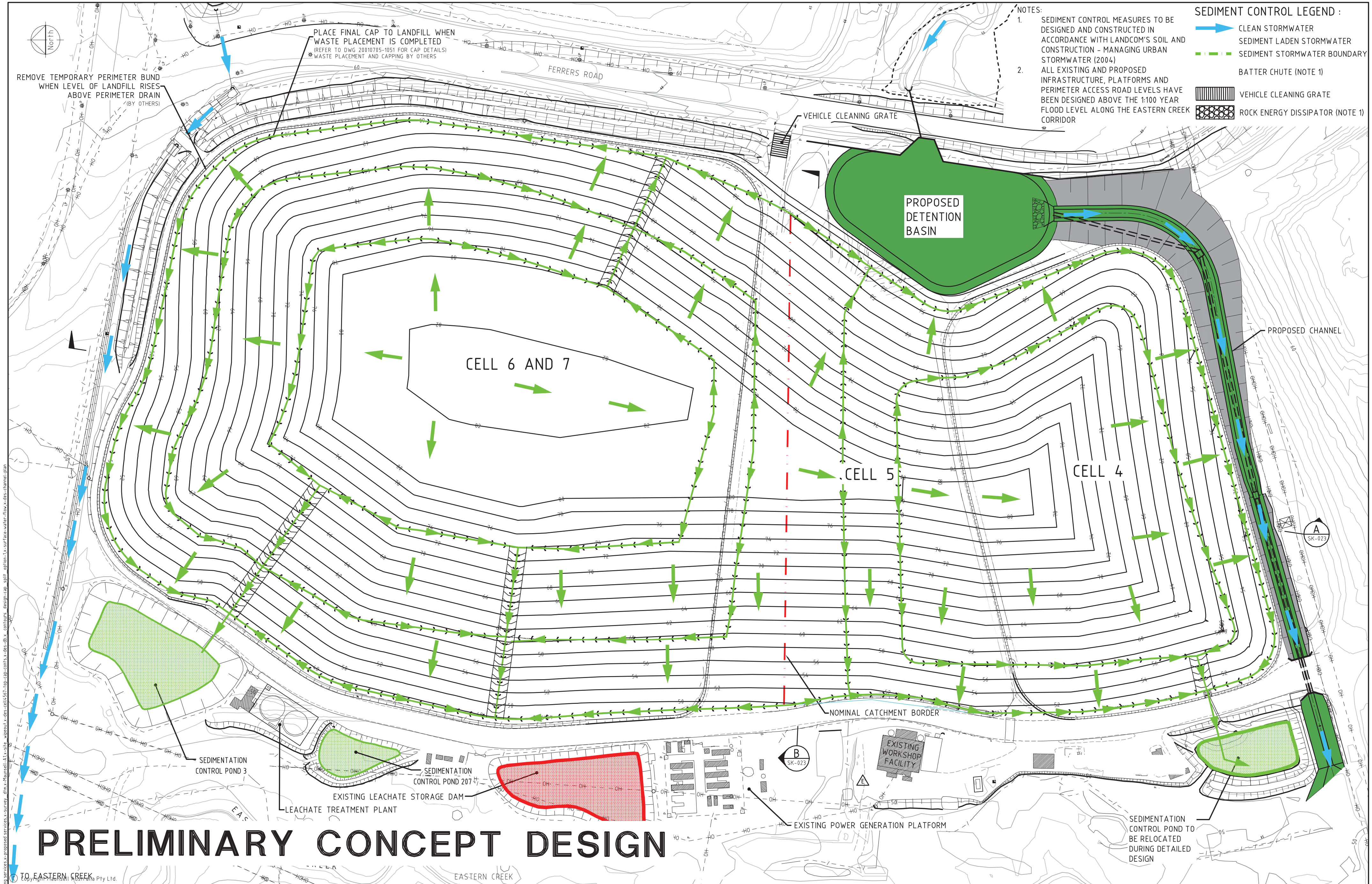
Rev. A



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SURFACE WATER MANAGEMENT LAYOUT

