13. Soils and surface water

The information presented in this chapter is based on the findings of the surface water assessment undertaken by GHD. The surface water assessment report is included in Appendix H of this EIS.

13.1 Approach and methodology

The surface water assessment included:

- Review of information provided by SITA, in particular the existing Soil and Water Management Plan (SITA 2012)
- Review of the proposed landfill staging plans
- Review of the properties of on-site and imported soils in terms of soil type, capping material, soil erosion potential and their potential for subsidence or instability
- Review of existing regulatory requirements (specifically in regard to total suspended solids in surface water discharges from the site)
- Investigation of the existing conditions of on-site surface water including water quantity and water quality, and an assessment of the water requirements
- Description of stormwater management measures and proposed controls, taking into account the potential for flooding during construction, operation and post-closure
- Development of control measures in accordance with Landcom (2004) 'Soils and Construction Managing Urban Stormwater Volume 1' (Landcom 2004) and DECC (2008) Managing Urban Stormwater Soils and Construction – Volume 2B – Waste Landfills (DECC 2008)
- An assessment of the impacts after management measures are put in place

This chapter addresses surface water which is defined as the rainwater runoff on the LHRRP which subsequently drains off the LHRRP and does not percolate through the bulk landfill waste mass. The rainwater which percolates through the bulk landfill waste mass is considered 'landfill leachate' and is addressed in Chapter 15 as it is managed through a separate system to leachate generated from the GO facility and ARRT facility.

This chapter also addresses surface water which comes into contact with the garden organics at the GO facility. This contact water is termed GO facility leachate as rainfall water may come into contact with organic materials.

This chapter also addresses process leachate generated in the ARRT facility. This refers to the water that comes into contact with the processed waste.

Groundwater is considered in Chapter 14.

13.1.1 Objectives

In addition to addressing the SEARs, the surface water assessment provides an assessment of how well the proposal meets SITA's objectives.

The following objectives have been identified:

- No significant impacts on the community or environment
- Prevention of surface water contamination

- Minimising sediment generation and transport off the site
- Minimising soil erosion
- No significant impacts to downstream flow conditions

13.2 Existing environment

13.2.1 Surface water features

Most of the LHRRP lies within the Mill Creek catchment. Mill Creek originates from the LHRRP and flows north along the western boundary towards Georges River. The gradients of the LHRRP are typical of a dissected plateau, with the slopes becoming steeper close to Mill Creek. Mill Creek itself has a slope of 2% as it travels through the LHRRP. Baseflow for the perennial rivers and streams are generally sourced from seeps and springs derived from groundwater.

Most of the LHRRP (the landfilled portion) lies within the catchment area of Mill Creek, with the exception of the area bounded by New Illawarra Road and Little Forest Road in the south-east and the administration facilities, which drains to Bardens Creek. As this area is not impacted by the proposal, impact to Bardens Creek were not assessed in the surface water assessment. Mill Creek originates from within the LHRRP and flows in a northerly direction through approximately the centre of the site, covering most of the length of the site. Towards the origin of the creek, the channel is not always clearly visible. Apart from small overflows, flooding is not expected to occur over the proposal site because the gradients of the proposal site allow good drainage.

The main sediment and water reuse basin dam located at the north-west corner operates as a sediment retention basin and water reuse basin.

Figure 13.1 shows the surface water features and environment in the vicinity of the proposal site.

13.2.2 Regional water uses

A licence search was undertaken using the NSW Office of Water NSW Water Register. All lots adjacent to the proposal site and adjacent to downstream waterways were input into the register search tool to identify licenced surface water users that could potentially be impacted by activities at the proposal site. This search continued downstream to the confluence with the Georges River, at which point the contribution of flows from the proposal site are not a significant proportion of the overall catchment area.

The only licensed surface water user identified was the Lucas Heights 1 Golf Course. However it is understood that this water use is related to dams installed on the east of the golf course site. The dams are not located downstream of the proposal.

LEGEND

Waterways

10 m Contours

Paper Size A4

0 70 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
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Job Number 21-23482
Revision A
Date 24 Feb 2015

Surface water environment

Figure 13.1

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G:\21\23482\GIS\Maps\MXD\21-23482-Z0321_SurfaceWaterEnvironment.mxd

Data source: Imagery: SITA. Created by:rgtowner

13.2.3 Site water management

There are a number of surface water management features currently in place at the proposal site. Surface water diversion drainage is constructed around the rim of each active waste disposal cell to control surface water runoff flowing into or from the cells. The drainage typically comprises open channel drains on the outer edge of earthen bunds. Surface water is collected in drains, swales and ponds and diverted to sediment dams. The dams are designed to allow for settlement of suspended solids before discharging offsite following large rainfall events when stormwater has reached capacity.

A stormwater treatment facility is located at the LHRRP which treats sediment laden stormwater in the main sedimentation basin prior to any discharging to Mill Creek. The treated water is then discharged to Mill Creek (in accordance with the EPL conditions) or reused at the LHRRP.

SITA takes a proactive approach to managing surface water quality at the LHRRP. Since SITA acquired the site, a number of surface water management works have been completed or have been included as part of routine maintenance works. These are discussed in the surface water assessment report (Appendix H).

Figure 13.2 shows the location of the key surface water features.

13.2.4 Baseline surface water quality

To gain an understanding of the existing baseline conditions of water quality of the major water receptor, Mill Creek, GHD undertook a detailed aquatic ecosystem survey (refer appendix to Surface Water Assessment, Appendix H) which investigated the aquatic ecosystems of Mill Creek. The purpose of the investigation was to examine if any impacts to aquatic macroinvertebrates, a well-known indicator of creek/river health, may be occurring in the habitats downstream of the LHRRP.

Based on the results of the field survey and data analysis, the following conclusions were made:

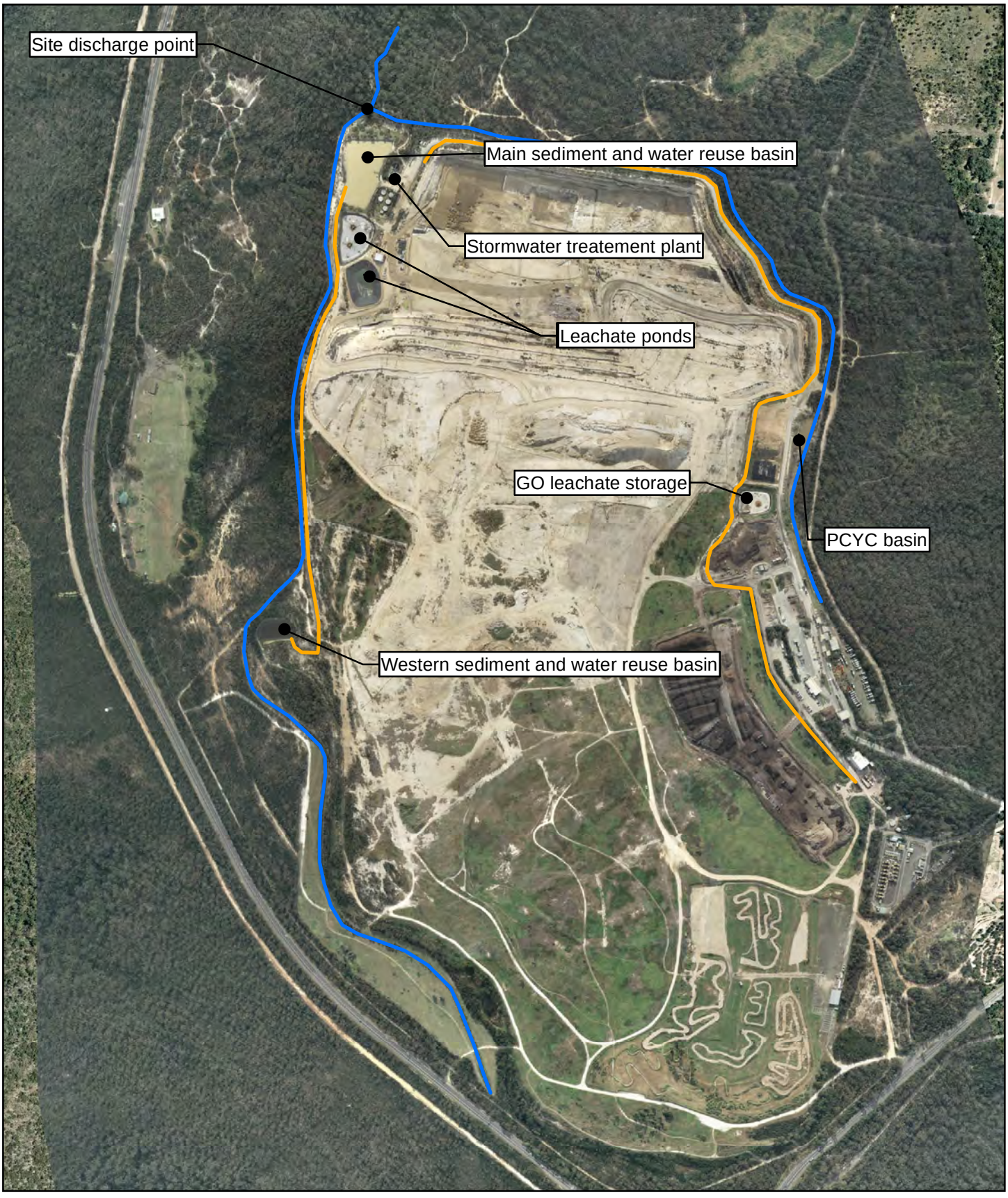
- Results of the *in situ* water quality monitoring suggested that dissolved oxygen was slightly below the ANZECC assessment criteria at the majority of the monitoring locations. Electrical conductivity and pH were within the recommended ranges. The LHRRP and off-site recreational vehicle users may be having some minor impacts on Mill Creek in relation to turbidity values, although turbidity may have been affected by a recent rainfall event.
- Habitat was found to be generally in good condition. The LHRRP may be having some minor impacts on Mill Creek in relatively close proximity to the LHRRP (MC1), as the condition here is lower than at the upstream site. Habitat condition improves at MC2. A decline at MC3 is likely to be the result of disturbance caused by recreational vehicle users. Aquatic and riparian habitat at MC4 (located furthest from the LHRRP) was in a reasonably pristine condition. The recovery of habitat condition at this monitoring location suggests that any impacts of the LHRRP are spatially limited and that the natural condition of the surrounding catchment downstream will ensure minimal impacts to the Georges River receiving environment.
- Macroinvertebrate communities present at the monitoring locations were generally in a healthy condition. Communities were dominated by pollution tolerant taxa, although some sensitive taxa were present. Recent studies of urban streams in the Georges River catchment found few or no pollution-sensitive taxa, suggesting that Mill Creek is one of the better condition streams in the area. Key drivers of losses in taxonomic diversity in Mill Creek are currently unclear and are spatially limited and which may be linked to offsite activities in certain locations (such as recreational vehicle use).

In 2013-14 the River Health Monitoring Program entered its fifth year of monitoring in the Georges River Catchment. River Health monitors three important ecological indicators to provide an assessment of catchment health; water quality, vegetation and macroinvertebrates. A copy of the River Health Georges River Report Card is contained in Appendix H and also publicly available online <http://www.georgesriver.org.au/>.

For 2013 - 2014, Mill Creek downgradient of the site reported an overall River Health Grade grade of A+ which suggests excellent conditions.

For 2013 – 2014, Barden Creek downgradient of the site received an overall River Health Grade of A+ which suggests excellent conditions.

This corresponds with the findings of this report which are that habitat and macroinvertebrate populations are in general in good condition and that any impacts of the LHRRP on Mill Creek are spatially limited as further downstream the health of Mill Creek was found to be in an excellent condition.



LEGEND

Clean water drainage line

Disturbed area drainage line

Paper Size A4

0 30 60 120 180 240

Metres

Map Projection: Transverse Mercator

Horizontal Datum: GDA 1994

Grid: GDA 1994 MGA Zone 56

N

GHD

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Revision A

Date 12 May 2015

Site surface water features

Figure 13.2

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Data source: Imagery: SITA and GOOGLE EARTH 2015. Created by:jrichardson

13.3 Assessment of potential impacts

13.3.1 Overview

Key risks related to surface water include:

- erosion and sediment control, include potential discharge of sediment laden water
- water sourcing and security
- flooding
- surface water quality impacts, such as leachate entering the surface water system and being discharged off-site

13.3.2 Erosion and sediment control

All disturbed and unvegetated areas would have high level of erosion and sediment controls applied to capture and treat any suspended solids in the run-off water. The staging of the proposal has also been designed to generally minimise the disturbed areas (by capping and revegetating areas) prior to commencing work in areas that are currently capped and revegetated.

The effectiveness of the current erosion and sediment control practices at the proposal site was assessed by analysing the total suspended solids concentrations recorded in Mill Creek downstream of the proposal site.

Existing sediment control practices would continue with the proposal, and hence no adverse impact to downstream waterways is expected from the proposal. Notwithstanding this, mitigation measures are proposed in Section 13.4 in accordance with the Blue Book Volume 1 (Landcom, 2005) and Blue Book Volume 2b (DECC 2008). These are expected to result in further improvements in erosion and sediment control.

During the construction of the ARRT and GO facilities, some temporary disturbed areas of a significant size would be created that have the potential to impact on downstream water quality. Mitigation measures to manage these risks would be developed in accordance with the Blue Book Volume 1 (Landcom 2005) in a soil and water management plan. The plan would be incorporated into the construction contractor's environmental management plans. General principles proposed in the plans would include minimisation of exposed areas at any one point in time, maximising ground cover, collecting sediment at the source and potentially provision of sediment basins utilising water management storages proposed for the operational phase. Implementation of these measures is expected to prevent significant impacts from occurring.

Collection of disturbed area runoff and diversion of clean runoff

For effective erosion and sediment control it is necessary to divert upstream clean water around disturbed areas and also to collect sediment laden water from disturbed areas. This would be achieved through constructing open channels and utilising existing clean water channels such as Mill Creek.

As part of this assessment, preliminary sizing guidelines were developed for the clean water channels and the channels for sediment laden water to ensure that the proposal would operate in accordance with the Blue Book volume 2b (DECC 2008) in terms of conveyance of clean and sediment laden runoff. These sizing guidelines were then applied to the proposed drainage channels for each stage. Thus preliminary channel sizes have been included in the proposed landfill staging plans. Specific assessment of channel capacities was also undertaken for existing surface water features such as Mill Creek and the eastern drainage channel.

Figure 13.3 to Figure 13.8 show the preliminary channel sizes for the different phases of the proposal.

Specific assessment of channel capacities was also undertaken for existing surface water channel such as Mill Creek and the eastern drainage channel. This involved a capacity check of these specific channels involving either a HECRAS one-dimensional hydraulic model or Manning's hydraulic calculations.

Advice on sizing was developed based on modifying the XP-RAFTS hydrologic model to estimate the peak 20-year ARI event peak flow rate for a range of potential catchment areas and then using a Manning's Calculation to estimate the required channel size for each catchment area. Key parameters for this assessment are listed in Table 13.1.

Table 13.1 Channel sizing parameters

Parameter	Value	Notes
Channel Manning's n	0.025	Compacted earth
Channel bed slope	1 %	Likely minimum slope
Channel side slope	1V:4H	
Maximum flow depth	Varies (Max 1m)	Based on results of Manning's calculation for each catchment area
Channel base width	Varies	Based on results of Manning's calculation for each catchment area

Assessment of the main sediment basin

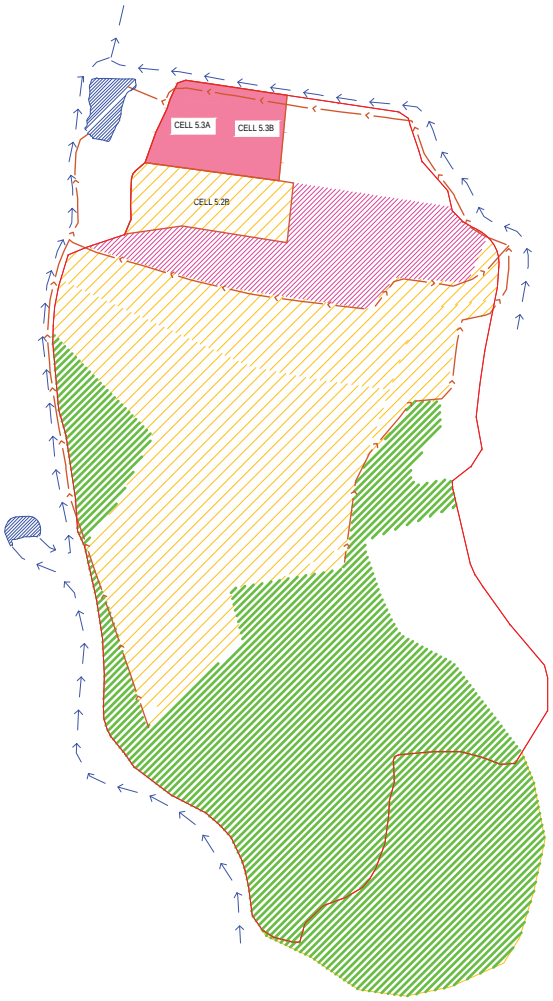
The main sediment and water reuse basin dam located at the north-west corner operates as a sediment retention basin and water reuse basin. The required volume and operational strategy of the main sediment basin were quantitatively assessed.

The main sediment dam located at the north-west corner of the basin would be operated as a Type D sediment basin in accordance with the Blue Book (Landcom 2005 and DECC 2008). However the basin would also operate as a water reuse basin with its water reuse volume provided below the zone actively managed for erosion and sediment control.

Three zones would comprise the total storage of the basin (of total volume 32 ML):

- A sediment storage zone: This would be located at the invert of the basin and would be the volume of the basin that fills up with captured sediment over time. The volume of this zone would be 5 ML with the predicted clean out frequency being in the order of once every 10 years. Existing sediment traps located further upstream within the LHRRP would be maintained and managed such that a large proportion of the mass of sediments is captured before entering the main basin. This would significantly reduce the cleanout frequency and sediment storage zone volume required.
- A water reuse zone: This would be located above the sediment storage zone and would provide water for reuse for dust suppression. Water levels would be allowed to fluctuate within this zone based on rainfall and water demand patterns. This would have an estimated volume of 17 ML which is calculated as the remaining volume of the basin once the sediment storage and sediment control "settling" zones are subtracted. This volume of water would be available for water reuse.
- A sediment control "settling" zone: This zone would allow for capture and treatment of the design erosion and sediment control event. The calculated volume of this zone is 10 ML. Once the water level in the basin rises to this level, water would be treated through the stormwater treatment plant and discharged. This process would continue until the water

level is below the range of this zone. The stormwater treatment plant would treat waters to ensure that the concentration of suspended solids in water discharged is less than 50 mg/L. When the water level exceeds the top of the ‘settling’ zone, it would overflow from the basin in accordance with the EPL.



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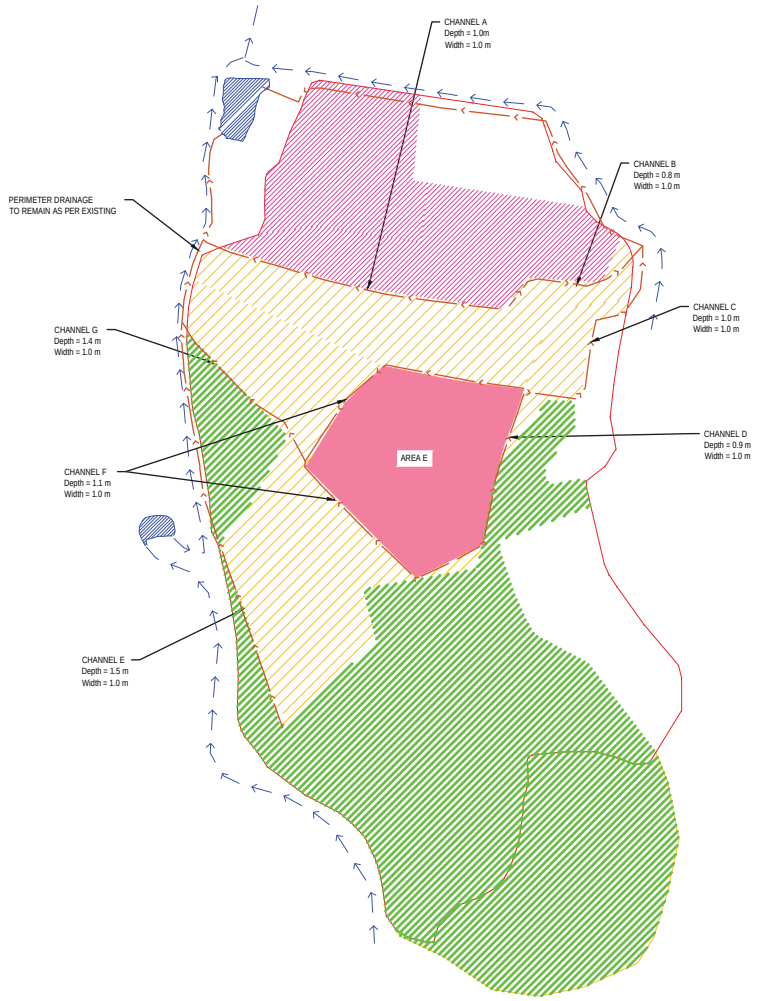
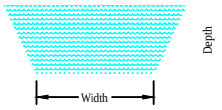


PHASE 1

Notes:
All drainage channels are trapezoidal



Paper Size A4

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- Intermediate Cover - Slopes
- Existing Cap
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- Proposed Post Closure Cap - Platform
- Proposed Post Closure Cap - Slopes
- Indicative Surface Water Diversion Drain
- Indicative Surface Water Collection Drain

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Revision A
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Preliminary channel sizes
Existing and Phase 1

Figure 13.3

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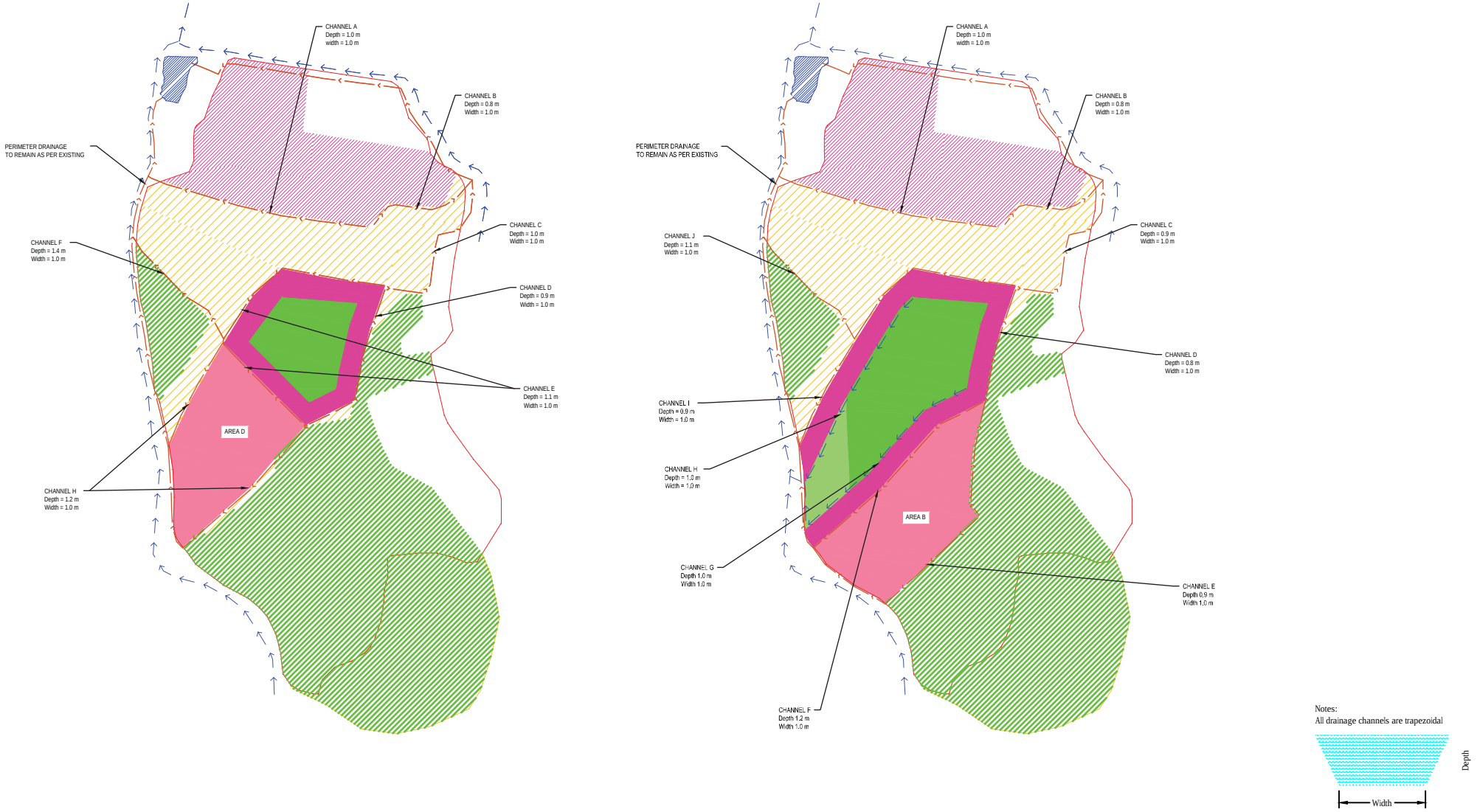

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- Proposed Post Closure Cap - Platform
- Proposed Post Closure Cap - Slopes
- Indicative Surface Water Diversion Drain
- Indicative Surface Water Collection Drain

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Preliminary channel sizes
Phase 2 and 3

Figure 13.4

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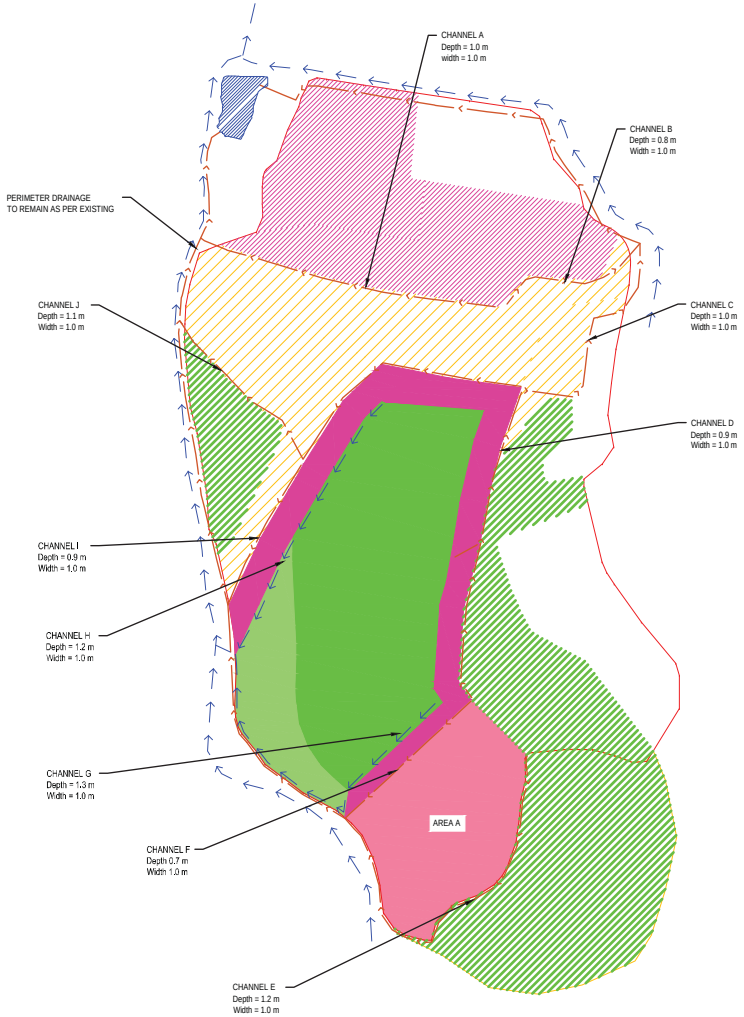
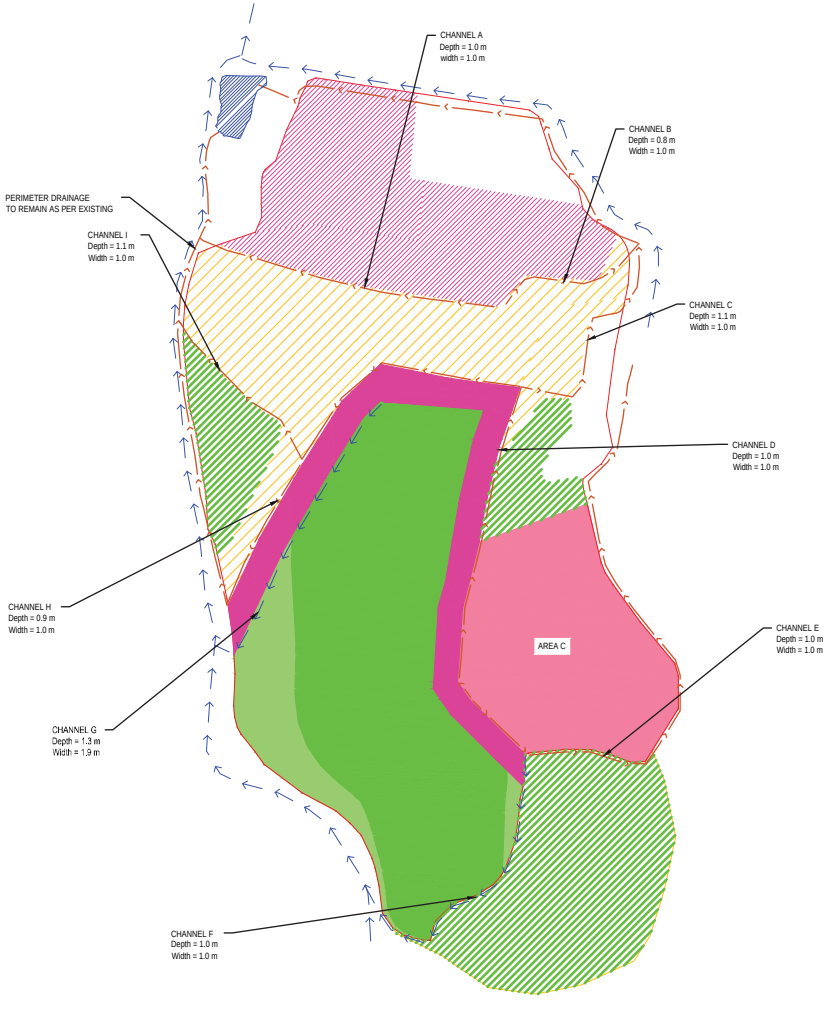
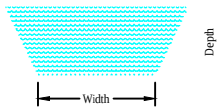


PHASE 4



PHASE 5

Notes:
All drainage channels are trapezoidal



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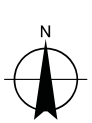

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- Intermediate Cover - Slopes
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- Proposed Final Cap - Slopes
- Proposed Post Closure Cap - Platform
- Proposed Post Closure Cap - Slopes
- Indicative Surface Water Diversion Drain
- Indicative Surface Water Collection Drain

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Revision A
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Preliminary channel sizes
Phase 4 and 5

Figure 13.5

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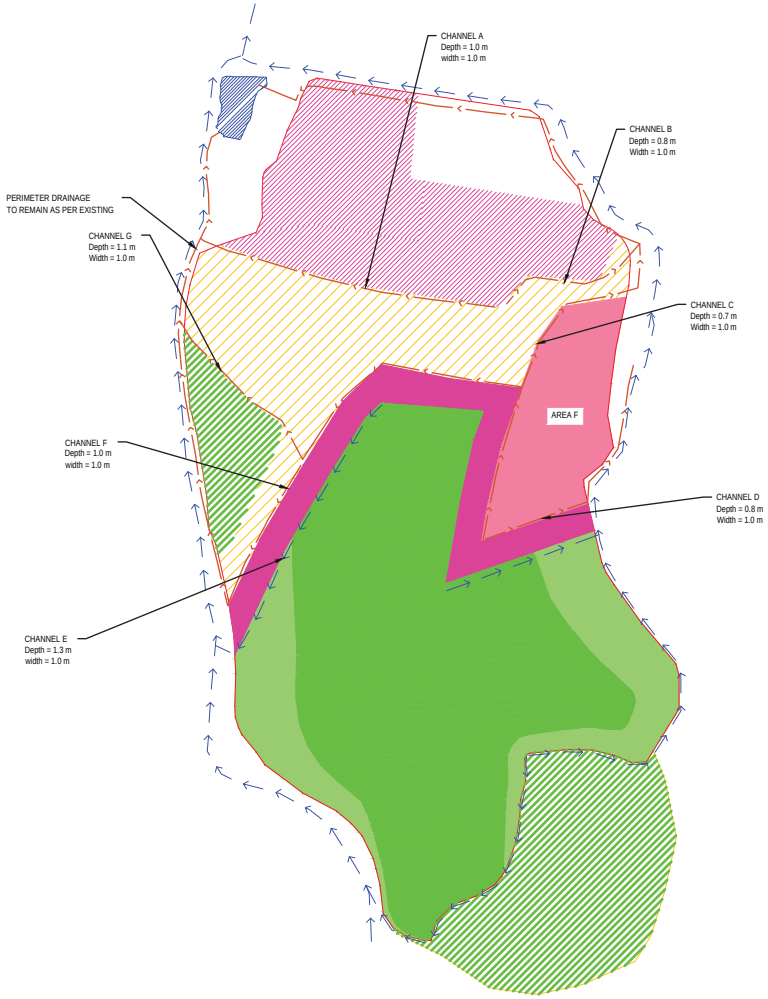
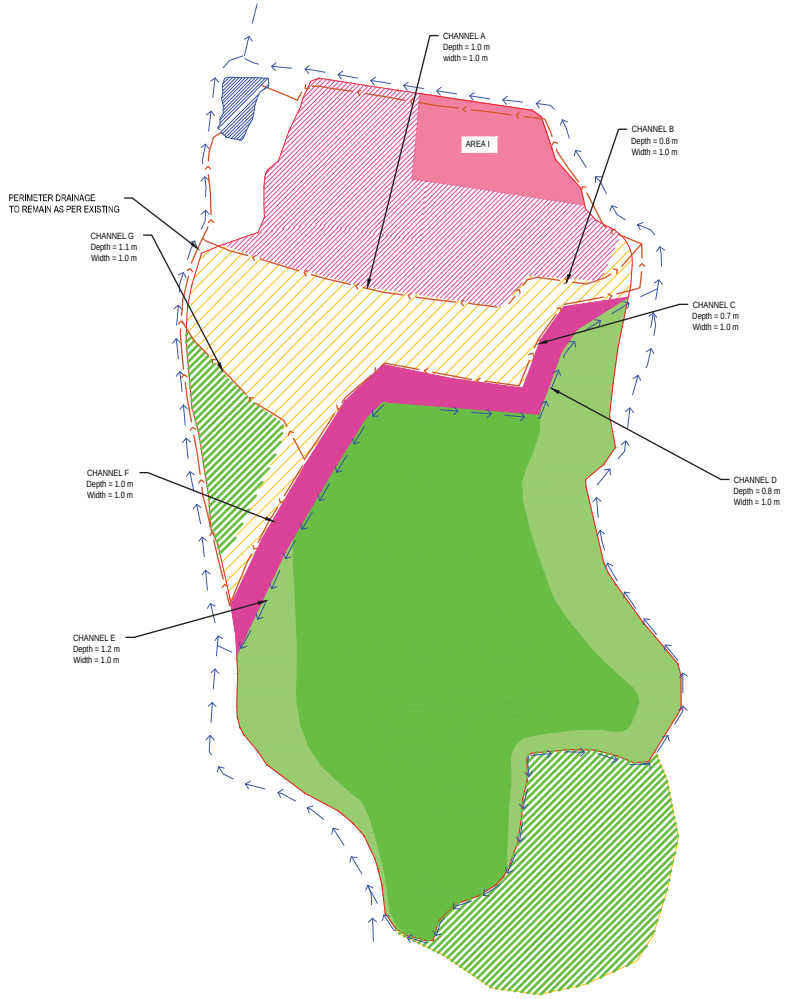


PHASE 6



PHASE 7

Notes:
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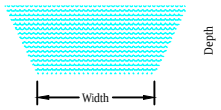

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- Proposed Final Cap - Slopes
- Proposed Post Closure Cap - Platform
- Proposed Post Closure Cap - Slopes
- Indicative Surface Water Diversion Drain
- Indicative Surface Water Collection Drain

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Date 14 May 2015

Preliminary channel sizes
Phase 6 and 7

Figure 13.6

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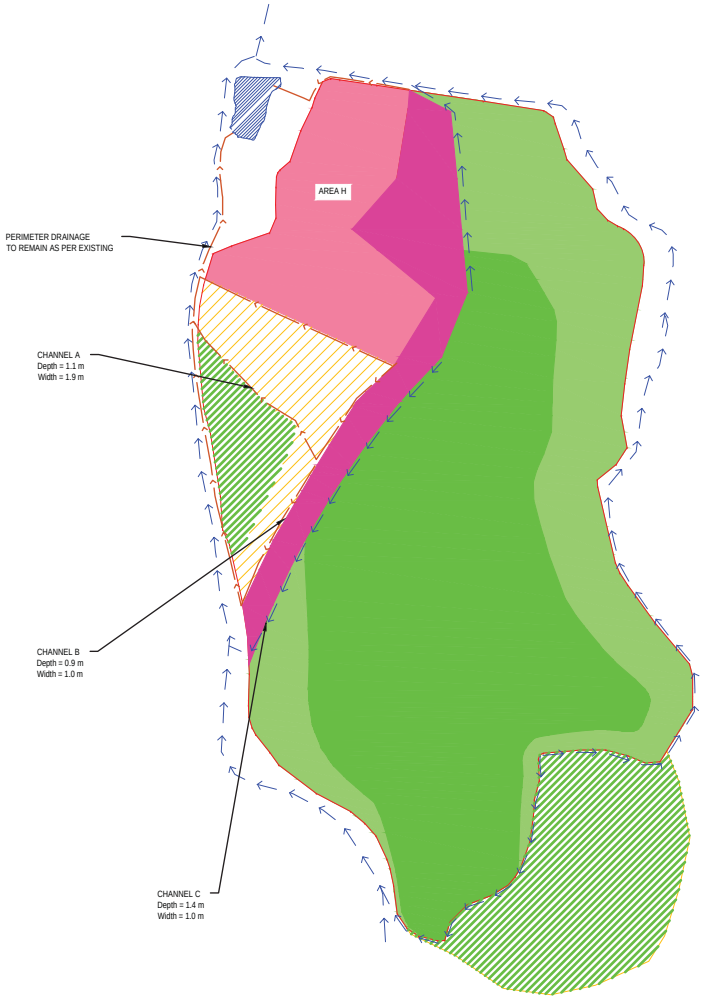

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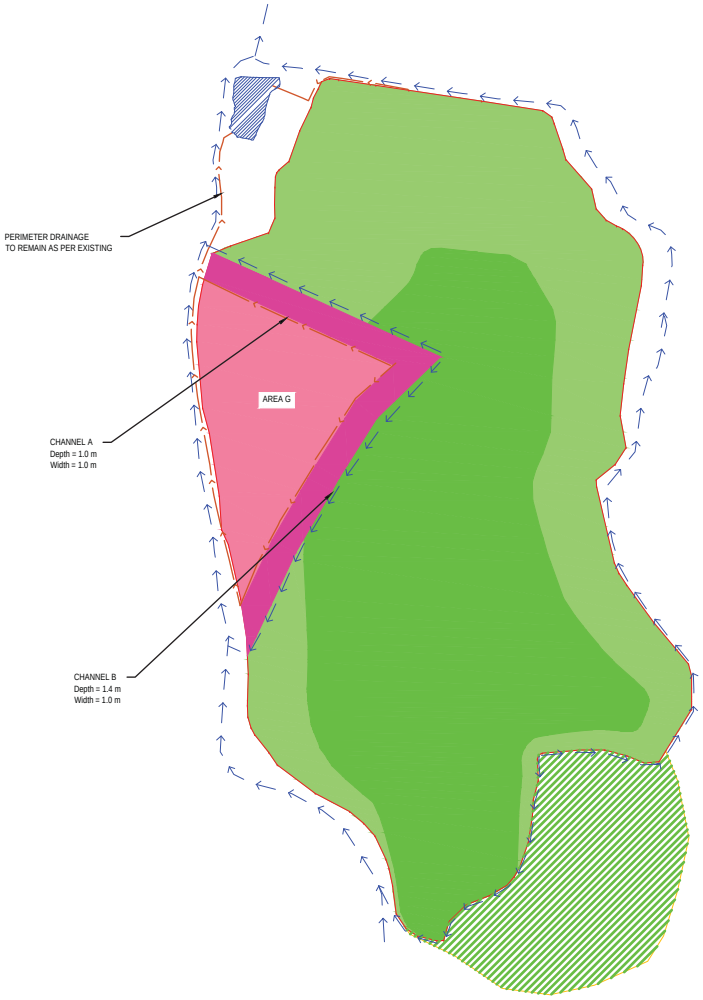
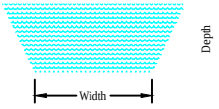


PHASE 9

Notes:
All drainage channels are trapezoidal



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- Intermediate Cover - Slopes
- Existing Cap
- Proposed Final Cap - Platform
- Proposed Final Cap - Slopes
- Proposed Post Closure Cap - Platform
- Proposed Post Closure Cap - Slopes
- Indicative Surface Water Diversion Drain
- Indicative Surface Water Collection Drain

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Preliminary channel sizes
Phase 8 and 9

Figure 13.7

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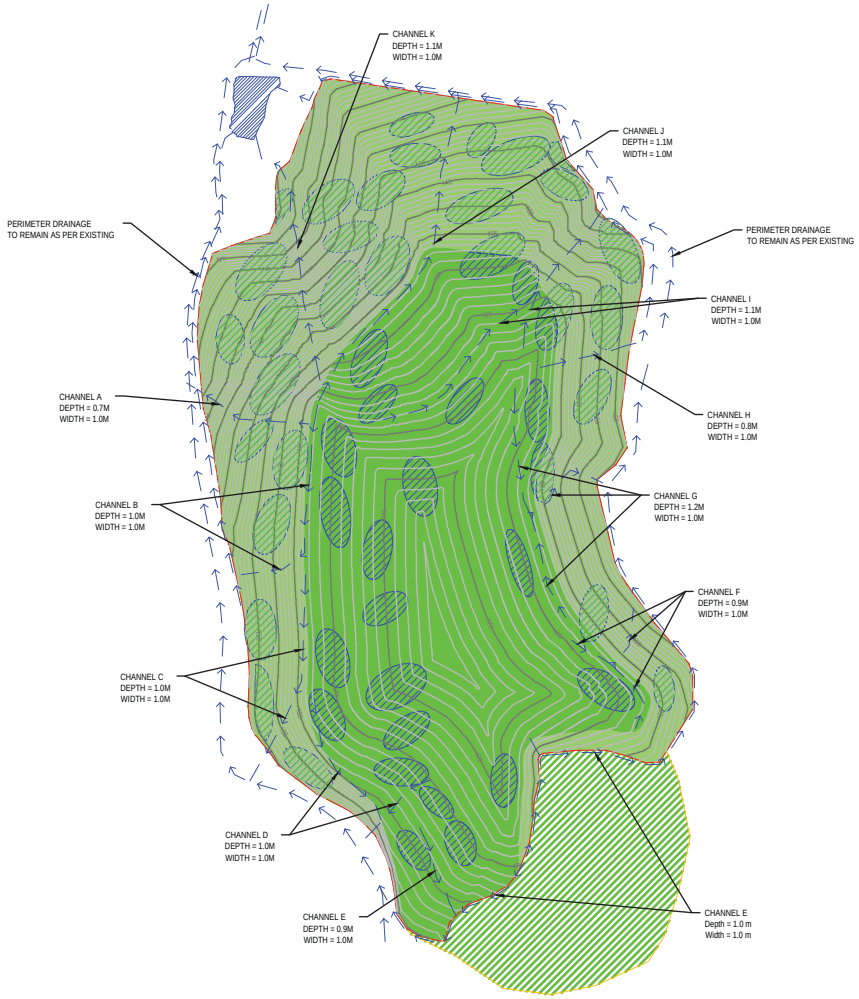
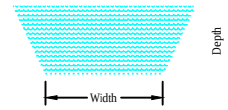


Notes:
All drainage channels are trapezoidal



FINAL POST-CLOSURE

Paper Size A4

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- Proposed Final Cap - Platform
- Proposed Final Cap - Slopes
- Proposed Post Closure Cap - Platform
- Proposed Post Closure Cap - Slopes
- Indicative Surface Water Diversion Drain
- Indicative Surface Water Collection Drain

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Job Number 21-23482
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Preliminary channel sizes
Final Post Closure

Figure 13.8

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Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:afoddy

13.3.3 Water sourcing and security

There would be no major increase in the demand for water needed for site activities as the LHRRP is progressively reprofiled, capped and revegetated. The primary demand for water would be for dust suppression, the need for which would decrease over time as exposed areas are capped.

Some temporary increases in the amount of water needed for dust suppression purposes would occur during construction of the GO and ARRT facilities. The amount of water collected on site and available for site controls would be limited due to the zone of water actively managed for erosion and sediment control in the main sediment and water reuse basin. Some additional water may be required from other sources during dry periods.

Following wet periods, excess water collected in the basin would be treated and discharged off site in accordance with the quality limits applying to the LHRRP. This would be necessary to make the capacity of the basin available as soon as possible for storage of sediment laden run-off from each future rainfall event.