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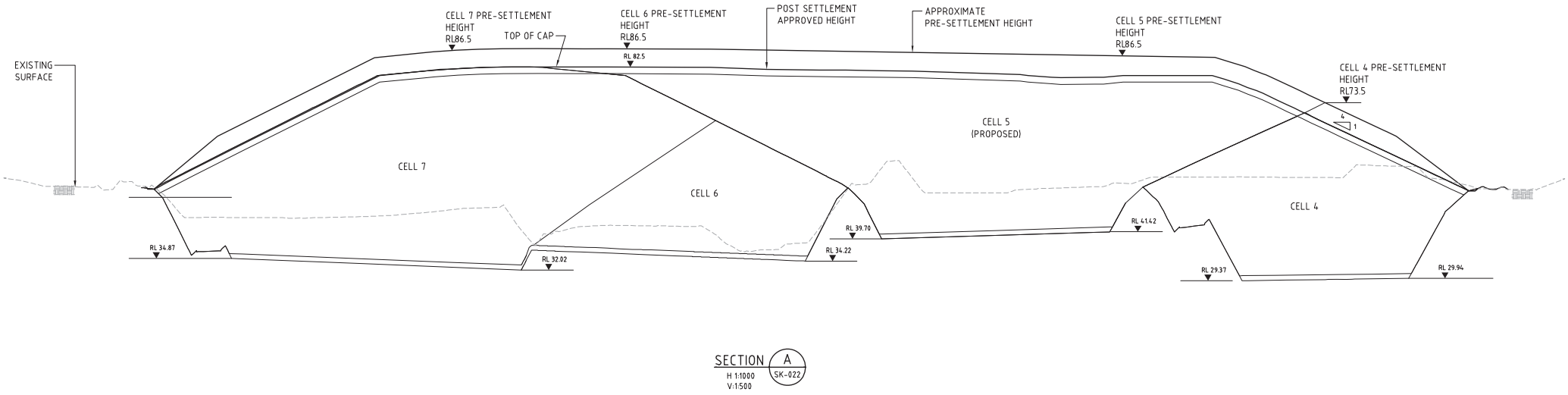
Xref's: x-contours_ dtm x-design x-existing services x-proposed services x-survey dtm x-Maunsell-A1 x-site wipeout x-des-cell4567-top-cap-conts x-des-db x-contours design-cap split option-1 x-surface-water-flow x-des-channel-plan



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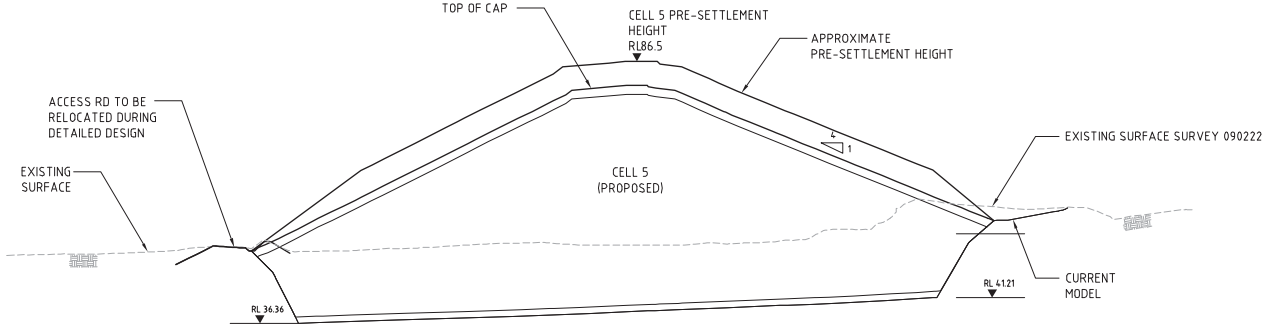