Water balance

A water balance was developed using the GoldSim software package for both the existing scenario and the proposal scenario (Phase 5). Figure 13.9 and Figure 13.10 show the existing and proposal case results of the water balance.

As can be seen from these figures the backup supply of potable water for dust suppression increases from the existing case to the proposed case from 0.1 ML/year to an average of 0.9 ML/year. This is only approximately 1% of the total water supplied for dust suppression and 2% of the total site annual potable water demand. In addition to this the potable water is required only 7 times during the modelled time period of 55 years.

Therefore, it is not expected that the activities associated with the proposal would result in a significant increase in potable water demand. Additional retention basins would be constructed if required.

It should be noted that the capacity of the main sediment and water reuse basin has recently been increased significantly. No shortages of water for dust suppression have been experienced since that time.

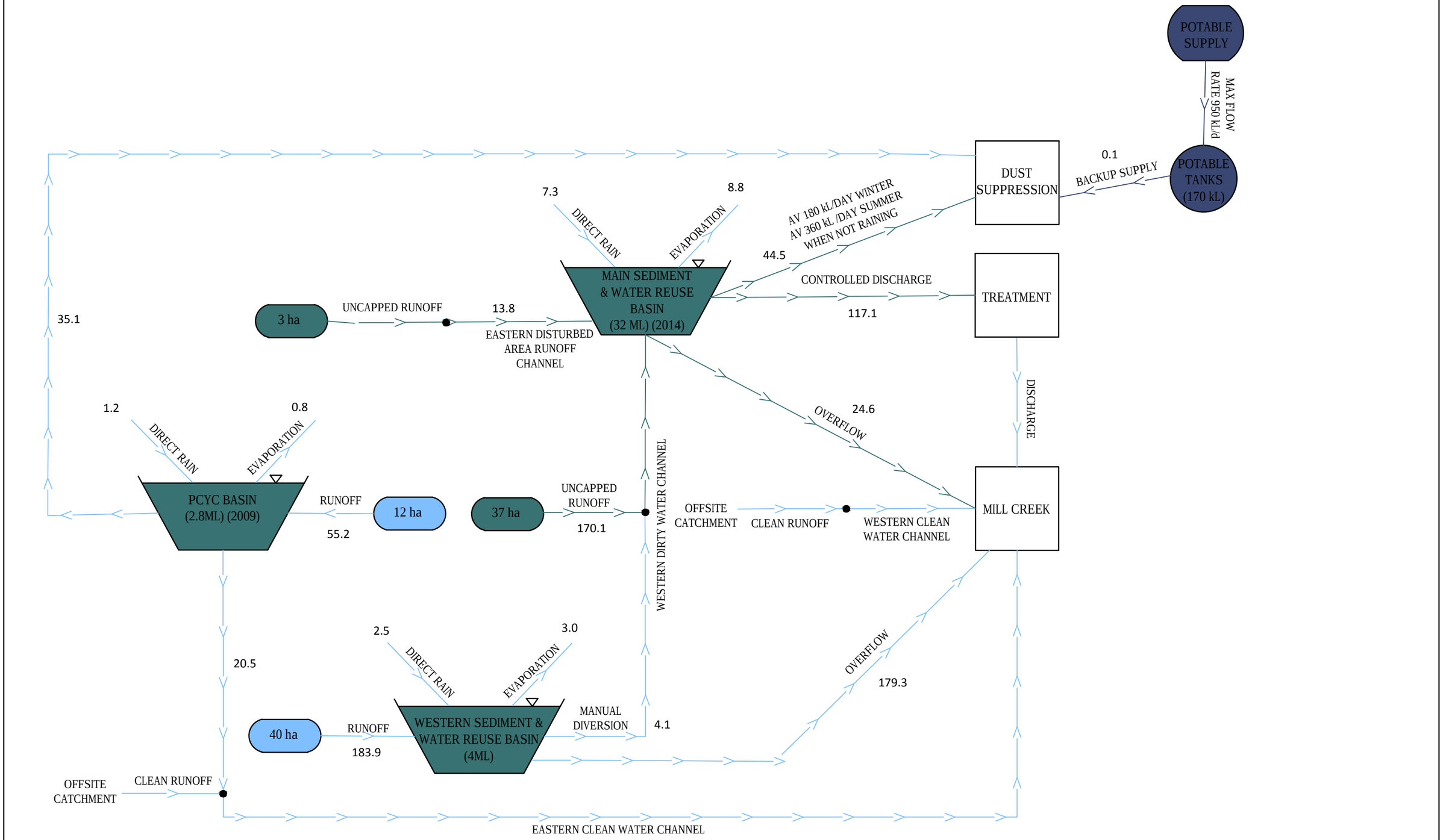
ARRT and GO facilities

The water balance took into account the key elements of the water cycle of the proposed ARRT and GO facilities, as shown in Figure 13.11. This included:

- Runoff from the GO facility (with runoff co-efficients estimated based on the literature)
- Capture of runoff that comes into contact with organic material in a sump at the north eastern end of the GO facility area, with the sump assumed to have only small capacity – hence water is pumped immediately or overflows to the storage dam downstream of the ARRT facility
- Pumping of water from this sump to a supply dam at the top of the GO facility area
- Reuse from the supply dam in both the ARRT and the GO facilities
- Capture of contaminated GO runoff during periods of high rainfall in a storage dam downstream of the ARRT facility, in the event that the runoff from the GO facility cannot be pumped from the sump to the supply dam at the top of the GO facility area
- Disposal of excess water from this storage dam via sewer during high rainfall periods
- Reuse from the supply dam for composting purposes within the GO and ARRT facilities

Runoff from the ARRT facility area was not represented in the water balance as it was expected to be clean since all operations and all materials are contained within buildings. This water would be managed in a separate water system.

The results of the water balance indicate that for the proposed configuration no discharges would be expected from the system over the modelled time series. Therefore it is not expected that there would be any leachate discharged to downstream waterways from the operation of the ARRT and GO facilities.



LEGEND

POTABLE WATER
CLEAN WATER
SITE RUNOFF
LEACHATE
WASTEWATER
XX MEAN ANNUAL FLOW (ML/YEAR)

SITA AUSTRALIA
LUCAS HEIGHTS RRP

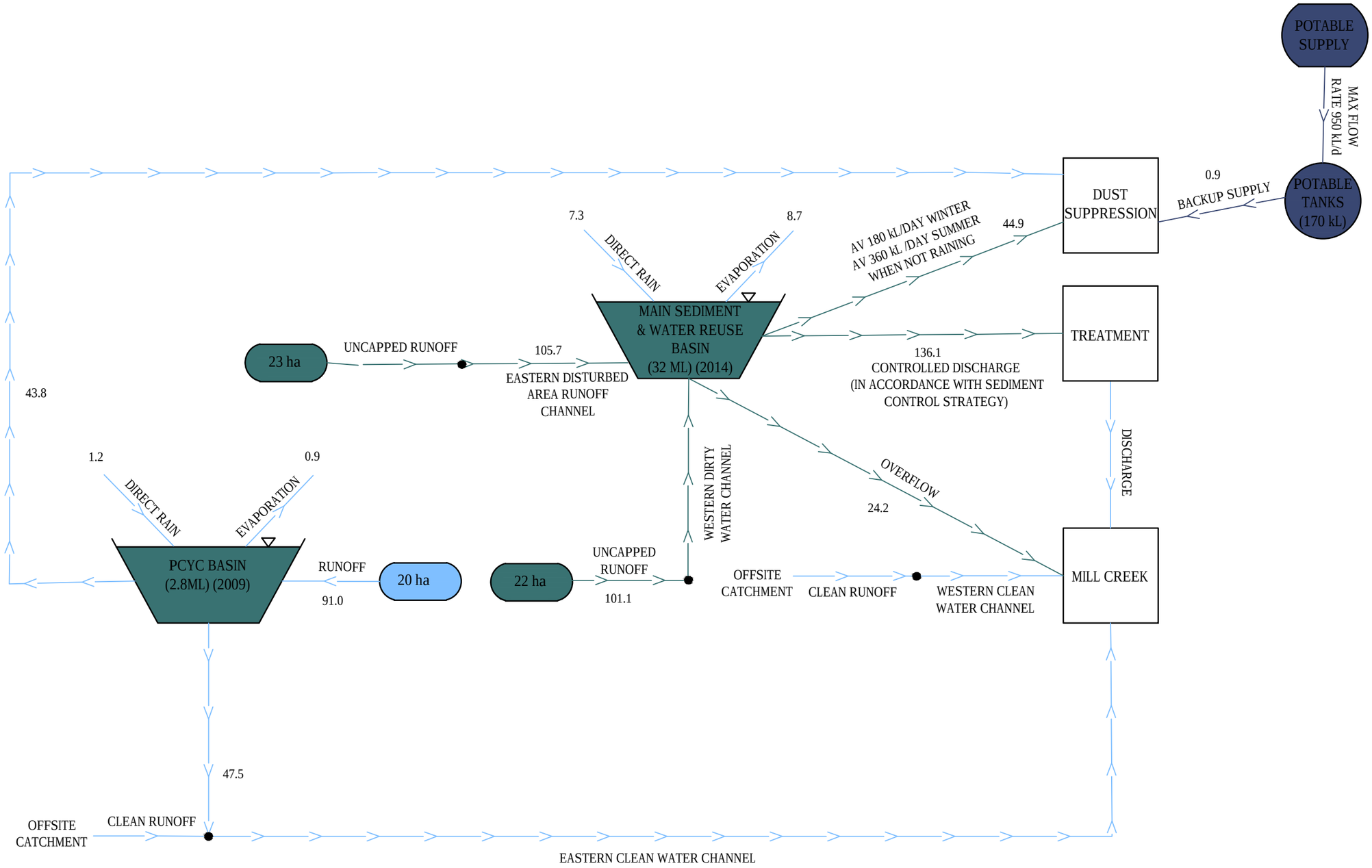
WATER CYCLE SCHEMATIC EXISTING SCENARIO

Job Number 21-23482
Revision B
Date JULY 2015

Figure 13.9

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 3 July 2015 - 2:13 PM Plotted by: Carol Ng Cad File No: G:\21\23482\Technical\Surface Water\Water Balance\Lucas Heights Water Cycle Scematics.dwg



LEGEND

- POTABLE WATER
- CLEAN WATER
- SITE RUNOFF
- LEACHATE
- WASTEWATER
- XX MEAN ANNUAL FLOW (ML/YEAR)

SITA AUSTRALIA
LUCAS HEIGHTS RRP

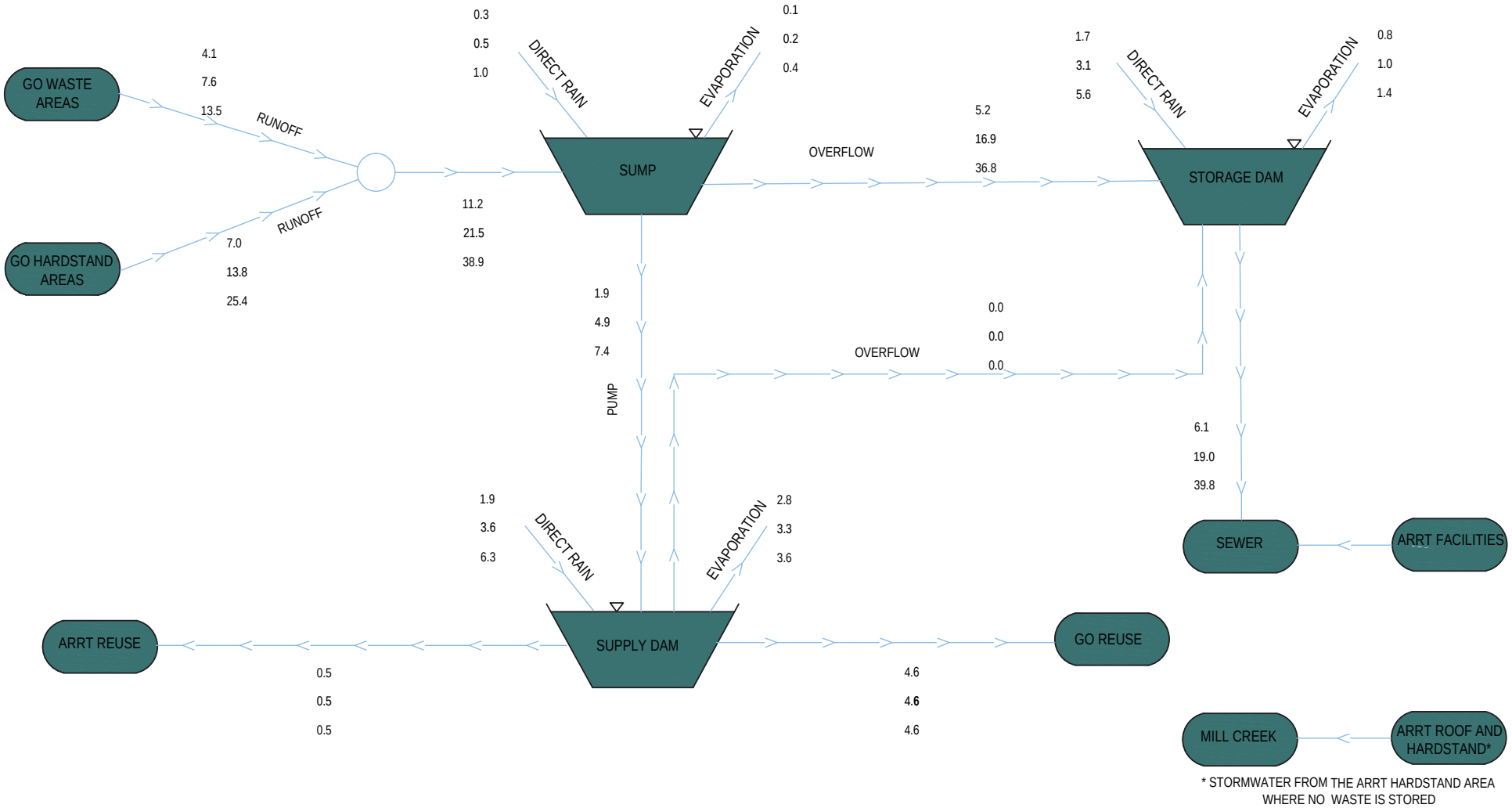
WATER CYCLE SCHEMATIC
PROPOSED SCENARIO (STG 5)

Job Number 21-23482
Revision B
Date JULY 2015

Figure 13.10

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 3 July 2015 - 2:13 PM Plotted by: Carol Ng Cad File No: G:\21\23482\Technical\Surface Water\Water Balance\Lucas Heights Water Cycle Scematics.dwg



* STORMWATER FROM THE ARRT HARDSTAND AREA WHERE NO WASTE IS STORED

LEGEND

Minimum annual flow (ML / YEAR)

Mean annual flow (ML / YEAR)

Maximum annual flow (ML / YEAR)

SITA AUSTRALIA
LUCAS HEIGHTS RRP

WATER BALANCE RESULTS
ARRT / GO

Job Number 21-23482
Revision B
Date JULY 2015

Figure 13.11

Level 15, 133 Castlereagh Street, Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Plot Date: 3 July 2015 - 2:10 PM Plotted by: Carol Ng Cad File No: G:\21\23482\Technical\Surface Water\Water Balance\Lucas Heights Water Cycle ScematicsAARTGO.dwg

13.3.4 Flooding

Impacts on downstream flow conditions

An XP-RAFTS hydrologic model was developed to estimate the peak design flow rate for flow leaving the proposal site in Mill Creek. The model was simulated for the current approved final scenario as well as the final capped scenario. The final capped scenario was conservatively selected as this has the potential to be the point in time in the proposal when the greatest peak runoff rate from the proposal site would occur, due to it having the greatest catchment area directly contributing to offsite discharges. The currently approved final scenario was also selected as an approved base case, off which to assess impacts. The primary differences between the two scenarios are the sub-catchment divisions and the catchment slope, as the topography and slope of the final landform is different.

The results of modelling are shown in Table 13.2, which shows that the proposal would increase the peak flow rate discharged from the proposal site by up to approximately 1%.

At this level of increase, downstream flooding would not change significantly. It should also be noted that additional runoff from the proposal site enters downstream from the discharge point, lessening the downstream flooding impact.

Table 13.2 XP-RAFTS results – downstream peak flow rates

Scenario	Estimated peak flow rate – 5-year ARI event (m3/s)	Estimated peak flow rate – 100-year ARI event (m3/s)
Approved final scenario	37.1	62.8
Proposed final scenario	37.5	63.2
% Increase	1.1 %	0.6 %

Inundation of site features during flood events

In general the gradient of the proposal site is relatively steep with well-defined watercourses or drainage lines. There is also minimal history of inundation from floodwaters at the LHRRP. Therefore, in general it is expected that the risk of external floodwaters inundating the proposal site is minimal.

An exception to this is for sensitive features of the proposal site located directly adjacent to drainage lines such as the leachate ponds and the proposed GO and ARRT facilities. Therefore a flood assessment was undertaken to assess the risk of flooding in Mill Creek on these site features.

The flood assessment involved development of a steady state one-dimensional HECRAS hydraulic model of Mill Creek in the vicinity of these features. Design 100-year ARI peak flow rates were extracted from the XP-RAFTS modelling as discussed above.

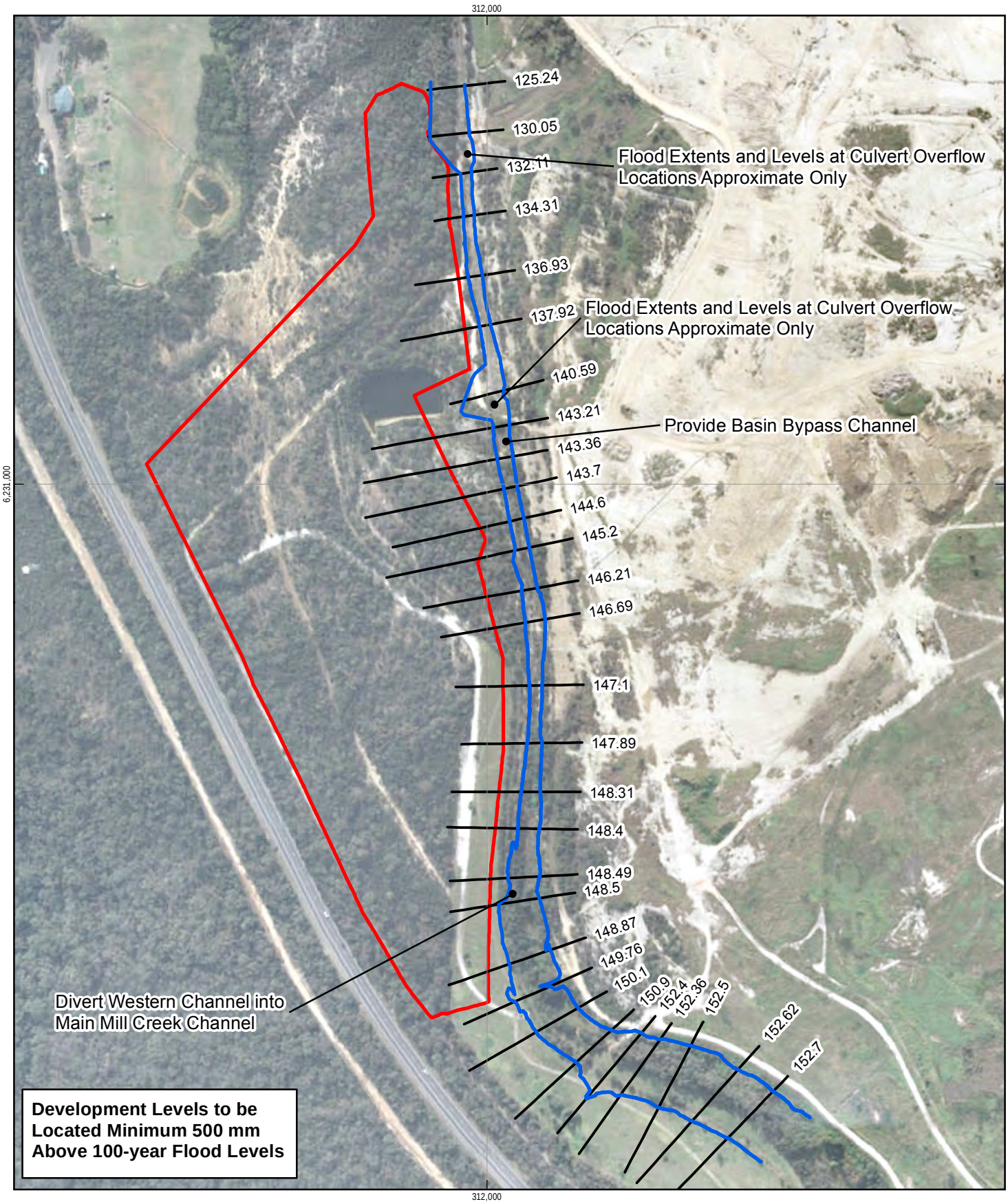
The results of the hydraulic modelling are shown in Figure 13.12 and Figure 13.13.

Figure 13.12 shows the flooding conditions in the vicinity of the GO / ARRT area. These flood results were used to inform the design of the GO / ARRT area. On this basis, the proposed pad or building levels would be a minimum of 500 mm above the design 100-year flood level.

Figure 13.13 shows the flooding conditions in the vicinity of the leachate ponds. It can be seen that inundation of the leachate ponds is not expected during the 100-year ARI event, which is the commonly adopted flood planning level in NSW.

Therefore the proposal is not expected to result in unacceptable flood risk from water inundating the site features.

Furthermore, hydraulic calculations undertaken for the eastern and northern perimeter drainage showed that inundation of the existing excavated void from the east and the north is not expected for the 100-year ARI event.



LEGEND

100yr ARI Event Flood Extents

Hydraulic Model Cross Sections (Max 100-yr Water Level Labelled)

ARRT GO Facilities Preliminary Boundaries

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision A
Date 12 May 2015

Flood Results – ARRT/GO Area

Figure 13.12

Level 15 133 Castlereagh St Sydney T 61 2 9239 7156 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

G:\21\23482\GIS\Maps\Deliverables\21_23482_Flooding_AART_GO_RevB.mxd

Data source: Imagery: SITA. Created by:rgtowner

LEGEND

100yr ARI Event Flood Extents

Hydraulic Model Cross Sections (Max 100-yr Water Level Labelled)

ARRT GO Facilities Preliminary Boundaries

Paper Size A4

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision A
Date 06 Mar 2015

Flood Results – Leachate Ponds Area

Figure 13.13

Level 15 133 Castlereagh St Sydney T 61 2 9239 7156 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

G:\21\23482\GIS\Maps\Deliverables\21_23482_Flooding_LeachatePonds.mxd

Data source: Imagery: SITA. Created by:dolloyd

13.3.5 Impacts on waterway morphology

The proposed Mill Creek realignment, which is adjacent to the proposed ARRT facility, has the potential to impact on downstream waterway morphology through modification of flow regimes in the creek.

HECRAS modelling indicates that the culvert immediately to the east of the Western Sediment and Water Reuse Basin forms a hydraulic control during large storm events. That is, the culvert restricts flows and water backs up behind it, controlling upstream flow conditions through the realigned section as well as downstream hydraulic behaviour.

Therefore modification of the flow regimes upstream of the culvert, through realignment of the creek, is not expected to have a significant impact on downstream flow conditions. As a result, no significant impacts on downstream creek stability and morphology are expected to arise. Furthermore, the creek is generally located in bedrock and is not susceptible to changes in morphology.

13.3.6 Surface water quality

This existing impact discussed above is not expected to increase as the proposal is expected to improve water quality through the following measures:

- Provision of final revegetated cap across the proposal site, constructed as each area is completed. The cap would consist of a low permeability compacted clay layer (or an EPA approved alternative) which would reduce the generation of leachate through reduced rainfall infiltration and the ability to more effectively shed surface water off the proposal site. As assessed in the Leachate Assessment Report (GHD 2015b), the proposed reprofiled landform and the proposed cap will allow less water through than the crushed sandstone cap which has been constructed on the site to date. These actions would also reduce the potential risk of leachate entering surface water and being discharged off-site.
- The proposed staging for reprofiling the landfill which would progressively cap and revegetate areas which are currently not capped and revegetated. This would occur before disturbing areas that are already capped and revegetated.
- Complete containment of leachate from the landfill, GO and ARRT facilities, which would exclude this leachate from the surface water system water that is able to be discharged off-site.
- Additional leachate control measures, including a dual gas/leachate management trench constructed near the perimeter of the re-profiling area, to control the risk of leachate escaping to surface water. The purpose designed trench would consist of a nominally 1.5 – 2 m deep trench within the existing waste mass backfilled with suitable drainage material and perforated pipe. Extraction risers would be located along the length of the trench, to allow leachate to be extracted and transferred to the existing leachate containment system.

13.3.7 Post-closure impact assessment

After completion of site operations the proposal site would be converted to a parkland area including significant vegetated and landscaped areas. The surface water assessment also included potential surface water impacts during this post-closure phase. Details of the proposed post-closure surface water management system are listed below:

- The PCYC Dam and Western Sediment and Reuse Dam would have already been decommissioned by this stage in previous phases of the proposal.

- The main sediment and water reuse dam would remain, functioning as a water reuse dam, and would be again cleared of sediment at completion of operations in 2038 before the parkland's availability.
- Decommissioning of the ARRT and GO facilities, including the GO facility dams.

Drainage channels as shown in Figure 13.8 would collect surface runoff. The channel locations have been proposed such that the area draining to the main sediment and reuse basin is approximately equal to the maximum catchment draining to the dam during the operational phase of the proposal.

This would provide the maximum volume of water available for reuse (if needed) over the parkland site, whilst not significantly decreasing environmental flows to Mill Creek compared to during the operational phase of the proposal. For example, if all of the proposal site was directed to the basin environmental flows in Mill Creek would be reduced, but if none of the proposal site was directed to the basin, a minimal amount of water would be available for irrigation.

Detailed design of the drainage channels would be required prior to the construction of the channels before commencement of each landfill stage in consideration of potential for scour, including rock protection, energy dissipation or stepping where required. An indicative design has been undertaken and the design methodology, basis and results are provided Appendix H. This indicative design takes into account the post-closure surface water drainage requirements.

The selection of lining type should consider the velocities likely to be experienced in the channels during a 20 year ARI design storm event in order to prevent excessive soil erosion. The 20 year ARI design storm event was selected in accordance with the Blue Book Volume 2b (DECC 2008), for a duration of disturbance greater than 3 years.

The capacity of the perimeter drainage (Mill Creek and drainage around the east and north of the site) was reviewed to determine if the peak 100-year ARI event could be conveyed in the drainage line and modelling was undertaken. Based on the dimensions obtained from the topographic survey, the outer perimeter drains would be able to convey a 100-year ARI event for Mill Creek. The outer perimeter drains along the northern and eastern boundary and both perimeter drains are also expected to be able to convey water during the 100-year ARI event. As there are two perimeter drains along the northern and eastern boundaries and during a 100-year ARI event, both drains would be able to convey flows. The existing dimensions are therefore considered to be adequate. The existing perimeter drains are therefore proposed to be retained post-closure of the LHRRP.

Expected channel velocities and potential channel lining treatments are detailed in Appendix H. The most suitable channel lining type would be determined during detail design with consideration of critical flows velocities and final drain locations.

Table 13.3 summarises the impact assessment of the post-closure proposal site in terms of surface water. This shows that the post-closure site uses would not result in any unacceptable impacts in terms of surface water.

Table 13.3 Post-closure surface water impacts

Potential Impact	Assessment
Mobilisation of sediment from disturbed soils and discharge of sediment laden runoff	The post-closure site would be vegetated with minimal volumes of sediment able to be mobilised
Insufficient water available for parkland usage	Water balance modified to represent post closure scenario. Results of this show that the reuse dam only empties once during the modelled time series of 55 years

	for the following demand regime: * 0.4 ML is extracted per day when the storage volume on that day is greater than 30% of capacity; and * 0.15 ML is extracted per day when the storage volume on that day is less than 30% of capacity. These demands may be adopted as withdrawal limits (subject to more detailed review at the completion of operational phase) and therefore shortages of water are expected to be infrequent.
Inundation of Leachate Dam from Water In Drainage Lines	Drainage line sizes adjacent to Leachate Pond to be maintained as existing, therefore inundation not expected during the 100-year event..
Leachate entering surface water	The ARRT and GO facilities would be decommissioned and won't exist at the site, hence pose a nil risk of impacting on water quality. Entire site would be capped and revegetated reducing the risk of leachate being able to enter surface water.

13.3.8 Potential for landslip and subsidence

The proposed final landform would be shaped with batters graded at less than 1 in 3 (V:H) and a minimum fall of 5%. Veneer stability of the final cap profile would need to be considered as part of the final detailed design of the cap barrier and drainage system, and suitable reinforcement provided if required.

Subsidence of the waste has been considered through the preparation of baseline and post-settlement final landforms based on the methodology from Sowers (1973) as presented in Qian et al (2002). The modelling indicates that the waste would settle 3% to 22% of the landfilled waste thickness. The design of the final cap and any infrastructure, such as roads and drains, would have to consider settlement and ongoing maintenance would be required. Refer Appendix C for additional information.

Global failure of the waste mass is prevented by maintaining adequate drainage throughout the waste which is landfilled above the level of the surrounding natural sandstone. Removal of the existing cap and cover material would allow leachate to pass through into the existing leachate collection system and installation of a perimeter leachate collection trench would assist further.

The geotechnical environment would be considered during the detailed design of the GO facility and ARRT facilities to address landslip or subsidence risks.

13.3.9 Soils and contamination in relation to final use

Following the completion of filling, the landfill would be capped to contain the waste and reduce leachate generation by rainfall infiltration. The landfill liner and leachate collection and treatment systems would continue to operate following closure of the landfill, containing and extracting leachate for treatment. The proposal site would be rehabilitated to convert the proposal site to open parklands. Refer Section 6.5.

The GO and ARRT facilities would both be fully decommissioned upon site closure. Since during operation, the facilities would consist of sealed hardstand with all water being captured in ponds for disposal to sewer, it is expected that following decommissioning – including disposal of the hardstand material and pond liners – the proposal site would be free of impacts from the facility and would be able to be incorporated into the planned parklands.

13.4 Mitigation and management measures

Reprofiling the landfill would be in accordance with the staging plans (Figure 6.5 to Figure 6.10) which have been developed to increase the areas of the site capped and revegetated thereby reducing the erosion potential of the site

An erosion and sediment control plan or soil and water management plan would be developed for the proposed ARRT and GO facilities.

A comprehensive list of prevention, mitigation and rectification measures has also been identified and they are detailed in the LHRRP OEMP (Appendix S), GO facility OEMP (Appendix T) and ARRT facility OEMP (Appendix U). The identified mitigation and rectification measures would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

Examples of key measures that are included in the OEMPs are provided below.

- Continued use of existing measures in place to minimise demand for potable water including reuse of water captured in site basins for dust suppression
- Where possible, minimising exposed areas over which sediment would be generated through maintenance of both natural and artificial ground cover such as grass or erosion control cover products
- Where sediment is generated, capturing the majority of sediments as close as possible to the point of generation through sediment traps
- Discharging of disturbed area drainage lines into a sediment basin designed in accordance with Landcom (2005) and Blue Book Volume 2b (DECC 2008)
- Diversion of clean upstream runoff around the site to avoid mixing with runoff from disturbed areas
- Appropriate management of vehicle movements to minimise generation and transport of sediment
- Appropriate management of material stockpiles including locating them as far from drainage lines as possible
- General flood management practices would be employed on site including keeping drainage lines free of waste and debris and monitoring drainage lines during periods of heavy rainfall
- Surface water monitoring would continue to be undertaken as prescribed in EPL 5065.
- Further investigation of the habitat condition and macroinvertebrate populations to confirm the preliminary findings contained within Appendix C. It is recommended that this work be undertaken every three years commencing soon after reprofiling works commence in Area E.
- Progressively revegetated completed reprofiling areas
- Separate runoff from disturbed areas would be from undisturbed areas where possible
- Design and operate sediment dams and sediment traps to promote sedimentation
- Maintained erosion and sediment control measures until the site is stabilised
- Maintenance of drains to prevent weed build up

13.5 Conclusions

With the implementation of the proposed mitigation and management measures, it is not expected that the proposal would result in an unacceptable impact in terms of sediment discharge to downstream waterways.

Activities associated with the proposal would not result in a major increase in potable water demand.

Stormwater discharged from the proposal site is not expected to have any unacceptable impacts on flooding conditions downstream.

Reprofiling and re-capping of areas would reduce the potential risk of leachate entering the surface water system hence would not deteriorate receiving water quality.

The water balance suggests that proposed dams for the GO facility would have sufficient capacity and hence there would be no discharge of leachate to Mill Creek during the modelled time series.

The overall weekly demand for process leachate from the operation of the ARRT facility composting process would exceed the volume of process leachate anticipated to be collected from the system. Hence no excess process leachate would be generated or discharged to Mill Creek. In the event that excess process leachate is produced, it would be transferred to a suitable facility for treatment and disposal.

Therefore, the proposal is not expected to result in any unacceptable impacts relating to surface waters.

The surface water assessment addresses the SEARs and concludes that the proposal would meet the following objectives:

- No significant impacts on the community or environment
- Prevention of surface water contamination
- Minimising sediment generation and transport off the proposal site
- Minimising soil erosion
- No significant impacts to downstream flow conditions
- Maximise use of collected water on site for dust suppression, irrigation, composting, maintenance of haul roads etc.
- Keep surface water drains free of litter

GO facility

- Separate runoff from areas where compost and related materials would be placed from areas there is no compost and related materials, where possible
- Maintenance of bunds separating catchments in the GO facility
- Ongoing monitoring of leachate volumes generated, stored and reused and disposed of for the GO facility
- Periodic review of the leachate water balance model

ARRT facility

- ARRT facility users are made aware of the requirement for loads to be delivered in covered or enclosed vehicles

- Sealed surfaces are sprayed using collected stormwater rather than potable water sources
- Ongoing monitoring of leachate volumes generated, stored and reused and disposed of for the ARRT facility
- Period review of the leachate water balance model.

Post closure

A post-closure environmental management plan (SITA, 2014d) has been prepared which details the management requirements. The identified mitigation and rectification measures would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

Examples of key measures that are included in the post-closure environmental management plan are provided below:

- Removal of sediments from storage ponds after five years (and prior to handover) if required
- Activate the stormwater treatment plant if required
- Maintain vegetation in drains to ensure adequate flow
- Remove any built up litter from surface water drains
- Repair any erosion or scoured vegetation as required

14. Groundwater

The information presented in this chapter is based on the findings of the groundwater assessment undertaken by GHD. The groundwater assessment report is included in Appendix I of this EIS.

14.1 Approach and methodology

The tasks undertaken as part of the groundwater assessment included:

- Review of previous hydrogeological investigations
- Interpretation of historic and recent water quality data
- Review of the relevant legislative documents and requirements relating to groundwater management for landfills
- Review of the proposal description with a view to outlining key proposal features that may potentially change the existing interaction of the proposal with the groundwater environment
- Establishment of the existing environmental conditions
- Assessment of the impacts (if any) to groundwater and down gradient receptors
- Identification of proposed measures to mitigate and/or manage potential impacts
- Identification of proposed measures to monitor for the presence of impacts and to respond to the identification of impact

14.1.1 Objectives

In addition to addressing the SEARs, the groundwater assessment provides an assessment of how well the proposal meets SITA's objectives. The following objectives have been identified:

- No significant impacts on the community or environment
- No significant impact on groundwater quality

14.2 Existing environment

14.2.1 Geology

The LHRRP is located on the Woronora Plateau, which is primarily comprised of the Triassic aged Hawkesbury Sandstone geological unit (Hawkesbury Sandstone). In the vicinity of the LHRRP, the Hawkesbury Sandstone is approximately 200 metres thick and consists of cross bedded massive sandstones (often well cemented), laminates and occasional black shale and claystone lenses.

A laterally extensive discrete zone of fracturing can develop within the Hawkesbury Sandstone at depths of 30 to 50 metres below ground level (m bgl). Joint sets within the Hawkesbury Sandstone have been observed to be aligned in NNE and ESE directions and coupled with a north east dip in the regional geology.

At the LHRRP itself, the geological conditions can be summarised as follows:

- Surficial Clayey SAND/Sandy CLAY ranged in depth from 0 to 2.8 metres below ground level (m bgl)

- Very low strength weathered Sandstone extending from the ground surface's or beneath unconsolidated sediments to depths of up to 6.1 m bgl
- Medium to high strength slightly fractured to unbroken Sandstone extending from the base of the low strength sandstone to depths of 60 m bgl (the maximum depth of characterisation). Laminate and siltstone layers were noted in some bores

14.2.2 Hydrogeological conditions

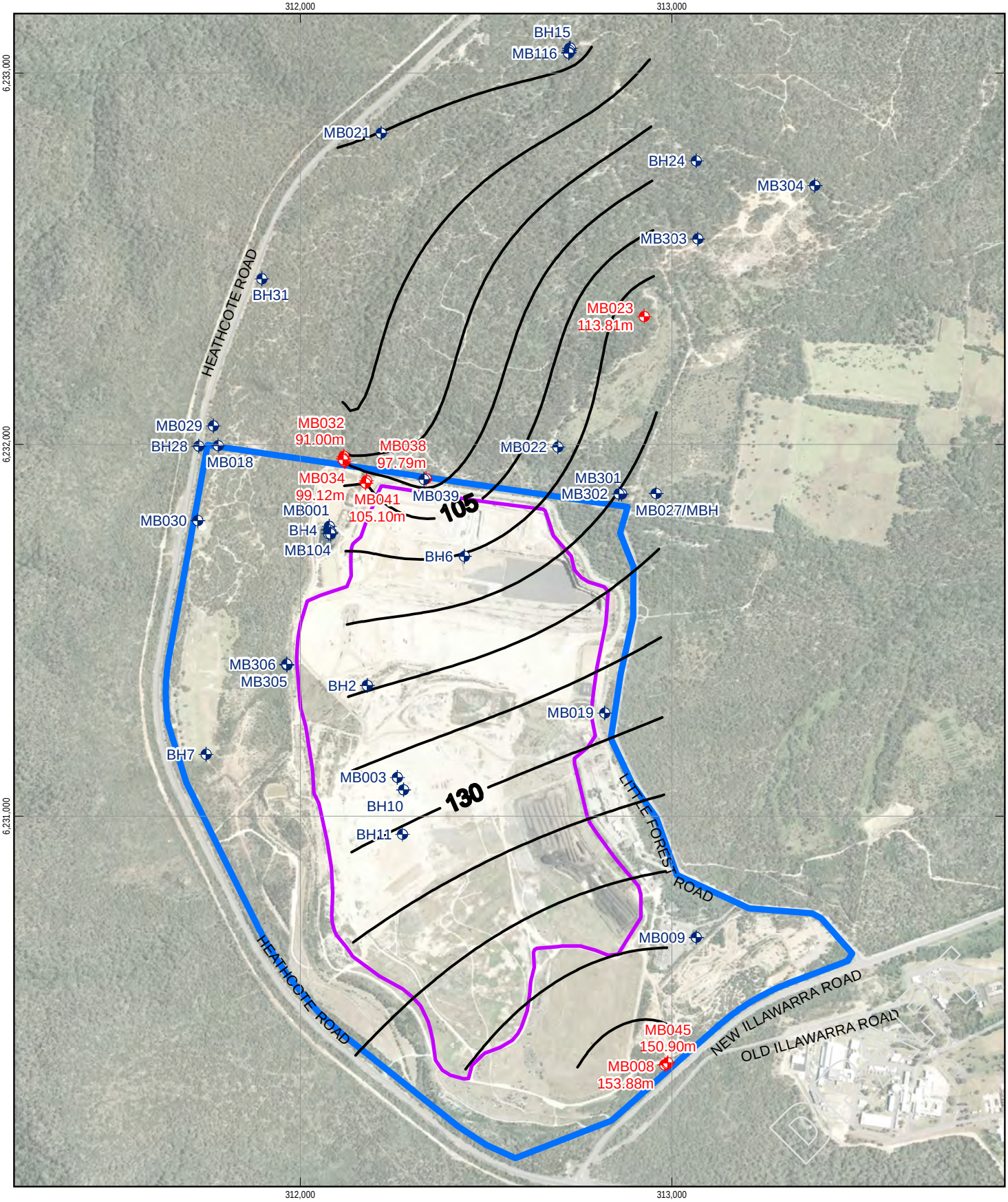
The prevailing hydrogeological conditions at the LHRRP can be summarised as follows:

- Groundwater flow through the rock types that constitute the Hawkesbury Sandstone is typically very slow due to the nature and physical characteristics of these rock types. As such, groundwater flow through the Hawkesbury Sandstone predominantly occurs via joints, fractures and bedding planes within the rock mass
- Joints, fracture and bedding plane features are commonest at relatively shallower depths (i.e. nearer the ground's surface) than at relatively deeper depths
- Available information suggests that fracturing of the Hawkesbury Sandstone at depths of 30 and 50 m bgl is intermittent and not laterally extensive at the LHRRP. Furthermore, this fracture zone has been interpreted to be located beneath a low permeability zone that acts to limit the connection between the landfill and underlying groundwater systems.
- The physical characteristics of certain rock types within the Hawkesbury Sandstone would act to limit the vertical movement of groundwater, especially at relatively deeper depths where joints, fracture and bedding plane features are less common. However, fracturing along bedding planes would generally increase the horizontal movement of groundwater. Overall, this would result in significantly lower vertical groundwater movement than horizontal groundwater movement
- As groundwater tends to follow the paths of least resistance, the overall hydrogeological conditions would promote horizontal groundwater movement
- The observed NNE and ESE aligned joint sets coupled with a north east dip in the regional geology would be expected to further control groundwater flow directions resulting in preferential groundwater migration to the north at the LHRRP
- Topographical features (such as the valley associated with Mill Creek) dissecting the shallow geological units and associated groundwater systems would act as preferential discharge points for the shallow groundwater systems and tend to distort the northward groundwater flow direction.

14.2.3 Groundwater conditions

Horizontal groundwater elevations and flow directions

Groundwater elevations at the LHRRP have been monitored at a number of locations for many years. The groundwater assessment report contains a number of figures and cross-sections that summarise the horizontal groundwater elevations and flow directions between 1992 and 2014. Figure 14.1 and Figure 14.2 summarise the horizontal groundwater elevations and flow directions observed during 2014.



LEGEND

- Groundwater bores
- Groundwater bores AHD*
- 2014, 5m Groundwater contour
- Landform reprofiling
- LHRRP boundary
- Roads

*Only groundwater bores with elevation were used to generate the groundwater contours

Paper Size A4

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

SITA Australia
Lucas Heights Resource Recovery Park
Preliminary Environmental Assessment

2014 interpreted groundwater contours

Job Number 21-23482
Revision B
Date 20 Aug 2014

Figure 14.1

N:\AU\Sydney\Projects\21\23482\GIS\Maps\MXD\21-23482-Z008_2014_GW_Contour_A4_Rev0.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

Data Source: NSW Department of Lands: Cadastre - Jan 2014; Geoscience Australia: 250k Data - Jan 2014; NSW Department of Primary Industry - Jan 2014; Google image Jan 2014. Created by: qjchung

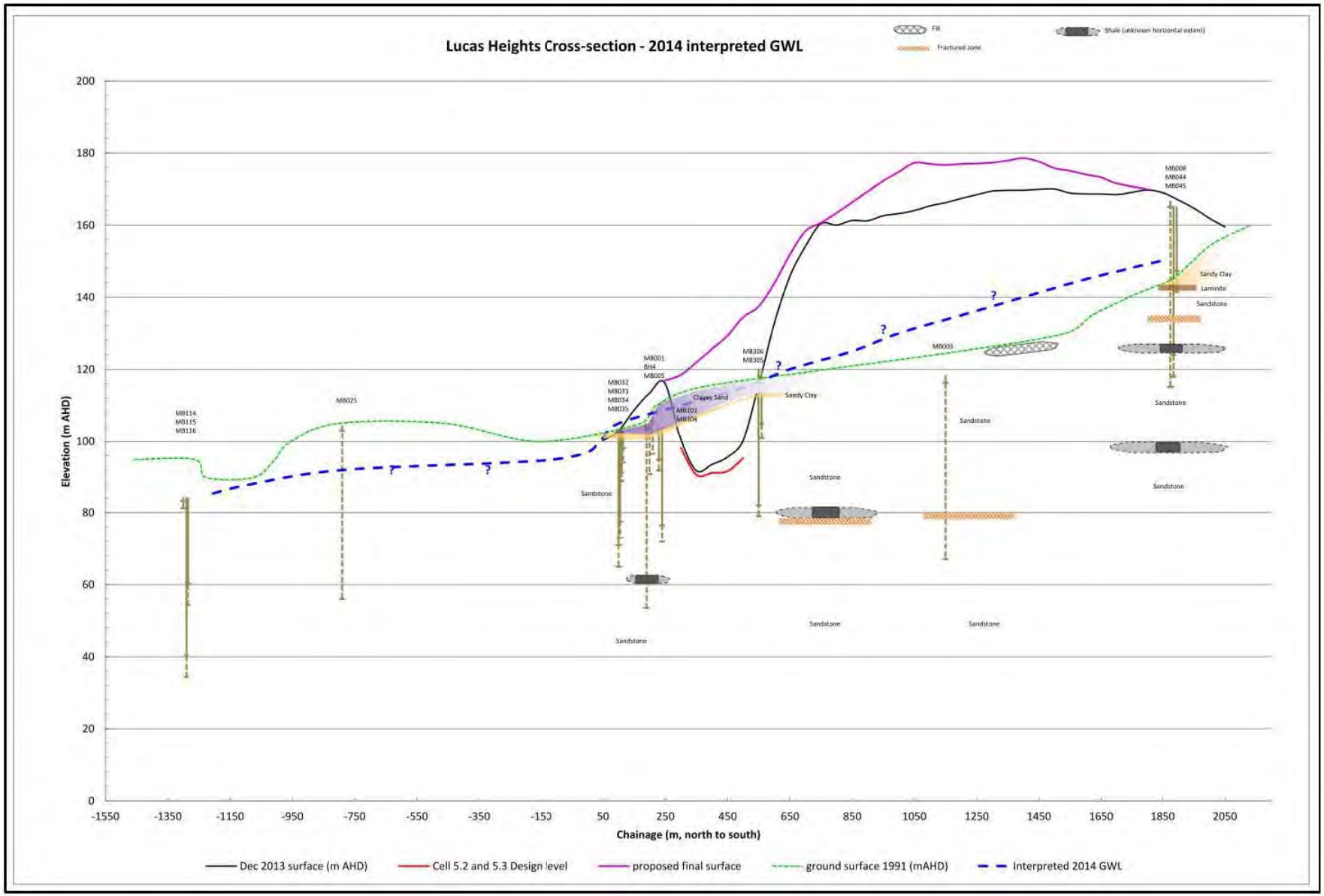


Figure 14.2 Cross-section of 2014 – interpreted groundwater contours

The data upon which the figures contained within the groundwater assessment (including Figure 14.1 and Figure 14.2) suggests that:

- The prevailing direction of groundwater movement is northwards
- The northerly flow gradients generally approximate 0.02 m/m
- The groundwater flow velocities range between 0.004 and 0.4 m/day
- There is limited groundwater elevation data available for the location of the proposed ARRT facility and GO facility.
- There is potential for groundwater elevations to be above the level of Mill Creek around the northern toe of the landfill (Chainage of 50 m) and approximately 1.1 km further down gradient. This suggests the potential for groundwater discharge to the Creek in these locations.
- The base of the Stage 5 landfill is below prevailing groundwater elevations in this area. This creates an inward groundwater flow into the landfill at this location.
- At present there are limited data to relate groundwater elevations in the sandstone aquifer to leachate levels in the older sections of the landfill.
- The leachate levels within the landfill are perched on low permeability zones resulting in variable leachate elevations throughout the landfill. These levels are not indicative of the levels at the base of the landfill where the potential for interaction with the underlying groundwater system exists. Even in the absence of a basal drainage system the natural slope of the underlying bedrock would promote flow toward the valley centre with subsequent migration northward down the valley. This would inherently limit the potential for build-up of leachate at the land base of Stages 1 to 4 and promote flow of leachate to the Stage 5 landfill area.