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NOTE:
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2. PRE-SETTLEMENT HEIGHT BASED ON 4.0m SETTLEMENT TO POST SETTLEMENT APPROVED HEIGHT.
3. THE MAXIMUM HEIGHT OF CELL 4 PRE SETTLEMENT IS APPROXIMATELY RL73.5

PRELIMINARY CONCEPT DESIGN

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A			REVISION IN PROGRESS	

Scale
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1 : 500 FULL SIZE A1

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EASTERN CREEK LANDFILL - NORTHERN CELLS

SECTION DETAILS

Status: SKETCH
Drg No.: 20010705-SK-023
Rev.:

TABLES

Table 1: Summary of quarterly monitoring results 2005- 2009 at SW001, Eastern Creek

Pre-2008 Dataset

	pH (field)	Electrical Conductivity (field)	Biological Oxygen Demand	Total Organic Carbon	Ammonia as N	Total Kjeldahl Nitrogen	TSS	TDS
Units	--	µS/cm	mg/L	mg/L	mg-N/L	mg-N/L	mg/L	mg/L
26-Aug-05	8.84	1416	0.5	3	0.03	0.8	15	420
31-Oct-05	7.62	558	4	13	0.07	1.3	19	870
24-Nov-05	7.63	477	3	6	0.07	0.8	57	360
15-Feb-06	7.46	857	0.5	8	0.03	0.2	2	490
18-May-06	8.04	596	1	6	0.26	0.6	2	390
10-Aug-06	8.64	851	0.5	13	0.005	0.7	8	370
22-Nov-06	9.43	1013	0.5	-	0.005	0.4	8	-
19-Feb-07	6.76	707	0.5	-	0.03	1	7	-
16-May-07	8.97	360	0.5	-	0.03	0.6	3	-
29-Aug-07	8.97	1450	2	-	0.1	1.5	36	-
20-Nov-07	8.15	292	1	-	0.04	1.2	42	-
Count	11	11	11	6	11	11	11	6
Mean	8.2	779.7	1.3	8.2	0.1	0.8	18.1	483.3
Median	8.15	707	0.5	7	0.03	0.8	8	405
Minimum	6.76	292	0.5	3	0.005	0.2	2	360
Maximum	9.43	1450	4	13	0.26	1.5	57	870

Post-2008 Dataset

	pH (field)	Electrical Conductivity (field)	Biological Oxygen Demand	Total Organic Carbon	Ammonia as N	Total Kjeldahl Nitrogen	TSS	TDS
Units	--	µS/cm	mg/L	mg/L	mg-N/L	mg-N/L	mg/L	mg/L
25-Feb-08	7.55	1864	5	-	0.005	2.1	25	-
7-May-08	7.09	724	4	-	0.67	2.9	290	-
13-Aug-08	7.77	1011	0.5	-	0.04	0.6	8	-
3-Nov-08	7.65	921	1	-	0.1	1.5	<1	-
24-Feb-09	8.72	887	7	-	0.33	2.2	740	-
21-May-09	8.4	499	1	-	0.04	4.5		-
Count	6	6	6	0	6	6	4	0
Mean	7.9	984.3	3.1	-	0.2	2.3	265.8	-
Median	7.71	904	2.5	-	0.07	2.15	157.5	-
Minimum	7.09	499	0.5	0	0.005	0.6	8	-
Maximum	8.72	1864	7	0	0.67	4.5	740	-