Vertical groundwater elevations and flow directions

Vertical groundwater gradients were calculated for nested groundwater monitoring wells at the LHRRP based on data collected between 2002 and 2014. The majority of wells displayed downward flow conditions, however, there was an anomaly between MB034 and MB033 where an upwards flow was persistently detected indicating that this is a stable, preferential flow path and corresponds with the fracture zone identified earlier between 74 and 85 m AHD.

The vertical head gradients are generally large in comparison with horizontal head gradients suggesting that the vertical hydraulic conductivities are significantly lower than the horizontal hydraulic conductivities.

The large vertical gradients also suggest that the shallow sandstone lithology is likely to be significantly retarding vertical flow. This conceptually fits with the water quality result which suggests limited interaction between the landfill leachate and underlying groundwater systems.

The predominant downward head gradient does however provide the potential for vertical migration of leachate and groundwater where the geological conditions would allow. This circumstance however is not considered to be of concern as the horizontal flow path is the predominant flow direction. Any elevated influence of leachate on groundwater quality would likely be first experienced in the horizontal direction at shallower depths.

Water quality conditions

Water quality monitoring has been undertaken at the LHRRP for more than 25 years.

In summary, this monitoring data generally suggests the following:

- Insignificant quantities of leachate are being discharged from the LHRRP into local groundwater and surface waters
- Whilst numerous groundwater and surface water impacts associated with landfill leachate have been identified at the LHRRP historically, these are generally minor in nature. The one exception of note was a leachate dam overflow that impacted Mill Creek at monitoring point MC1 during January 2005, the cause of which was investigated and procedures put in place to prevent future incidents.
- It appears unlikely that the slightly elevated concentrations of ammonia observed occasionally in Mill Creek would be due to discharge of leachate influenced groundwater to Mill Creek
- The leachate collection system along with the impermeable base / bedrock is preventing landfill leachate from entering the groundwater beneath the landfill and hence the migration of leachate via groundwater to down gradient receptors such as Mill Creek.

Potentially sensitive receptors

The key receptors in relation to groundwater are those that are potentially in hydraulic connection with leachate should it migrate within groundwater from the landfill. These are surface water, groundwater dependent ecosystems and groundwater users.

Surface water

In relation to surface water, it is anticipated that Mill Creek is likely to be the principal point of discharge for shallow groundwater moving beneath the landfill.

Within the LHRRP, Mill Creek is a highly disturbed environment that has been re-directed. The 1999 EIS for the LHRRP (NECS, 1999) suggested that Mill Creek was primarily ephemeral with stagnant pools predominating at times of no flow. Aquatic biological studies suggested that while ecosystems were highly disturbed immediately down gradient of the landfill, there was a rapid recovery of taxa within 100 m of the landfill and a large increase in taxa abundance 2.5 km downstream.

Data characterising the flow behaviour and aquatic ecology within Deadmans Creek was not available, but it is expected that this creek is likely to be more dependent on groundwater discharge and have aquatic ecosystems more sensitive to impacted groundwater than Mill Creek.

The Woronora River is considered to be perennial in nature and likely to be a discharge point for groundwater due to its low elevation and the size of its catchment. Up gradient of the LHRRP, the Woronora River catchment is relatively undisturbed and well vegetated in native bushland. Downstream of the LHRRP, the catchment is more disturbed by development and is likely to receive run-off from residential areas.

Based on the available information, aquatic ecosystems in the lower reaches of Mill Creek and in Deadmans Creek and the Woronora River are considered to be potentially sensitive receptors.

Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are most likely to occur in areas with shallow groundwater levels close to the prevailing ground surface. The available information suggests that areas immediately adjacent to Mill Creek, Deadmans Creek and the Woronora River have the potential to be significant GDEs. As a precaution, it is assumed that all native vegetation in the study area are groundwater dependent to some degree.

Groundwater users

A total of 87 groundwater boreholes were identified within a five kilometre radius of the LHRRP, all of which were identified for monitoring purposes rather than direct use. It is proposed that future development in the area would be on a reticulated water supply, suggesting that there is a low potential for groundwater to be extracted for potable water supply purposes. Further to this the likelihood of groundwater extraction for other purposes such as domestic or stock use is considered to be low given that extensive zones of the surrounding area are comprised of native bushland, in the Holsworthy Military reserve or in National Parkland.

Based on the above information the groundwater resource in this area is not considered to be a sensitive resource from human and livestock use perspectives.

Figure 14.3 presents a summary of the current conceptual understanding of the hydrogeological and groundwater conditions at the LHRRP.

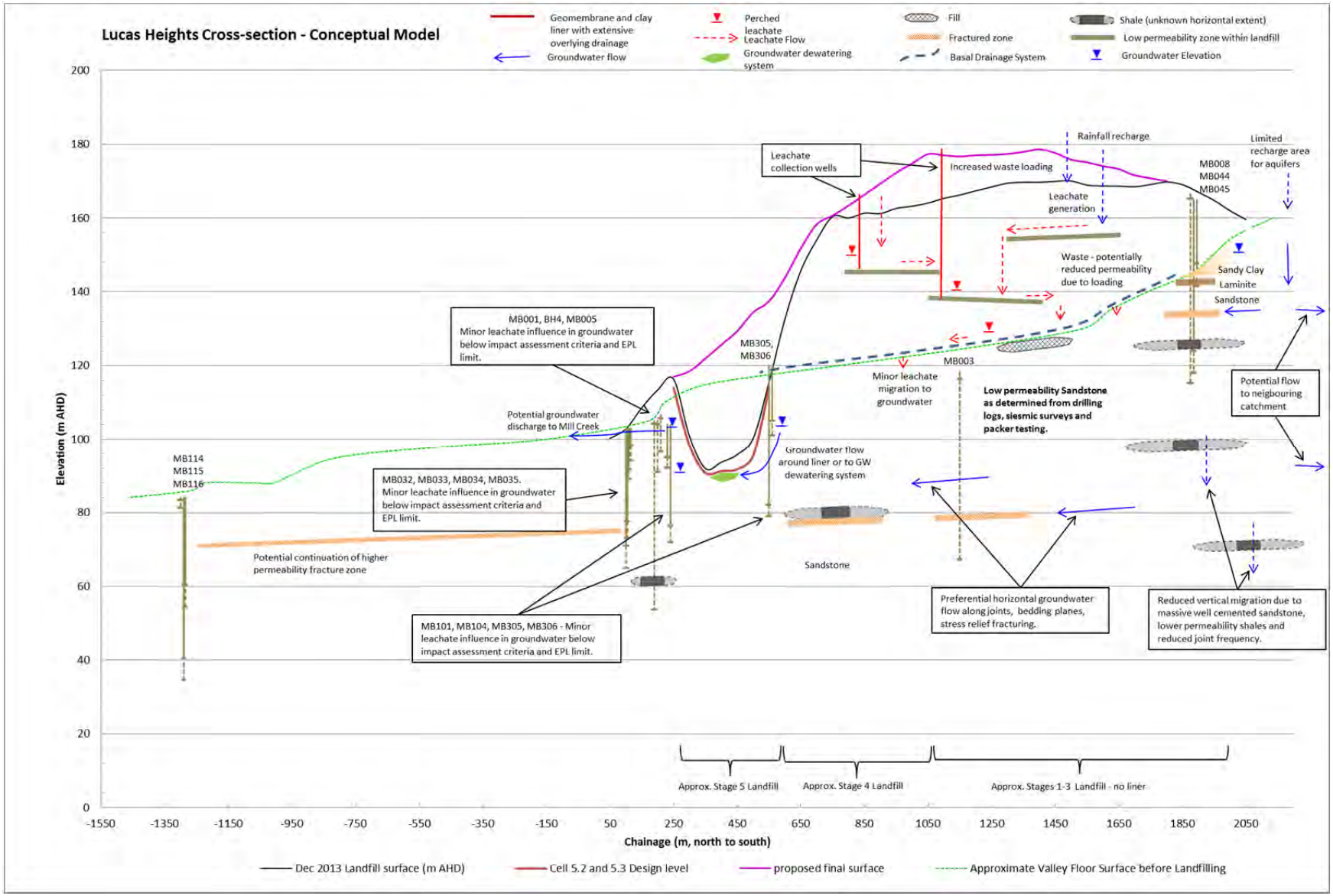


Figure 14.3 Conceptual hydrogeological and groundwater conditions

14.3 Assessment of potential impacts

14.3.1 Overview

The impact assessment has included assessing the key components of the proposed proposal against the existing environmental setting outlined above.

The key features of the proposal include:

1. Landfill reprofiling
2. Development of the ARRT facility
3. Movement and expansion of the GO facility
4. Parkland areas

The potential impacts associated with these proposed activities can be separated into those associated with construction, operation and post closure. These can subsequently be separated into groundwater quality and groundwater availability related potential impacts.

The key potential receptors include potential GDEs and aquatic ecosystems associated with Mill Creek, Deadmans Creek and the Woronora River. There are no registered boreholes within 5 km that are used for purposes that may be potentially adversely impacted.

Further detail on the potential interaction of the proposal with groundwater and the associated assessment is provided in the following sections.

14.3.2 Groundwater interaction

Landfill reprofiling

The geometry of the currently approved final landform has been observed to create ponding of rainwater. This increases the potential for infiltration of rainwater into the waste and additional leachate generation. The proposed reprofiling works would limit the potential for surface ponding to occur due to increases in surface gradients.

The re-profiling works will be completed with a layered capping system that will include a sealing layer, an overlying sealing protection layer and a surficial revegetation layer that is designed to achieve greater than 5% slopes as recommended by the EPA (EPA, 1996) and control stormwater infiltration and thereby leachate generation.. This would result in a reduced potential for leachate generation and consequent impacts on underlying groundwater and down gradient receptors.

Increased loading of waste on the landfill associated with increased waste depth has the potential to reduce the ability of leachate to drain through the deeper waste into the leachate capture pipework and reduce the potential flux to the underlying groundwater system. The additional weight can also possibly compromise the integrity of the capture pipework. This would reduce the ability of the subsurface drainage network to capture leachate.

The already approved Stage 5 landfill area is currently being developed and is available to suitably collect, contain and extract leachate that is influenced by the increased loading of waste. Stage 5 includes the following key features:

- A low permeability clay and geomembrane liner overlain by a high permeability drainage system which drains to a central sump. This system is at lower elevations than the

existing landfilled areas and is designed to collect leachate from the Stage 5 landfill and residual leachate seepage from all other stages of the landfill (located up gradient).

- A groundwater depressurisation system, including high permeability matting and drainage lines linked to a central pump, which is separated from and underlies the landfill double liner system and leachate drainage system. This is in place to prevent the build-up of groundwater pressure behind/below the liner, preventing heaving or instability until such time that there is sufficient waste thickness to prevent this occurring. The system is located at an elevation of approximately 90 m AHD, which is at or slightly below groundwater elevations in shallow wells screened in this area. As such it would act as a primary point of discharge for shallow groundwater while it is in operation. This system could also be used as a groundwater interception and capture system if in the future unacceptable groundwater impacts were identified.

The basal leachate drainage and collection system would operate after closure, to reduce the potential for leachate levels to build up in the landfill. It is expected that leachate accumulation would be able to be efficiently extracted from Stage 5 rather than up gradient areas with higher basal elevations (Stages 1 to 4). Mitigation measures are proposed to augment the existing leachate collection and extraction systems should this be needed. Ongoing leachate management would occur until such time as the leachate volume monitoring and/or leachate and water quality monitoring data suggest that risks are insignificant and as directed by the EPA.

Existing groundwater monitoring data suggests that the combination of the insitu geology and current leachate collection system is resulting in concentrations of parameters in groundwater which are below the level where impacts on the surrounding groundwater and surface water systems may occur. As similar conditions would be maintained with the proposal, it is expected that there would be no unacceptable impacts from the proposed landfilling activities at the LHRRP.

ARRT facility and GO facility

The construction of the new ARRT facility and the relocation of the GO facility would involve excavation works but these works are not expected at depths that would intercept groundwater.

During construction, the ARRT facility and the GO facility would not be processing waste and the primary potential for interaction of these facilities with groundwater would be via minor spills of construction related liquids such as diesel fuel and hydraulic fluids that could potentially infiltrate into the underlying groundwater system. These impacts would be minimised by developing appropriate management practices and emergency response procedures and would be detailed in a CEMP.

Post closure, the potential for degradation of groundwater quality by the operation of the ARRT facility and/or the GO facility would be negligible as potentially contaminating activities would no longer be occurring at these facilities.

From an operational perspective, to avoid groundwater quality impacts, these facilities have been designed to minimise the potential for groundwater impacts to occur. The designs include:

- Low permeability surface beneath processing infrastructure with fully enclosed water management systems.
- Separation of dirty water and clean water to minimise the generation of leachate and thus the potential for impacts should any water escape to underlying groundwater.
- Storage of leachate within enclosed treatment systems or within ponds with low permeability liners.

Once in operation, the use of low permeability surfaces within the ARRT facility and the GO facility would reduce groundwater recharges. This may result in a decrease in groundwater elevations beneath the LHRRP. Given already naturally low recharge rates and that recharge impacts would be highly localised, it is not expected that there would be overall adverse impacts to groundwater elevations and flows.

Parkland changes

Parkland features such as low permeability areas, vegetation types, surface water management systems, parkland topography and permitted recreational activities would result in different infiltration characteristics from the currently approved parkland masterplan. This could potentially affect leachate generation.

The primary difference between the currently approved masterplan and the proposal is a minor reduction in tree coverage, which would be replaced by native lawn areas. This may alter the overall level of infiltration compared to the approved masterplan. The proposed reprofiling and final capping profile would have a more significant impact on reducing infiltration than minor changes made to vegetation types.

Parkland features such as the type of vegetation and the type of recreational facilities present across the landfill would be designed to limit infiltration to the underlying capping layers (by preventing activities that would damage vegetation cover and maintaining vegetation) and/or damage to the underlying capping layers (by using shallower rooting plants and preventing activities that may cause damage).

14.4 Mitigation and management measures

14.4.1 Landfill reprofiling

Measures to manage and mitigate the risks along the groundwater pathway include the following:

- Development of a monitoring system to assess changes in the landfill leachate collection system associated with re-profiling the landfill. This may include one or a combination of the following:
  - Ongoing assessment of the leachate generation volumes within the Stage 1 to 4 landfill areas during re-profiling via development and regular updating of a landfill water balance model that compares expected infiltration volumes against collected leachate volumes.
  - Characterisation and monitoring of leachate levels in dual purpose gas/leachate collection wells for changes to water levels.
  - Monitoring of the leachate extraction yields from dual purpose gas/leachate collection wells and leachate collection trench installed around the areas being reprofiled (Leachate Assessment Report GHD 20015) to assess yields over time.
  - Implementation of an improved collection system if water balance discrepancies are interpreted and/or overall changes in leachate levels and yields are observed and taking into account groundwater quality data.
- Ongoing leachate management will occur until such time as the leachate volume monitoring and or leachate and water quality monitoring suggest that risks are no longer significant and as determined by the EPA. This has been incorporated into the Post closure Environmental Management Plan.
- Ongoing monitoring of groundwater wells on a quarterly basis until not required by the EPA.

14.4.2 ARRT facility and GO facility

Measures to manage and mitigate potential groundwater impacts associated with the ARRT and GO facilities include:

- Inclusion of measures to reduce potential water quality impacts associated with the ARRT facility and the GO facility construction in the CEMP. Emergency response procedures in the event of a spill would also be included.
- Inclusion of operational procedures and practices designed to minimise the production and spillage of leachate and/or fluids used in operational activities in the OEMPs.
- Development of a groundwater monitoring network comprising at least four shallow wells and two deeper wells (at multiple depths) around the location of the ARRT facility and the GO facility to:
  - Characterise background water quality and groundwater elevations
  - Assess the effectiveness of management procedures and the mitigation measures implemented
  - Identify any impacts.
- Groundwater monitoring on a bi-annual basis against key criteria identified within landfill leachate, garden organics runoff and groundwater as well as total nitrogen and total phosphorus
- Further investigations would be triggered if ammonia concentrations exceed 1 mg/L in groundwater samples

14.4.3 Parkland changes

The EMP for the parkland site would include site procedures for managing vegetation, site facilities and potentially damaging recreational activities or site works.

14.5 Conclusions

Existing groundwater monitoring data suggests that the combination of the insitu geology and current leachate collection system is resulting in concentrations of parameters in groundwater which are below the level where impacts on the surrounding groundwater and surface water systems may occur. As similar conditions would be maintained with the proposal, it is expected that there would be no unacceptable impacts from the proposed landfilling activities at the LHRRP.

The Stage 5 landfill leachate collection system and control measures have been designed and installed in accordance with best practice to facilitate preferential capture of leachate from up gradient landfill areas and further minimise the potential for impacts to underlying groundwater. The existing groundwater drainage system located beneath Stage 5 provides additional capacity for interception of groundwater in the unlikely event that adverse groundwater impacts are detected.

The proposed reprofiling of the landform and subsequent capping is expected to reduce overall infiltration to the landfill, resulting in reduced potential for impacts on underlying groundwater and down gradient receptors.

Despite this, it is important that leachate levels within the landfill are monitored and actively managed to minimise the possibility of leachate entering groundwater.

The proposed ARRT and GO facility operations include activities that require management and monitoring during construction and operation, to avoid impacting groundwater. The proposed design of these facilities which utilises impermeable surfaces for processing activities within the

ARRT and GO facilities, and operations within buildings for the ARRT facility, minimises the potential for impacts on groundwater. After closure and removal of these facilities, the potential for groundwater contamination is minimal.

Groundwater elevation observations and the hydrogeological condition identified around the landfill suggest that any reduction in groundwater recharge and hence flow associated with the proposal would be minimal during construction and operation and after closure. This is supported by the overall footprint of the landfill remaining similar to existing conditions and current groundwater quality data that suggests that there is limited interaction between leachate and the underlying groundwater system.

There would be a reduction in recharge associated with the development of impermeable surfaces at the ARRT and GO facilities to minimise the potential for groundwater contamination. Given already naturally low recharge rates and that recharge impacts would be highly localised, it is not expected that there would be overall adverse impacts to groundwater elevations and flows.

With the adoption of the proposed mitigation measures and a long term commitment to monitor for the emergence of impacts and respond if required, the potential for adverse impacts on groundwater would be acceptably minimised.

The groundwater assessment addresses the SEARs and concludes that the proposal would meet the identified objectives of:

- No significant impacts on the community or environment
- No significant impacts on groundwater quality.

15. Leachate

The information presented in this chapter is based on the findings of the leachate assessment undertaken by GHD. The leachate assessment report is included in Appendix J of this EIS.

15.1 Approach and methodology

This chapter deals specifically with leachate from the landfill operation. Other aspects which may be impacted by leachate from the proposal, including air quality are dealt with in other chapters. The leachate assessment provides a cumulative assessment of the leachate impacts considering all sources of water being treated by the Lucas Heights 1 treatment plant and disposed to sewer at the Lucas Heights 1 site. This includes the landfill leachate from the LHRRP landfill, Harrington's quarry and Lucas Heights 1. It does not consider water from the existing and proposed GO and ARRT facilities.

Leachate generated from the GO facility ('GO leachate') as a result of surface water coming into contact with waste or composting materials, is considered as part of the soils and surface water assessment (Chapter 13). The landfill leachate and GO leachate management systems would keep these different types of leachate separate. It is noted that leachate generated from the ARRT facility would be contained within buildings and hence also managed in a separate system.

The tasks undertaken as part of the landfill leachate assessment included:

- Review of information including previous modelling
- Review of proposed staging plans
- Review of the capacity of the existing leachate infrastructure
- Assessment of existing leachate sources
- Identification of proposed leachate management measures and controls, including controlling the potential for leachate seepages entering surface waters
- Review of the capacity of leachate infrastructure to manage future leachate generation and treatment requirements
- Assessment of the impacts after management measures are put in place

15.1.1 Objectives

In addition to addressing the SEARs, the leachate assessment provides an assessment of how well the proposal meets SITA's objectives. The following objectives have been identified:

- No significant impacts on the community or environment
- Prevention of groundwater pollution by leachate
- Prevention of surface water pollution by leachate, including Mill Creek
- Prevention of the degradation of local amenity

15.2 Existing environment

15.2.1 Leachate generation

A conceptual model (Figure 15.2) was developed to illustrate the various aspects of the existing system.

The primary sources of landfill leachate are:

- LHRRP (Lucas Heights 2)
  - Landfilled waste
  - Groundwater collection system
  - Leachate impacted surface water
- Lucas Heights 1 landfilled waste
- Harrington's quarry

Locations of these sources are identified in Figure 15.1.

In addition to these primary sources, additional leachate is also generated by direct rainfall into the leachate dams.

Other site facilities which generate waste water utilise a separate treatment/disposal system. This includes general site facility and the existing garden organics facility. The performance of the Lucas Heights 1 treatment plant and sewer connection are not impacted by these other facilities.

LEGEND

- Lucas Heights Resource Recovery Park boundary
- Harringtons Quarry
- Roads
- Lucas Heights 1

Paper Size A4

0 250 500 1,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision A
Date 09 Jun 2015

Landfill leachate sources

Figure 15.1

15/133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

G:\21\23482\GIS\Maps\MXD\21-23482-Z062_Leachate.mxd

Aerial Imagery: Google, 2014. LHRRP Boundary: GHD, 2014. Roads/Suburbs: NSW LPMA 2012. Location Data: GEOSCIENCE AU 2014. Created by:afoddy

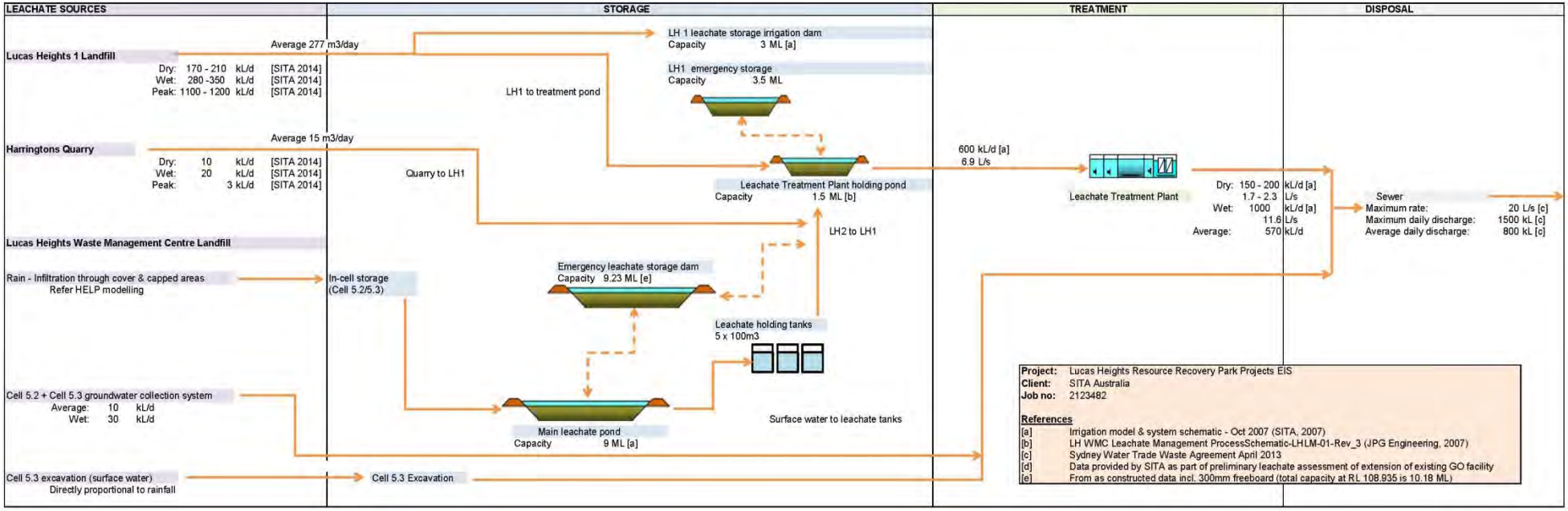


Figure 15.2 Conceptual leachate system

15.2.2 Historical leachate volumes

Leachate is generated predominantly by infiltration of rainwater through the waste. The existing landfilled areas were developed in a phased manner with each area constructed into cells with leachate management systems.

Recorded annual total leachate volumes are summarised in Table 15.1.

Table 15.1 Historical leachate collection – LHRRP landfill

Period	Total leachate collected (m^3)	Rainfall (mm)	Days	Average leachate collected (m3 /day)
01/01/08 to 31/12/08	111,568	1,082	366	305
01/01/09 to 31/12/09	98,480	805	365	270
01/01/10 to 31/12/10	97,173	929	365	266
01/01/11 to 30/06/11	56,518	653	181	312
01/07/11 to 30/06/12	155,557	1296	365	426
01/07/12 to 30/06/13	130,303	623	365	357
01/07/13 to 05/06/14	119,765	489	340	352

Leachate volumes can vary depending on a number of factors including the intensity and duration of rainfall events and whether the landfilling area includes the more recent northern cells.

15.2.3 Leachate containment and transfer

The main containment for leachate is within a HDPE geomembrane lined dam, located in the north west corner of the proposal site. The main leachate dam has a containment capacity of 9,000 ML and includes mechanical aeration. This dam is aerated.

A double lined (900 mm compacted clay and HDPE geomembrane) emergency leachate containment dam was constructed adjacent to the main dam in mid-2014 by SITA. This dam has a design containment capacity of 9 ML. The total capacity, including within the freeboard volume, is 10.18 ML.

There are also five 100 kL leachate tanks adjacent to the main leachate dam.

At the Lucas Heights 1 site, there are three leachate containment dams:

- A leachate holding dam adjacent to the leachate treatment plant (capacity approximately 1,500 m^3)
- An emergency leachate dam (capacity approximately 3,500 m^3)
- A leachate containment irrigation dam (capacity approximately 3,000 m^3)

Leachate can be readily transferred between the available leachate containment locations. The pipeline transferring leachate from LHRRP to Lucas Heights 1 has a best practice automated monitoring system which immediately shuts down the transfer of leachate in the unlikely event that a leak should develop and triggers an alarm to inform SITA of the leak.

The design and construction of Cell 5.2B and Cell 5.3 included both compacted clay and HDPE geomembrane barriers in the base of the cells. This double lined system exceeds the EPA guideline design requirements and provides significantly more environmental protection. This double lined system was installed to allow for temporary leachate fluctuations within the base of the cell following extreme wet periods, further increasing the containment capacity of the proposal site.

15.2.4 Leachate treatment and disposal

The existing leachate treatment system is a sequencing batch reactor (SBR) treatment system that discharges directly to sewer at Lucas Heights 1.

The treatment process biologically oxidises the ammonia in the leachate, converting it to nitrate and nitrate species. Two reactors work in parallel with independent diffused air systems, pH controls and decant systems, allowing shut down for maintenance and to provide a more uniform plant throughput through staggered cycles.

This system has a current average leachate treatment capacity of 570 kL/day. The current annual average sewer discharge limit is 800 kL/day at a maximum daily discharge of 1,500 kL, in accordance with the Trade Waste Agreement. SITA can discharge other waters with concentrations of substances below the agreed limits without it first passing through the leachate treatment plant. SITA has advised that it will increase the treatment plant capacity to 870 kL/day and the average daily sewer discharge limit to 1,200 kL/day by early 2017.

Irrigation is not proposed to be used as a method of leachate disposal at the Lucas Heights 1 landfill or the LHRRP.

15.3 Assessment of potential impacts

15.3.1 Leachate sources and receptors

The following leachate sources were identified:

- Leachate generated by infiltration through the cover materials
- Leachate generated due to groundwater intrusion
- Leachate generated due to waste compression and waste decomposition
- Leachate contained in dams adjacent to Mill Creek
- Leachate being transferred from LHRRP and Harrington's quarry to Lucas Heights 1 treatment plant

Lucas Heights 1 is not part of the proposal as no changes are proposed to the generation, storage or disposal of leachate for this site. The existing GO and proposed GO and ARRT facilities are also not included as they are part of separate systems and addressed in Chapter 13.

The following receptors were identified:

- The local groundwater.
- The local surface water courses, in particular Mill Creek and the Georges River.

15.3.2 Leachate generation

Cover and cap types

Seven cover and cap profiles were identified and are described in Table 15.2.

Table 15.2 Cover and cap scenarios

Cover profile	Materials	Description
Existing final cap	1800 mm (min.) compacted crushed sandstone	Southern parts of the existing landfilled area which have been revegetated with grasses
Intermediate cover	300 mm (min.) compacted crushed sandstone	Central parts of the landfill, waste batters and areas of the active landfill cell where no waste will be placed within 90 days
Daily cover8	150 mm (min.) crushed sandstone	Active landfill cell where waste will be placed within 90 days. SITA generally maintains this area at less than 10,000 m^2
Tip face	No cover	Areas of active landfilling. SITA maintains the active tip face with maximum area of approximately 2,500 m2
Stripped cap	300 mm compacted crushed sandstone	Areas within the proposed re-profiling area which currently have existing final cap or intermediate cover. Existing soils will be partly removed for use on site and to promote leachate movement into the existing leachate collection system. The area of cover material removed will be limited to 20,000 m2 or at least 2 weeks in advance of the active tip face
Proposed final cap (or equivalent)	100 mm topsoil 250 mm revegetation layer 500 mm subsoil layer 600 mm compacted clay barrier 300 mm seal bearing	Once re-profiled and at final levels, each area will be capped with a low permeability cap and revegetated with grasses
Proposed post-closure cap (or equivalent)	100 mm topsoil 400 mm revegetation layer 500 mm subsoil layer 600 mm compacted clay barrier 300 mm seal bearing	Once the landfilling has ceased at the site, the site will be rehabilitated. The revegetation layer will be thickened over almost a quarter of the re-profiled area to support growth of larger plants. The post-closure cap is outlined in the rehabilitation landscape plan.

LHRRP landfilled waste

HELP modelling was undertaken to estimate the volumes of leachate which would be generated for each cover type for two climate scenarios (the 50% (average) annual exceedance probability (AEP) rainfall year and 10% AEP (wet) rainfall year) based on a 1 hectare area with the results able to be scaled for larger areas. A summary of results is provided in Table 15.3.

Table 15.3 Estimate of infiltration through cover profiles at LHRRP landfill

	50% AEP rainfall year	10% AEP rainfall year
Precipitation (mm)	1,015	1,315

[8] Tarps have been trialled and are proposed to be used as an alternate daily cover. The crushed sandstone has been considered in the modelling as it is expected to be more permeable.

Actual evaporation (mm)	1,319		1,469	
Cover profile	Infiltration (mm)	Infiltration (% rainfall)	Infiltration (mm)	Infiltration (% rainfall)
Tip face	487	48%	697	53%
Daily cover	396	39%	523	40%
Existing final cap - platform	177	17%	295	22%
Existing final cap - slopes	118	12%	224	17%
Stripped cap	151	15%	227	17%
Intermediate cover -platform	73	7%	119	9%
Intermediate cover - slopes	46	5%	85	6%
Proposed final cap - platform	65	6%	67	5%
Proposed final cap - slopes	64	6%	64	5%
Post closure cap - platform	65	6%	67	5%
Post closure cap - slopes	64	6%	65	5%

It is noted that the results indicate that:

- There is more leachate generation in the modelled wet year than the average rainfall year
- There is generally more leachate generated in platform areas than on batters
- There is significant leachate generation through the existing final cap profile (12% – 22% infiltration
- There would be significantly less infiltration (5% - 6%) through the proposed final cap profile (or equivalent)
- The thickened areas of the post closure cap may generate 5% – 6% infiltration

Of particular note, the difference between the infiltration through the existing final cap and the proposed final cap is of significance. It indicates that the proposed works would provide significant improvement for the completed site. For the landfill area (113 ha) the existing final cap is predicted to generate leachate in the order of 133,300 m^3/yr in a 50% AEP year and 252,700 m^3/yr in a 10% AEP year, the proposed final cap (or equivalent and including post closure areas) is predicted to generate 88,400 m^3/yr and 105,700 m^3/yr, respectively. These are illustrated in Figure 15.3.

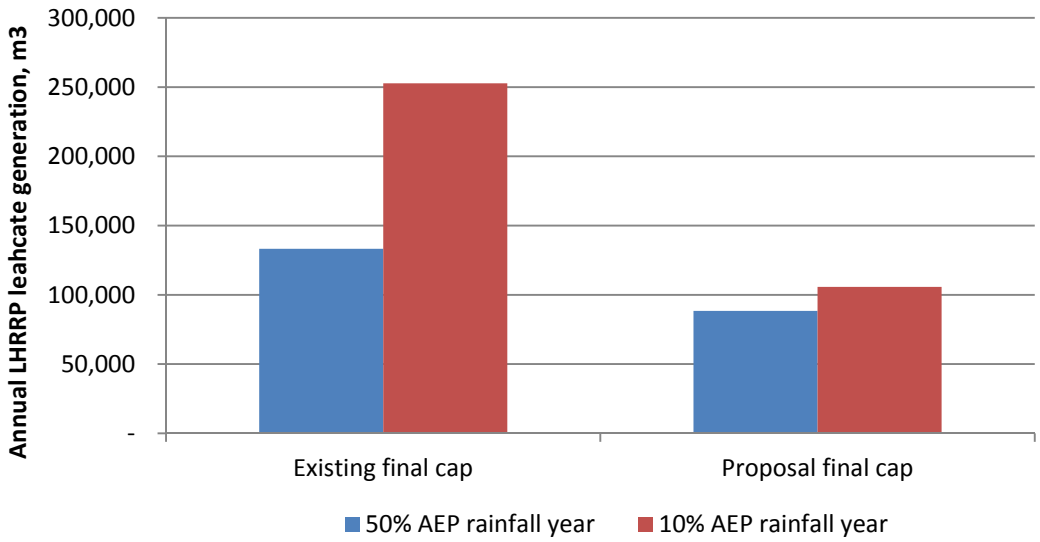


Figure 15.3 Comparative leachate generation for LHRRP landfill

The results of the HELP model were used to estimate the volume of leachate generated through leachate infiltration through the LHRRP landfill surface for each of the proposed stages of the development, as summarised in Figure 15.4.

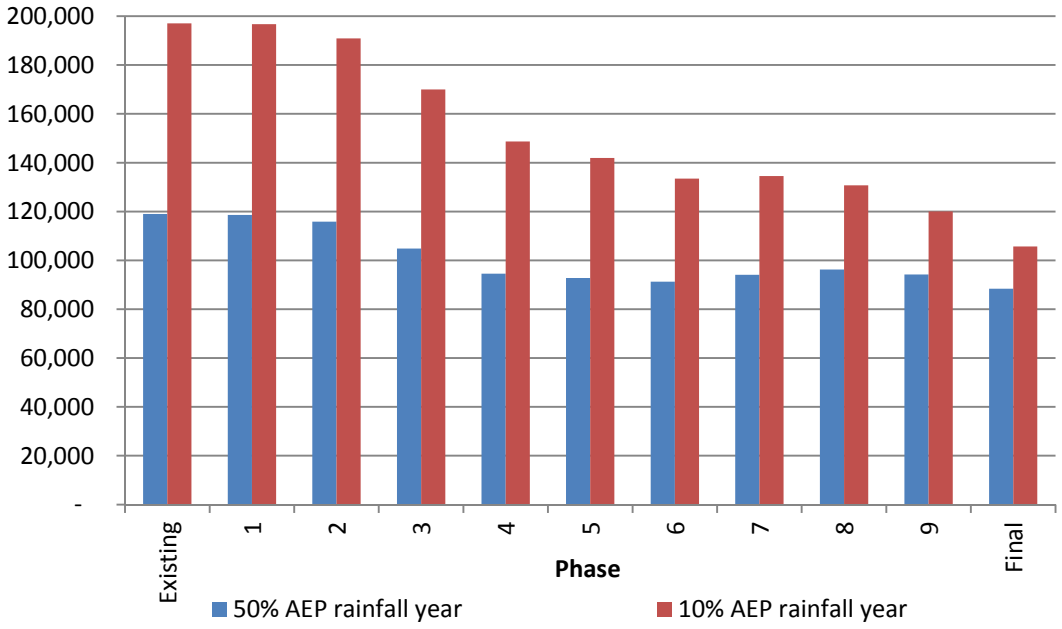


Figure 15.4 Predicted leachate generation for proposed development of LHRRP landfill

When considered over the projected life of the landfill, and as illustrated in Figure 15.5, it can be seen that the works proposed would have a significant impact on the volumes of leachate expected to be generated at the LHRRP landfill. In particular, the reshaping and capping works over Phases 1 to 6 of the proposal, from 2014 to 2021, would reduce the volume of expected leachate being generated by at least 25% in the modelled weather scenarios.

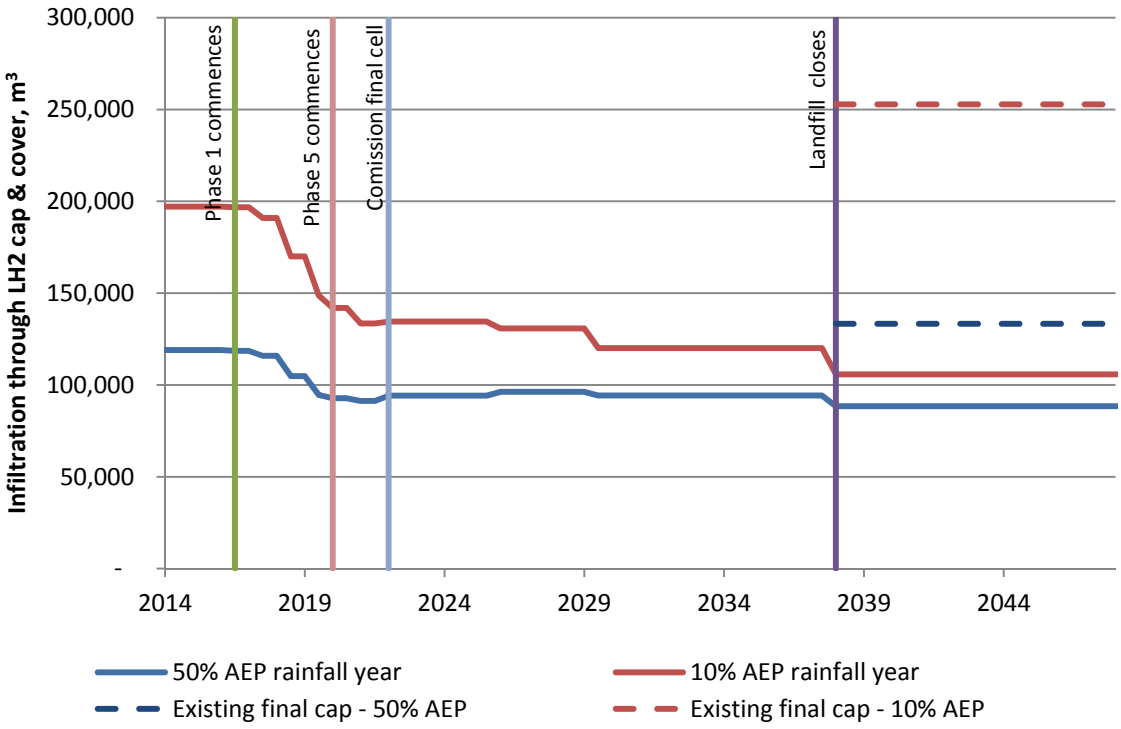


Figure 15.5 Estimation of leachate generated by infiltration at LHRRP landfill

Other leachate sources

No changes are expected to occur which would affect the generation of leachate from the other sources of leachate. A summary of the assumed generation rates are outlined in Table 15.4.

Table 15.4 Estimate of leachate generation for other leachate sources

Leachate source	50% AEP rainfall year	10% AEP rainfall year
Lucas Heights 1 landfilled waste (m3/day)	270	327
Harrington's quarry (m3/day)	15	20
Groundwater collection system (m3/day)	10	30

15.3.3 Leachate water balance model

The containment and treatment capacity of the proposal site was assessed against the expected volumes of leachate generated in two climate scenarios.

Two years, representing the 50% and 10% AEP years, were used as test cases for the leachate water balance. The aim of the balance was to assess if:

- Over an average year, the system can support peaks in leachate generation and at the end of the year has managed to treat all leachate generated
- There is sufficient containment capacity to support the leachate collected in a high rainfall year (10% AEP rainfall year).

The leachate water balance considered:

- The leachate collected from:
  - LHRRP (Lucas Heights 2) landfilled waste, groundwater collection system, and surface water if leachate impacted (as a conservative assumption)
  - Lucas Heights 1 landfilled waste

  - Harrington's quarry
- Rainfall into all leachate dams
- Minor evaporation from all leachate dams
- Treatment plant and sewer disposal capacity
- Capacity of general use (operational) leachate dams
- Capacity of emergency leachate containment dam
- Temporary fluctuations of leachate within Cell 5.2 and Cell 5.3

The proposed GO and ARRT facilities are part of separate leachate management systems that have been assessed in Chapter 13.

The leachate water balance provides an estimate of the volume of leachate which may need treatment at the Lucas Heights 1 treatment plant and disposed to sewer. A summary of the net generated leachate for all sources is contained in Table 15.5.

Table 15.5 Estimate of net leachate generation

Scenario	Estimated leachate generation for 50% AEP rainfall year			Estimated leachate generation for 10% AEP rainfall year		
	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)	Average monthly (kL/month)	Peak month (kL/month)	Total for year (kL)
Existing	19,000	50,000	228,000	28,000	56,000	334,000
Stage 1	19,000	51,000	228,000	28,000	56,000	334,000
Stage 5	17,000	36,000	202,000	23,000	41,000	279,000
Final landform	16,000	28,000	198,000	20,000	29,000	243,000

A balance of the net leachate generation and the available treatment capacity provides an indication of the required leachate storage capacity.

The average daily treatment capacity is assumed to be:

- 570 kL/day until early 2017 (existing scenario and beginning of Phase 1)
- 870 kL/day from early 2017 (Phase 1 onward)

The average daily sewer discharge capacity is assumed to be:

- 800 kL/day until early 2017 (existing scenario and beginning of Phase 1)
- 1,200 kL/day from early 2017 (Phase 1 onward)

In the cases where all above ground containment is at capacity, excess leachate can temporarily fluctuate in the level in the base of Cells 5.2 and Cell 5.3. This leachate would be preferentially extracted for treatment to reduce the levels as quickly as possible.

A summary of the containment requirements are summarised in Table 15.6 and Table 15.7, where:

- Average monthly containment is the average of the volume of leachate contained in the system in each month, over the modelled year
- Peak monthly containment is the largest volume of leachate contained in the system in any month
- Peak in-cell temporary leachate level is the largest level of temporary leachate fluctuation in Cell 5.2 and Cell 5.3 in any month.