Table 2: Summary of overflow sampling results 2005- 2009 at Dam 201, Eastern Creek			
Pre-2008 Dataset			
Date	**Ammonia**	**TSS**	**pH**
	mg-N/L	**mg/L**	**pH units**
2/13/07	6.82	450	7.7
2/27/07	7.2	210	7.4
4/26/07	13	130	8.1
6/8/07	14	530	8.1
6/12/07	25	100	8.1
6/15/07	29	470	8
6/16/07	16	1700	7.9
6/17/07	15	330	8.1
6/18/07	14	260	8
6/19/07	36	350	8
6/20/07	26	220	8
6/27/07	76	480	8
7/9/07	120	870	8.1
8/20/07	32	1900	8
Count	14	14	14
Mean	30.72	571.43	7.96
Median	20.5	400	8
Maximum	120	1900	8.1
Minimum	6.82	100	7.4
Post-2008 Dataset			
Date	**Ammonia**	**TSS**	**pH**
	mg-N/L	**mg/L**	**pH units**
2/6/08	4.5	270	8.2
2/7/08	4.6	410	8.1
2/8/08	6.6	290	8
2/9/08	5.4	350	8.1
2/16/09	13.6	1460	7.7
2/17/09	13.4	1240	8
2/18/09	12.5	410	7.9
Count	7	7	7
Mean	8.66	632.86	8.00
Median	6.6	410	8
Maximum	13.6	1460	8.2
Minimum	4.5	270	7.7

Table 3: Summary of overflow sampling results 2005- 2009 at Dam 202, Eastern Creek			
Pre-2008 Dataset			
Date	**Ammonia**	**TSS**	**pH**
	mg/L	**mg/L**	**pH units**
9/7/06	0.21	4300	7.3
9/10/06	3.31	440	7.6
2/13/07	0.05	1300	7.9
2/27/07	0.05	100	8
2/28/07	-	57	8.1
6/16/07	6.5	2500	8
6/17/07	7.5	340	7.9
6/18/07	4.2	120	8.1
6/19/07	6.7	570	8
6/20/07	7.7	460	8
8/20/07	58	3300	8.3
12/6/07	3.6	33	8
Count	11	12	12
Mean	8.89	1126.67	7.93
Median	4.2	450	8
Maximum	58	4300	8.3
Minimum	0.05	33	7.3
Post-2008 Dataset			
Date	**Ammonia**	**TSS**	**pH**
	mg/L	**mg/L**	**pH units**
1/21/08	2.7	94	8.6
2/4/08	3	67	8
2/6/08	6.6	140	7.9
2/7/08	4.3	140	8
2/8/08	3.9	96	7.9
2/9/08	4.1	190	8
6/4/08	5.82	120	8.2
6/5/08	8.97	100	8
10/14/08	23.5	31	8.2
10/15/08	26.8	45	8.1
10/16/08	26.7	27	8.3
10/17/08	26.7	49	8.4
12/2/08	17.6	26	8.1
12/15/08	4.13	345	8.2
12/16/08	3.7	329	8.4
12/17/08	2.62	229	9.2
2/16/09	3.96	7260	7.8
2/17/09	6.62	727	8
2/18/09	9.42	620	7.9
2/19/09	9.18	447	7.8
2/20/09	9.94	324	8.1
Count	21	21	21
Mean	10.01	543.14	8.15
Median	6.6	140	8.1
Maximum	26.8	7260	9.2
Minimum	2.62	26	7.8

Table 4: Summary of overflow sampling results 2005- 2009 at Dam 203, Eastern Creek

Pre-2008 Dataset			
Date	**Ammonia**	**TSS**	**pH**
	mg/L	**mg/L**	**pH units**
9/7/06	0.14	2700	7.8
9/11/06	0.12	1400	7.7
2/27/07	0.05	5200	8.5
2/28/07	-	548	9.18
4/27/07	0.152	324	8.17
6/16/07	0.1	6600	7.9
6/17/07	0.11	4700	8
6/19/07	0.1	3200	8
6/20/07	0.09	3900	8
Count	8	9	9
Mean	0.11	3174.67	8.14
Median	0.105	3200	8
Maximum	0.152	6600	9.18
Minimum	0.05	324	7.7