Table 15.6 Estimate of leachate containment requirements – 50% AEP year

Scenario	Average daily leachate treatment capacity (kL/day)	Storage requirements for 50% AEP Rainfall year		
		Average monthly containment (kL)	Peak monthly containment (kL)	Peak in temporary leachate level (kL)
Existing	570	44,000	67,000	40,000
Stage 1	570	44,000	67,000	40,000
Stage 1	870	11,000	39,000	12,000
Stage 5	870	3,000	15,000	0
Final landform	870	0	1,000	0

Table 15.7 Estimate of leachate containment requirements – 10% AEP year

Scenario	Average daily leachate treatment capacity (kL/day)	Storage requirements for 90% AEP Rainfall year		
		Average monthly containment (kL)	Peak monthly containment (kL)	Peak in temporary leachate level (kL)
Existing	570	72,000	133,000	106,000
Stage 1	570	72,000	133,000	106,000
Stage 1	870	36,000	66,000	40,000
Stage 5	870	10,000	30,000	3,000
Final landform	870	0	4,000	0

In-cell leachate fluctuations

Leachate fluctuations within the base of the double lined new cells are dependent on both the dimensions of the void and the porosity of the waste and drainage system. A porosity of 40% has been assumed for leachate level fluctuation assumptions (Qian et al. 2002).

The existing levels are associated with the void within Cell 5.2, Cell 5.3A and Cell 5.3B which were specially designed for this purpose. When the remainder of Cell 5.3 is constructed additional capacity is gained. This is illustrated in Figure 15.6.

A review of the available capacity for temporary leachate fluctuations within the existing cells, which are double lined to a height of 10 m from the base of the cell, confirmed that there is sufficient capacity within the cells to manage excess leachate.

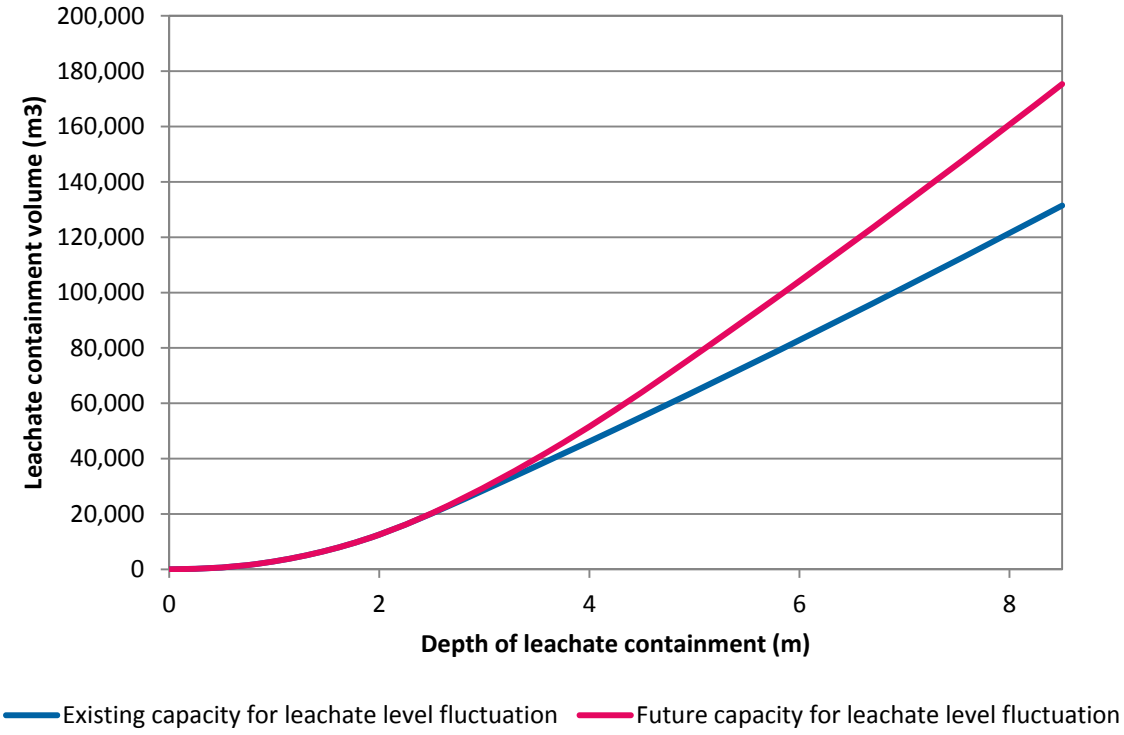


Figure 15.6 Leachate fluctuation capacity for Cell 5.2 and Cell 5.3

Summary of results

Key findings of the leachate water balance are:

- In all stages of the proposal, less leachate is required to be stored in the modelled 50% AEP rainfall year than the modelled 90% AEP rainfall year
- In all stages of the proposal, the containment and treatment capacity of the proposal site is sufficient to manage the leachate generated in the modelled 50% and 10% AEP rainfall years
- In all stages of the proposal, the containment capacity of the proposal site is sufficient to contain the leachate generated beyond the monthly disposal capacity in the modelled 50% and 10% AEP rainfall years

The results of the water balance model indicate that the proposal would:

- Provide a final landform which increases the proportion of rainfall which would run off the surface
- Provide a final capping system which would decrease the proportion of rainfall which would infiltrate into the waste
- Overall, generate less leachate than the current site arrangement

Detailed leachate water balance results are contained in Appendix J.

15.4 Mitigation and management measures

The following measures would be implemented throughout the development of the proposal:

- Ongoing monitoring of leachate volumes extracted from LHRRP landfill and other sources
- Periodic review of the leachate water balance model
- Monitoring of groundwater and surface water impacts, as required by the LHRRP EPL

A comprehensive list of prevention, mitigation and rectification measures has been identified and they are detailed in the LHRRP OEMP (Appendix S). The identified mitigation and rectification measures would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

Examples of key measures that are included in the OEMPs are provided below

- Ongoing monitoring of surface water and leachate as required by EPL
- Daily review of leachate levels
- Daily site inspections and pumping/discharge records
- Update of standard operating procedures as site develops
- Maintain relevant emergency procedures
- Take action as leachate volumes and levels increase
- Document corrective and preventative actions taken
- Undertake regular inspections and repairs of infrastructure including removal of sludge from dams and maintenance of pumps and aerators
- Compact and cover with daily and intermediate cover material to minimise infiltration of stormwater and further leachate generation
- Remove leachate from a number of gas extraction wells using air lift pumps, flowing by gravity to the leachate collection dam
- Maintain the leachate collection dam (holding capacity of 10 ML) to allow for the collection of leachate from the western ring main, central ring main, eastern ring main, Area 5-1 and Areas 5-2/5-3
- Maintain further emergency leachate containment dam (containment capacity of 9.2 ML) to contain leachate in extended wet weather events
- Actively manage leachate levels in the containment dams so that they are have sufficient capacity to cope with leachate arising from wet weather events

15.5 Conclusions

The leachate assessment and water balance model indicates that the proposal would:

- Provide a final landform which increases the proportion of rainfall which would run off the surface
- Provide a final landform which would decrease the proportion of rainfall which would infiltrate into the waste
- Overall, generate less leachate than the current site arrangement

Through the reduction in leachate generation and the improvement of the cap and final landform, the proposal would also reduce the potential to impact the environment through surface water and groundwater.

The existing leachate management system has the capacity to manage the volumes of leachate estimated to be generated in the modelled average rainfall and wet rainfall years through the use of emergency leachate containment in the double lined emergency leachate containment dam and Cell 5.3 and Cell 5.3. These containment structures were designed for this purpose.

The leachate assessment addresses the SEARs and concludes that the proposal would meet the following objectives:

- No significant impacts on the community or environment
- Prevention of groundwater pollution by leachate
- Prevention of surface water pollution by leachate, including Mill Creek
- Prevention of the degradation of local amenity

16. Contamination

This chapter is based on the findings of a preliminary contamination investigation that has been completed in accordance with SEPP 55. A copy of the report is provided in Appendix K.

16.1 Approach and methodology

In accordance with SEPP 55, a preliminary contamination investigation has been completed for the proposal site. This assessment was conducted to investigate whether various areas of the LHRRP site are suitable for the proposed uses from a contamination perspective, or can be remediated to make them suitable for these uses. There should be no increase in risk to health or the environment related to existing contamination issues (if any exist). As the LHRRP site currently contains a landfill, the adequacy of current measures to control contaminant migration from the landfill is also assessed.

The potential for contamination of surface water, groundwater and air as a result of construction and or operation of the proposal is addressed in Chapters 13, 14 and 12 respectively.

The proposal includes development of two distinct areas of the LHRRP:

- The landfill area which has been proposed for reprofiling.
- The GO and ARRT facilities on the western side of the proposal site, adjacent to each other.

In addition, the proposal site would be decommissioned in 2037 and landscaped to become public parkland. All of these proposed uses have been addressed in this assessment.

The following was undertaken:

- Review of historical aerial photography to assess historical land uses and potentially contaminating activities
- Search of EPA contaminated land and licensing records
- Review of published information on site setting in terms of sensitivity to contamination (geology, topography, hydrogeology)
- Review of WorkCover NSW records in respect of any dangerous goods stored at the proposal site
- Based on information gathered, development of conclusions and recommendations.

16.1.1 Objectives

The objective of this assessment is to provide information on the current and historical setting of the proposal site to:

- identify the potential for contamination to pose a constraint to the proposed redevelopment of these areas and
- demonstrate that land that may be contaminated is suitable for development in accordance with *State Environmental Planning Policy No. 55 - Remediation of Land 1998* (SEPP55).

16.2 Existing environment

16.2.1 Current and surrounding landuse

The area proposed for landfill reprofiling is known to contain landfilled general solid and special waste as it is an active landfill that has been operating for many years.

The GO facility and ARRT facility area comprises mostly previously disturbed bushland with a number of unsealed tracks traversing the area. No formalised infrastructure or land use occurs on the majority of the area, although the ARRT facility would extend across a small portion of the current SICTA leased land. The following land uses surround the GO facility and ARRT facility area:

- North: SICTA
- South and west: Heathcote Road with Holsworthy Military Reserve beyond
- East: the LHRRP including landfill

Of particular note from a contamination perspective is the landfilled area of the LHRRP. The landfill is a potential source of contamination for the GO facility and ARRT facilities due to its close proximity and nature of the activities occurring on this portion of the proposal site.

The area of the LHRRP leased to SICTA also poses a potential contamination risk as significant amounts of lead shot have been observed on the ground surface.

16.2.2 Environmental setting

Topography

The proposal site elevation as observed on the Spatial Information Exchange (SIX) website varies around approximately 150 mAHD. The area has a gentle grade to the east commencing from a localised high point located in the vicinity of the GO facility and ARRT facility area. The natural surrounding land slopes gradually to moderately downwards in an approximate north-easterly direction.

Soils

General

The 'Wollongong – Port Hacking Soil Landscape Series Sheet '(1:100,000) describes the soil and landscape in the vicinity of the LHRRP as follows:

- Landscape: gently undulating crests, ridges and plateau surfaces of the Mittagong Formation (alternating bands of shale and fine-grained sandstones). Local relief 10-50 m, slopes <10%. Rock outcrop is absent. Extensively to completely cleared, dry sclerophyll low open forest and low woodland.
- Soil: moderately deep (50-150 cm), hard-setting *Yellow Podzolic Soils* and *Yellow Soloths* on ridges and plateau surfaces. *Lateritic Podzolic Soils* on crests; *Yellow Earths* on shoulders of plateaux and ridges; and *Earthy Sands* in valley flats.
- Limitations: Stoniness, hard-setting surfaces, low soil fertility.

Natural soils are not expected to be encountered during landfill reprofiling due to the presence of landfilled waste. Buried waste is of unknown composition and must therefore be appropriately managed during the proposed reprofiling works from both an environmental and human health/safety perspective. However it is noted that stripping back of soil cover material does not involve exposing waste.

Acid sulfate soils

There is an extremely low probability of acid sulfate soil occurrence within the soil profile in the vicinity of the proposal site according to the Australian Soil Resource Information System website (accessed August 2014).

Hydrology

Initially, the headwaters of Mill Creek would have started in the valley adjacent to the eastern boundary of the GO/ARRT area. However, portions of this valley have been filled, subsequently altering the surface water drainage patterns. Mill Creek is considered a disturbed system however it is remains the closest surface water receptor to the LHRRP.

The creek drains in a northerly direction to the Georges River and is unlikely to impact the proposed area. Melinga Molong Gully Creek is also located close to the proposal site, approximately 1,200 metres to the south-east. This creek joins the Woronora River a further 1,000 metres south-east of GO/ARRT area. The Melinga Molong Gully Creek is unlikely to be relevant to this investigation due to separation by the local high point.

Geology

The Geological Survey of New South Wales, 1:100,000 'Wollongong-Port Hacking Series Sheet' (1985) indicates that the GO facility and ARRT facility area is underlain by Hawkesbury Sandstone (Triassic period) which is described as 'medium to coarse-grained quartz sandstone, very minor shale and laminite lenses'.

North east of the proposal site, another type of Hawkesbury sandstone was noted; described as 'claystone, siltstone, and laminite (shale lenses)'. Two dykes were also noted with a north-south orientation, located both east and west of the proposal site.

Existing groundwater bores

GHD conducted a review of existing registered groundwater borehole records using the NSW Water Information Database (accessed August 2014). The search was conducted to identify registered groundwater boreholes in close proximity to the proposal site and to record information such as bore use and standing water level.

A total of 87 groundwater boreholes were identified within a five kilometre radius of the proposal site, the vast majority of which are located within one kilometre to the north and east of the GO facility and ARRT facility area and are registered as Monitoring Bores for the current and former landfill areas.

The recorded standing water levels varied, however in general were recorded at depths of approximately 5 m to 8 m below ground level in the close vicinity of the GO facility and ARRT facility area. No salinity or groundwater yield information was provided within any of the bore records.

No registered bores are located on the GO facility and ARRT facility area, however a number of bores are located within the wider landfill area.

Groundwater Risk Map

The 1:2,000,000 'Groundwater in New South Wales, Assessment and Pollution Risk Map' indicated that the LHRRP is likely to be underlain by fractured pre-Permian rocks, mainly of igneous and metamorphic origins; with a low to medium potential for groundwater movement. The map also indicated that groundwater salinity is likely to be between 0 mg/L and 1,000 mg/L, which is suitable for stock, domestic and some irrigation purposes.

16.2.3 Site history records

Historical aerial photographs

A selection of aerial photographs were examined in order to ascertain past activities and land uses at the proposal site and surrounding land. Photograph from the years 1947, 1961, 1970, 1984, 1994, 2005 and 2014 were examined.

The historical aerial photographs showed that the GO facility and ARRT facility area appeared vegetated in the earliest available photograph before being largely cleared of vegetation between 1947 and 1961. The GO facility and ARRT facility area remained predominantly cleared until the 1982 photograph where vegetation was observed.

During this time, the only land use appeared to be an oval track towards the central-southern portion of the GO facility and ARRT facility area. A number of other dirt tracks traversed the GO facility and ARRT facility area during its history; the nature of which changed over time. Mill Pond appeared in the 2005 and 2014 photographs.

Landfill operations are apparent from the 1994 photograph onwards. Landfill operations appear to have occurred from the southern portions of the LHRRP towards the north.

The surrounding land appeared generally vegetated, with landfill operations located immediately east of the GO facility and ARRT facility area apparent from the 1994 photograph. SICTA was present north of the GO facility and ARRT facility area from the 1994 photograph. It is understood that SICTA has been present on the LHRRP prior to this. As previously identified, properties of this nature are often associated with lead contamination in the soil due to the bullets used and debris on the ground surface.

Office of Environment and Heritage

Under provisions of the Section 58, Subsection 2 of the CLM Act a public register of current NSW declarations and orders in force is maintained by the EPA. Under the POEO Act a register of current and surrendered licences is also maintained by the OEH.

A search of the register was undertaken on a suburb basis (i.e. Lucas Heights).

Contaminated Sites Register

A search of the Contaminated Land Record of Notices register in August 2014 identified two registered premises within a one kilometre radius of the LHRRP:

- Harrington's Quarry – Waste Services NSW
- IWC Landfill – Commonwealth Department of Administrative Services

Due to the distance, localised topography and inferred hydraulic gradient meaning they are likely down-gradient of the proposal site, the potential to impact the proposal site is considered to be unlikely.

POEO Register

A search of the register in August 2014 identified five premises with a POEO licence within a one kilometre radius of the GO facility and ARRT facility area. Of the premises identified, the premises located within the LHRRP to the immediate east of the GO facility and ARRT facility area (i.e. the landfill) are considered to pose a potential risk of contamination to the site due to the close proximity and the nature of the activity occurring on the premises.

The EDL landfill gas power station is located within the LHRRP boundary and located to the east of the proposed landfill reprofiling area. Particulate matter from the exhaust has potential to

pose a risk to the operation of the proposal, however this is considered unlikely due to the lean burn technology employed to ensure that emissions meet health criteria.

The remaining premises are not considered to pose a significant risk of contamination to the development area due to the distance between the properties and the nature of the licences and activities.

It is noted that the pond currently located in the north eastern corner of the proposed GO facility and ARRT facility area may be susceptible to run off from the adjacent landfill facility. However as part of the site's development this pond would be made redundant and be part of the ARRT facility. An assessment for this change is addressed in the surface water assessment (Chapter 13).

Workcover NSW

A search of the WorkCover NSW Dangerous Goods Record was undertaken for the larger LHRRP property (inclusive of the GO facility and ARRT facility area) in October 2013 by SITA. This showed that three above ground storage tanks have been registered.

Discussions between GHD and a SITA representative in August 2014 (pers. comm.) indicated that the tanks:

- Are located on the wider LHRRP area (not in the GO and ARRT areas)
- Are understood to be bunded to 110% of tank capacity
- Contain an epoxy coating for added protection against corrosion.

Further, no new tanks have been installed within the LHRRP premises between October 2013 and November 2014.

The presence of above ground fuel storage infrastructure on the broader LHRRP site is not considered to present a significant risk of potential contamination for the GO facility and ARRT facility area, given the tank protection measures, distance, local topography and the relatively limited storage capacity of the tanks.

16.3 Post closure EMP

The post closure EMP includes the relevant environmental and operational activities associated with the management of leachate, landfill gas, landfill cap and stormwater at the LHRRP site post closure.

Following final site closure in 2037, by 31 December 2039, SITA would establish a parkland area available for passive recreation as per the landscape plan developed for LHRRP. The parkland would be approximately 149 ha in area. The GO facility and the ARRT facility would be decommissioned.

The post closure EMP states that, while SSC would be responsible for maintaining the parkland, SITA would continue to have responsibility for the environmental performance of the disposed waste for a minimum 30 year period after site closure and in accordance with the closure requirements administered by the NSW EPA.

Key aspects of the post closure EMP are:

- A stormwater monitoring and maintenance program would be developed to describe details requirements such as inspection locations, inspection frequencies and corrective actions.
- Erosion and sediment control measures would be maintained until the site is stabilised

- Maintain leachate infrastructure on site to minimise the potential for surface water and groundwater pollution by leachate. This includes maintaining the integrity of the final capping profile and final surface/storm water drainage works
- The landfill gas extraction system and gas-to-electricity power station would continue to operate. Additionally, a gas monitoring and maintenance program would be developed for the post closure period to describe detailed requirements such as inspection locations, inspection frequencies and corrective actions.
- Landfill capping and revegetation should ensure that the final surface provides a barrier to the migration of water into the waste, controls emissions to water and atmosphere, promotes sound land management and conservation, and prevents hazards and protects amenity.

The extent and frequency of environmental monitoring post closure of the proposal site would be in accordance with the site closure plan (still to be developed), which would generally include the following:

- Ground and surface waters

  Surface water sample locations and testing procedures would be similar to those described for the operational phase of LHRRP. Post closure groundwater monitoring and surface water monitoring is still to be determined.

- Gas and leachate

  Monitoring and testing procedures would be similar to those used during site operations. Monitoring frequency would increase if significant increases in gas or leachate generation are observed or as required due to odour complaints received, or decrease as the longer-term gas and leachate production levels decline.

- Rehabilitation and pollution controls

  Regular inspections would continue until rehabilitation is satisfactorily completed. Pollution and drainage controls would continue to be inspected until areas are regarded as stable.

The post closure EMP also outlines goals and a management strategy for emergency incidents such as fires, spill of liquids, leachate escape, explosion of liquid fuels, vehicular accidents, personal injury, and emergency at ANSTO.

The key aspects, proposed monitoring programs and the management strategies for emergency incidents are important for assessing the appropriateness of the intended future uses of the LHRRP. Assuming the capping layer remains in place and is maintained and that the Closure Plan and post-closure monitoring programs are appropriately implemented, it is unlikely that future users of the park would come into contact with the contamination that underlies the landfilled portions of the LHRRP site.

16.4 Assessment of potential impacts

An overall assessment of the contamination status of the LHRRP is as follows::

- The existing area containing the landfill is considered to be contaminated, as it is filled with waste. However this contamination is managed by: lining of the newer landfill cells, suitable existing geology (all cells), landfill gas extraction, active management of leachate and monitoring of groundwater within the LHRRP, and intermediate cover placed over the completed landfill cells. These measures prevent site occupants from coming into contact with contaminated material, and also prevent the surrounding environment from being adversely affected by landfilled waste material.

- The proposed GO facility and ARRT facility area is currently undeveloped and comprises bushland containing a number of unsealed tracks traversing the area. There is no indication that the existing landfilling activities have impacted on this area.
- A review of aerial photographs dating back to 1947 indicates the GO/ARRT area was formerly cleared of vegetation and contained an oval track of unknown use. A pond of unknown origin and use was also observed within the two most recent historical aerial photographs. The landfill operations were apparent from the 1994 photograph onwards and appear to have occurred from the southern portions of the LHRRP towards the north.
- The SICTA land, located north-west of the proposal site, is potentially subject to lead contamination in the soil.
- Potentially contaminating land use activities were not noted on the GO facility and ARRT facility area during previous inspections undertaken by GHD.
- The potential for contamination of groundwater associated with the construction and operation of the proposal has been considered in detail in Chapter 14. Leachate from the proposed landfill reprofiling and continued operation, adjacent to the GO facility and ARRT facility area, was also considered as part of the groundwater assessment and also considered in detail in Chapter 15. A surface water assessment is provided in Chapter 13.

16.5 Mitigation and management measures

The following mitigation and management measures are proposed:

- Post development approval and prior to the GO facility and ARRT facility development, targeted soil sampling and subsequent lead analysis would be conducted on the ARRT facility area which is adjacent to, and proposed to extend onto SICTA. A detailed plan for testing would be required prior to construction of the ARRT facility. This would address any concerns about the area's suitability from human health and environmental perspectives, as well as provide waste classification for waste material generated during excavation works in this area. Should excess levels of lead be identified, a plan (including specific remediation measures if required) would be developed in accordance with regulatory requirements and approved by the appropriate agencies prior to the construction of the ARRT facility.
- As recommended in the groundwater assessment, a series of monitoring wells would be installed around the GO facility and ARRT facility prior to construction. These would be used to monitor any potential landfill gas and groundwater, as there is currently minimal data for these two aspects in this region. Monitoring of these wells during construction and operation of the GO facility and ARRT facility would provide early indication of any additional impacts from construction or operation on the proposal site.
- A general site inspection would be undertaken in conjunction with the soil sampling and well installation to identify any visual or olfactory signs of potential contamination on the site, primarily in the form of stockpiled materials or previously unknown land use activities.
- During the inspection, the nature and condition of the pond would be documented. Should the pond require draining, water samples would be collected to allow appropriate management to be arranged. Should rubbish or contaminant indicators be identified on site, soil sampling would be undertaken to characterise the potential risk prior to site development.