Table 5: Proposed Filling Programme for ECWRC Stage 2 Northern Area										
	Available Air Space (m^3)	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Cell 4	697,600	filled to ground level	filled to ground level	fill above ground level	fill above ground level	capping & rehabilitation				
Cell 5	1,090,000	unexcavated	unexcavated	a)excavation & construction b) fill to ground level	fill above ground level	fill above ground level	capping & rehabilitation			
Cell 6	941,760	fill to ground level	filled to ground level	filled to ground level	fill above ground level	fill above ground level	fill above ground level	fill above ground level	fill above ground level	capping & rehabilitation
Cell 7	2,175,640	excavation & construction	fill to ground level	fill to ground level	fill to ground level	fill above ground level	fill above ground level	fill above ground level	fill above ground level	capping & rehabilitation

Table 6: Design criteria for turf-lined channels.	
Parameter	**Design criteria**
Design capacity	1 in 20 year ARI time of concentration event
Soil erodibility[1]	Moderate (K = 0.038)
Maximum velocity for design storm[2]	2.2 m s^{-1} for channels lined with turf 2.7 m s^{-1} for channels lined with turf reinforced with UV-stabilised mesh
Average side batter (H:V)	2:1 - 3:1
Gradient **Note: It may be necessary to re-grade the existing perimeter drains in order to achieve design grade.**	Dirty water drain around Cell 4 0.5% Dirty water drain around Cell 5 0.5% Dirty water drain Cells 6 & 7 0.5% Clean water diversion adjacent Stage 2- 1.5%
Manning's *n*[3]	0.035
Runoff coefficient (C10)[4]	0.7
FF_{20}[5]	1.2

Note 1: Department of Housing (1998), Appendix B.
Note 2: Design velocities from Department of Housing (1998) Table 5.1.
Note 3: O'Loughlin and Robinson (1987), Table 14.17, page 337. Roughness coefficient for medium-length grass.
Note 4: Zone B, NSW. C10 from Figure 5.1, volume 2 Australian Rainfall and Runoff (Institution of Engineers Australia, 1987).
Note 5: Frequency factor for 20 year ARI (Pilgrim, 1987, Table 5.1).

Table 7: Summary of dimensions for stormwater drains.								
Drain	**Form**	**Gradient (%)**	**Top Width (m)**	**Bottom Width (m)**	**Flow Depth at design Q (m)**	**Bank grade (H:V)**	**Design Q ($m^3 s^{-1}$)**	**Cross sectional Area of flow at Design Q (m^2)**
Dirty water drain – Cell 4	Trapezoid (turf)	0.5%	3.5	0.5	0.5	2:1	0.85	1.0
Dirty water drain – Cell 5	Trapezoid (Turf)	0.5%	1.8	0.25	0.4	2:1	0.29	0.4
Dirty water drain – Cells 6 and 7	Trapezoid (Turf)	0.5%	7.0	1.0	1.0	3:1	5.4	4.0
Clean water diversion – Stage 2	Trapezoid (Turf)	1.5%	5.05	0.25	0.8	3:1	4.02	2.12

Table 8: Summary and assessment of design criteria for sedimentation dams.	
Parameter	**ECWRC Stage II Criteria**
Basin type [1]	Type D. Fine grained soils with >10% dispersible clays
Design approach	Storm containment
Design discharge	90th percentile, 5 day rain event
Settling zone capacity	Contain all runoff from 90th percentile, 5 day rain event =10 x C_v x A x R(90%tile, 5 day)
C_v (volumetric runoff coefficient)	0.7
Storage zone volume	Average 2 month soil loss from disturbed area. Minimum 30% settling zone volume.
R (rainfall erosivity factor)	164 x $(1.1177)^s$ $s^{0.6444}$ where s = 2 year ARI, 6 hour storm intensity = 10.52 mm hr^{-1} (Blacktown area) R = 2419.734
K (soil erodibility)	0.038 (Blacktown area)
LS (average)	8.68
P	1.2 (track walked along contour)
C	1 (no ground cover, worst case scenario)
Length:width ratio	Nominal 3:1
Embankments (H:V)	3:1
Outlet	100 year ARI time of concentration
Note 1: Waste Service NSW (2000).	