- During construction, if unexpected material (including waste materials or evidence of filling) is encountered, advice would be sought from an appropriately qualified Environmental Consultant in regards to the management of this material.
- To minimise water quality impacts associated with GO facility and ARRT facility construction, appropriate site management practices and emergency response procedures would be developed prior to construction and would be detailed in the CEMP.
- If required by the planning authorities, a Statutory Site Audit report should be prepared to approve any remediation works required to make the land suitable for construction of the ARRT or GO facilities. Until detailed design work has been completed, the extent of remediation works required would not be known, so preparation of this report should be delayed until this work has been completed.

16.6 Conclusions

The overall conclusion of the contamination assessment is that the site is suitable for its intended future uses, which is for continued landfilling/reprofiling of the existing surfaces, and construction and operation of the ARRT and GO facilities, followed by decommissioning of these facilities and landscaping to create a community parkland.

Assuming the capping layer remains in place and is maintained and that the Closure Plan and post-closure monitoring programs are appropriately implemented, it is unlikely that future users of the park would come into contact with the contamination that underlies the site.

17. Hazards and risk

The information presented in this chapter is based on the findings of the hazards and risk study undertaken by GHD to address the requirements of SEPP 33. The hazards and risk study is included in Appendix L of this EIS.

17.1 Approach and methodology

The hazard analysis was prepared consistent with the requirements of SEPP 33 and the publications Hazardous Industry Planning Advisory Paper No. 6 'Guidelines for Hazard Analysis' (HIPAP 6) and HIPAP No. 4 'Risk Criteria for land Use Safety Planning'.

The analysis was prepared to show that any residual risk levels are acceptable in relation to the surrounding land use, and that potential risks would be appropriately managed. This has been done by:

- Identifying intrinsic hazards and abnormal operating conditions that could give rise to hazards
- Identifying the range of safeguards
- Assessing the risks by determining the probability (likelihood) and consequence (effects) of hazardous events for people, the surrounding land uses and environment
- Identifying approaches to reduce the risks by elimination, minimisation and/or incorporation of additional protective measures.

Fire risks are considered in Chapter 18. Hazards and risks relating to surface water, groundwater and soil contamination are addressed in Chapters 13 to 16.

17.1.1 Objectives

In addition to addressing the SEARs, the hazard assessment provides an assessment of how well the proposal meets SITA's objectives.

The following objectives have been identified:

- No significant impacts on the community or environment
- No hazards with potential for significant offsite impact that would not be suitably controlled
- Risks are controlled to an acceptable level

17.2 Assessment of potential impacts

17.2.1 Preliminary risk screening

In accordance with the requirements of SEPP 33, a preliminary risk screening of the proposal was undertaken. The need for a preliminary hazard analysis (PHA) is determined by the results of the preliminary risk screening. The methodology for risk screening is outlined in the Department of Planning (1994) 'Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines'. The guidelines provide a risk-screening procedure based on the quantity of dangerous goods to be used by a proposal and the distance these materials are stored from a site's boundary.

According to SEPP 33, if any of the screening thresholds are exceeded then the proposed development should be considered potentially hazardous and a PHA is required. Also, if the

quantities are close to the screening threshold values and the development site is near a sensitive receiver then the proposed development is also considered to be potentially hazardous and a PHA is required.

The results of the preliminary risk screening indicated that a PHA is not required, as all materials, including transportation frequencies, do not exceed the respective thresholds, and the proposal is not considered potentially hazardous. However, to demonstrate that potential hazards have been considered and control measures put in place, a hazard identification process was completed (refer Section 17.2.2).

17.2.2 Hazard identification

Hazard identification represents a Level 1 or qualitative risk assessment and involves documenting all possible events that could lead to a hazardous incident. It is a systematic process listing potential causes and consequences (in qualitative terms). Reference is also made to proposed operational and organisational safeguards that would prevent such hazardous events from occurring, or should they occur, that would mitigate the impact on the plant, its equipment, people and the surrounding environment. This process enables the establishment, at least in principle, of the adequacy and relevancy of proposed safeguards.

The aim of the hazard identification study process is to highlight any residual risks associated with the interaction of the proposal with the surrounding environment. A range of possible hazard scenarios was developed but a consequence and likelihood assessment was not completed as none of the hazardous scenarios were considered credible for offsite impact. The results of this hazard identification process are provided in Appendix L.

The hazard identification process did not identify any significant hazards with the potential for offsite impact that would not be suitably controlled.

17.2.3 SICTA shooting range safety management

The ARRT facility would be located within the existing SICTA boundary and within proximity of operations at the shooting range.

Preliminary discussions with a SICTA representative has indicated that a safety exclusion zone applies within 150 m of the firing point. The pad for the ARRT facility building is approximately 120 m from the southernmost firing point and the building approximately 130 m away. Vertically, the pad for the ARRT facility building is approximately 3 m higher than the firing point and so the ARRT facility building would also penetrate the exclusion zone in the vertical plane.

17.3 Mitigation and management measures

17.3.1 Dangerous goods and hazard management

Health and safety is a core value of SITA's. SITA is committed to building a strong health and safety culture with a vision of 'no harm'.

The following mitigation measures are proposed regarding dangerous goods and hazard management:

- Dangerous Goods would be transported to site and stored in accordance with the Australian Dangerous Goods Code.
- Appropriate safe work procedures would also be implemented for the safe handling of the Dangerous Goods, including spill prevention and clean up requirements.

- Any smaller quantities of Dangerous Goods (aerosols, paints, cleaners etc.) that may be used on site are to be stored and used in accordance with the Australian Dangerous Goods Code, including appropriate labelling, separation where necessary and disposal.
- All safeguards identified in the hazard identification process would be implemented through the development and implementation of a comprehensive safety management system for the operation of the proposal or via an update of the existing safety management procedures for the existing site, taking into account any new requirements specific to the proposal. This would include:
  - Operation of the landfill, GO facility and ARRT facility in accordance with AS/NZS 4801 Occupational Health and Safety Management System and ISO 14001 Environmental Management System
  - Induction and training about potential hazards for all employees
  - Provision of first aid treatment stations, equipped and maintained, at the landfill, GO facility and ARRT facility
  - Personnel trained in first aid on site during all operating times in accordance with the appropriate statutory regulations
  - Making available/issuing all necessary protective clothing and safety equipment and ensuring it is maintained in good condition and used effectively

17.3.2 SICTA shooting range mitigation measures

Should there be a commitment to implement the ARRT facility, a detailed safety study would be undertaken to confirm the safety exclusion zone from SICTA operations and identify the hazard of constructing and operating the ARRT facility in the proposed location. A number of mitigation measures may be necessary including use of increased thickness of building walls (e.g. metal or concrete). Another option maybe to relocate the southernmost firing point northward. These and other mitigation options would be detailed in the future safety study. The costs of implementing the mitigation measures would be borne by SITA should the ARRT facility development proceed.

17.3.3 Emergency preparedness

An emergency response plan (ERP) has been developed for the operation of the LHRRP and is attached to the OEMP for the LHRRP (Appendix S). The plan describes the general policy and approach that should be followed when dealing with an emergency or incident, such as fire, spill of liquids, leachate escape, explosion of liquid fuels, vehicular accidents, personal injury, and emergency at ANSTO or civil disturbances (e.g. bomb threat).

All procedures provided in the ERP have been developed in accordance with Australian Standard AS 3745-2010 ‘Planning for emergencies in facilities’. The objective of the ERP is to equip SITA workers with the knowledge and skills to control and coordinate an emergency until the arrival of attending emergency services.

The Emergency Control Organisation (ECO), which includes a Chief Warden and other Wardens as relevant to the site, must initiate and control an appropriate response to emergency situations. Their primary role is to ensure that life safety takes precedence over asset protection. Training for ECO members on all procedures within the ERP would be conducted in accordance with the requirements of the Emergency Management Procedure. Training would be conducted upon appointment to the relevant position. Re-training would occur when procedures within the ERP are revised.

The ERP contains Action Plans which are designed to assist ECO members to respond to any incident with potential to cause injury to persons or damage to property. These procedures take

into consideration such factors as the use and characteristics of the facilities on-site as well as other structures and workplaces, appropriateness and adequacy of physical facilities, organisational structures, human resources and communication systems for all envisaged emergencies.

The ERP would be subject to continuous review and update.

17.4 Conclusions

The results of the preliminary risk screening indicated that a PHA is not required, as all materials, including transportation frequencies, do not exceed the respective thresholds, and the proposal is not considered potentially hazardous.

The hazard identification study did not identify any hazards with the potential for significant offsite impact that would not be suitably controlled.

The hazards and risk assessment addresses the SEARs and concludes that the proposal would meet the following objectives:

- No significant impacts on the community or environment
- No hazards with potential for significant offsite impact that would not be suitably controlled
- Risks are controlled to an acceptable level

18. Fire prevention and management

This chapter considers the fire risks associated with the proposal including facility and landfill fires as well as bushfires.

18.1 Approach and methodology

18.1.1 Bushfire

Bushfire risks have been considered in the form of a review of current bushfire risk factors. This included:

- Review of bushfire hazards, environmental features and slope
- Assessment of bushfire attack level
- Review of other factors driving bushfire risk at the site
- Development of mitigation measures.

18.1.2 Facility or landfill fire

Facility and landfill fire risks have been assessed by consideration of:

- Review of facility and landfill fire hazards
- Development of mitigation measures.

18.2 Existing environment

18.2.1 Bushfire hazards, environmental features, slope and fire weather

Hazard assessment

The proposal site is bushfire prone land as bushfire prone vegetation (Vegetation Category 1 and Vegetation Buffer) adjoins western and northern boundaries of the proposal site. This vegetation hazard constitutes a potential threat to the proposal.

Environmental features

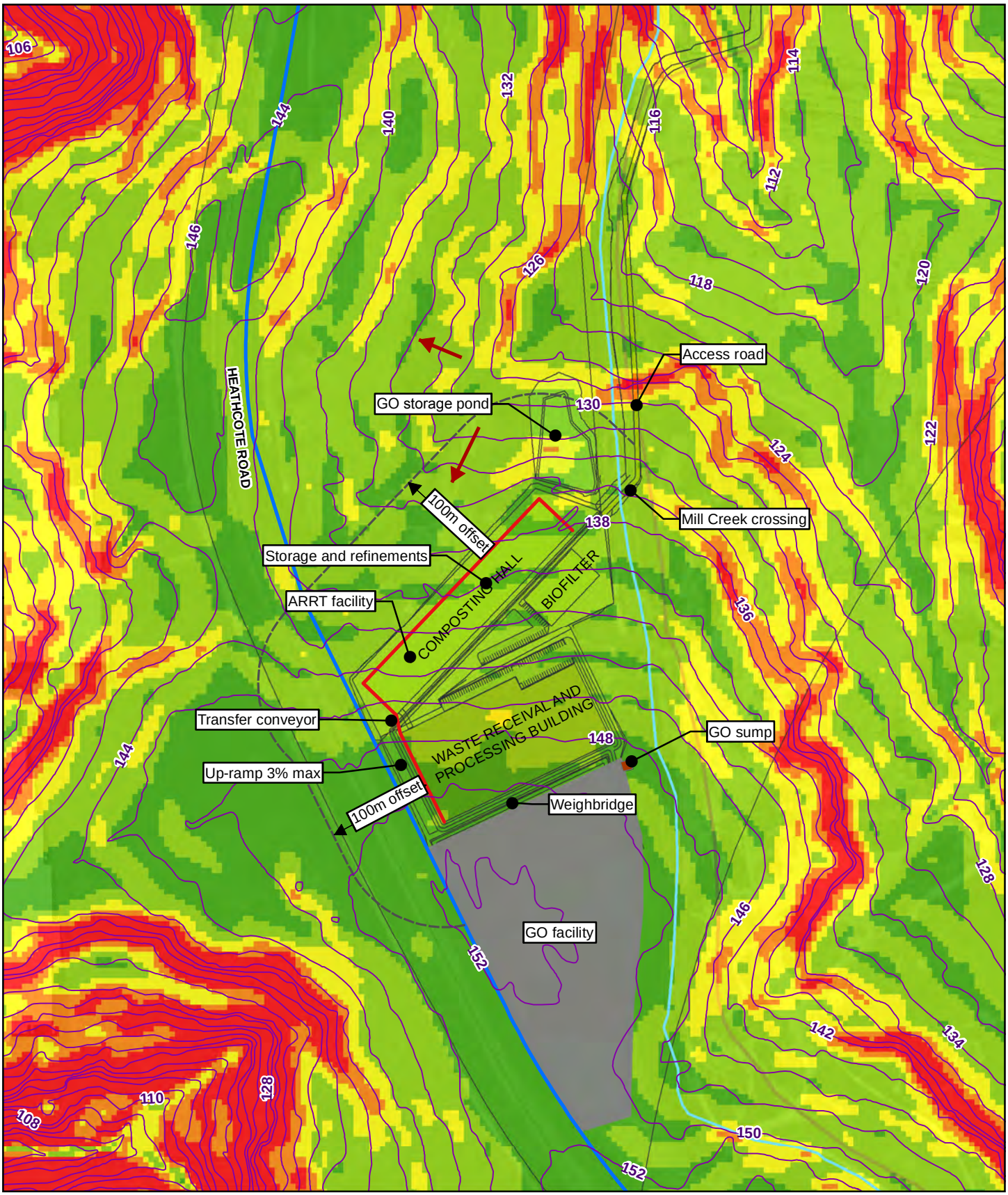
The vegetation communities across the area, appear to consist of partially cleared or degraded Sydney Sandstone Ridgetop Woodland and Sedgeland.

Vegetation communities to the west (north west through to south west) of the study area (the direction under which fires burning under adverse conditions would occur from) appear to consist of underdeveloped Sydney Sandstone Ridgetop Woodland and Sedgeland within Liverpool Military Area.

Slope

Slope is a significant influence on fire behaviour, with steeper slopes contributing to a greater rate of spread and intensity of a bushfire. The effective slope is also a key input into determining the bushfire attack level (the level of radiant heat) which an asset may be exposed to. The site assets of most risk from bushfire would be the ARRT facility, which comprises a number of large buildings with staff and equipment contained within.

From GIS mapping, the average slope of the areas to the north and west of the ARRT facility appears to be less than 5 degrees across the majority of the area, increasing to 5-10 degrees in small sections. This can be seen on Figure 18.1.



Legend

- Creek
- Landfill area
- Elevation contour (2 m increment)
- Lucas Heights Resource Recovery Park boundary
- 100m offset from buildings
- Buildings edge

Slope range

- 0.0 - 2.5
- 2.5 - 5
- 5.0 - 7.5
- 7.50 - 10
- 10 +

Upslope direction

Paper Size A4

0 37.5 75 150

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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SITA Australia
Lucas Heights Resource Recovery Park

Job Number	21-23482
Revision	A
Date	24 Aug 2015

Slope Map

Figure 18.1

G:\21\23482\GIS\Maps\MXD\21-23482-Z060_Slope.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Aerial Imagery: SITA/GHD. 2014. GO&ARRT: GHD/SITA, 2014. Roads/Suburb: NSW LPMA, 2012. Created by:afoddy

Australian standard AS3959-2009 specifies that bushfire assessments should be based upon the effective slope under the vegetation within 100 m of an asset. The effective slope across this part of the proposal site and adjoining areas within 100 m that is most likely to significantly influence fire behaviour is therefore estimated to be 0-5 degrees.

Fire weather

The proposal site is within the 'Greater Sydney Region' and has a corresponding fire danger index (FDI) of 100 (NSWRFS 2006).

18.2.2 Bushfire attack level

The bushfire attack level of the proposal site is determined by combining the attributes of vegetation coverage, slope and FDI. It is estimated that the western boundary of the site adjoining Heathcote Road will be subject to radiant heat at a range of bushfire attack levels up to 100 m from the hazard. At a minimum, within 57 m of unmanaged vegetation, buildings and persons may be exposed to radiant heat fluxes of at least 12 kW/m^2 (i.e. enough to ignite exposed timbers and break standard glass) or greater. By comparison, a radiant heat flux of 7 kW/m^2 is likely to be fatal to exposed persons, and at 4.7 kW/m^2 a fire fighter wearing protective clothing will feel pain after one minute of exposure (NSWRFS 2006).

Therefore the separation distance between the vegetation hazard and an asset in which a person may work or reside (or which as important financial or capability, i.e. production value), is an important factor for consideration in the proposed development areas where people work or congregate are particularly susceptible.

18.2.3 Other factors driving bushfire risk at the site

Vegetation cover in surrounding landscape

The subject land and surrounding landscape contains large areas of near-contiguous forest or woodland vegetation cover. The vegetation has potential for large, high intensity bushfires to develop, and such fires have occurred historically. Over the life of the proposal there is a high potential for the subject land to be impacted by a high intensity fire.

Proximity of woody / forested vegetation on adjoining property

Tracts of fire prone vegetation on adjacent lands have little (if any) separation with fire prone vegetation on-site (or located with at-risk assets). Vegetation adjoining and retained on the proposal site would act as a 'wick' in the event of a bushfire allowing a fire to penetrate into an area.

Spotting and ember attack potential of vegetation

Vegetation adjoining and within the proposal site (in the vicinity of the proposed GO and ARRT facilities) is extensive, contains trees known to generate prolific ember attack (such as eucalypts with fibrous bark) and capable of long distance spotting (>three km). In the event of a high intensity bushfire burning through the adjoining Holsworthy Military Area under adverse conditions (strong westerly wind influences) the site is likely to be subject to significant ember attack, enabling fire spread across Heathcote Road.

Land management practices on adjoining land and topography

Non-grassland vegetation cover on surrounding lands (Commonwealth and State Conservation lands) is mostly (>50 percent) not fuel-reduced by land management activity due to the difficulties in implementing prescribed burning in this landscape. The surrounding topography is also undulating with a series of north-south ridgelines restricting access in parts. These factors

mean that a fire is able to grow to significant size with limited options for control and burn into the study area under adverse conditions.

Potential ignition sources within and surrounding the site

Potential ignitions within the site area (such as accidental ignitions or combustion of mulch heaps) are unlikely to start large bushfires due to the presence of hardstand areas and the availability of plant. However in the broader landscape ignitions caused by lightning or arson (particularly the areas east of Macquarie Fields) have the potential to start large scale bushfires that would burn into the site.

18.3 Assessment of potential impacts

18.3.1 Bushfire

Based on the bushfire risk factors identified in section 18.2, a large scale high intensity bushfire is likely to impact the proposal site over the life of the proposal. The consequences of such a fire event may be significant and have life, capability, and financial impacts. Such risks highlight the need to develop effective strategies and procedures to mitigate bushfire risk in the construction and operation of the proposal, noting that the bushfire risk will never be able to be fully mitigated within the study area. Importantly site specific emergency procedures should be prepared and implemented for the study area. A range of mitigation measures have been developed, as discussed in Section 18.4.

18.3.2 Facility and landfill fire

The main potential types of fires within the proposal facilities or landfill include:

- Fire in the landfill – waste or gas
- Fire in GO facility or ARRT facility – compost
- Other facility fires:
  - Fire in offices/buildings
  - Fire around fuel storage tanks
  - Fire involving site plant and equipment

Fire spreading from off site (bushfire) is discussed in Section 18.3.1.

Fire in landfill – waste or gas

The landfill contains a large number of combustible materials. There is potential for fire to start at the landfill surface or beneath the surface. Landfill fires are not common occurrences however they are possible. Surface landfill fires typically start when a heat source has contacted the surface, for example deposit of hot waste, lightning or arson. For deep fires, the initiation mechanisms are often quite different and may include spontaneous combustion, legacy heat or piloted ignition.

The risk of a landfill fire would be reduced significantly by application of appropriate site operating procedures, appropriate and ongoing management of the landfill gas collection system and security to reduce the likelihood of deliberate arson.

In the unlikely event of a landfill fire, the associated risks would be managed by the provision of onsite fire suppression features and resources and establishment of emergency response procedures.

Fire in the GO facility or ARRT facility - compost

With the presence of flammable materials such as garden organics and other waste and stockpiles of finished compost there is the potential for fire at the ARRT facility and or the GO facility given the correct conditions and the presence of an ignition source.

If the conditions in the stockpiled or windrowed material are not managed appropriately, there is the potential for spontaneous combustion of the composting material. However, with appropriate management of compost piles in accordance with operating procedures, it is not considered likely that the conditions necessary for spontaneous combustion would be present. However, it is necessary that management strategies are applied to prevent spontaneous combustion (refer Section 18.4).

Other facility fires

Other fires are also possible at the GO facility or ARRT facility or other parts of the LHRRP including offices/buildings, around the fuel storage tanks or involving site plant and equipment. As outlined in the proposed mitigation and management measures (Section 18.4) buildings would be designed and fitted to meet the fire safety requirements of the Building Code of Australia. Appropriate fire prevention, detection and suppression (fire fighting) measures would be provided. The fuel storage areas would be managed in accordance with site operational procedures. Site operational procedures would also include preventative measures and actions for plant and equipment. These measures would reduce the likelihood of facility fires and potential for damage to property and personnel should a facility fire occur.

18.4 Mitigation and management measures

18.4.1 Bushfire management

The following measures are proposed to mitigate bushfire risks:

- Based on the effective slope in the GO and ARRT facility area and adjoining land north and west (0-5%), a 10 m specific asset protection zone (APZ) has been identified as being appropriate to be provided in the area adjoining Heathcote Road adjacent to buildings and on the northern side of the composting hall. This has been included in the proposal design. An APZ is the area between a building and vegetation hazard, in which active ongoing vegetation management is required. This includes minimising landscaping and not placing flammable fuels (such as woodchip or mulch) in areas identified as APZs. An APZ can incorporate hardstand areas such as carparks and roads.
- Identification and incorporation of appropriate construction standards for buildings and refuge areas during the detailed design phase. This may include measures such as screening of air intakes, windows and air-conditioning vents on buildings located within 100 m of and facing Heathcote Road.
- Details on bushfire management procedures would be outlined in the Operations Manual for the site. This would include:
  - Requirements for emergency access and egress including nomination of an alternative access route. An alternative access and egress route may be established to the north-east through the existing cleared and developed areas.
  - Formal preparedness procedures for staff and contractors to maintain awareness of and respond to escalating forecast fire danger.
  - Formal pre-rehearsed procedures for staff and contractors to respond to respond to a formal bushfire warning being issued by emergency services, including identification of escape routes and refuge areas.

18.4.2 Facility and landfill fire prevention and management

The following measures are proposed to mitigate against fire risks:

- SITA would provide fire prevention, detection, protection and fighting measures that are appropriate for the specific fire hazard and adequate to meet the extent of potential fires. Specifically, for any buildings, the fire safety requirements of the Building Code of Australia would be applicable. This includes the provision of smoke detectors, fire extinguishers, fire blankets, fire hose reels and sprinklers.
- All fire protection systems would be inspected and maintained in accordance with AS1851-2012 Routine Service of Fire Protection Systems and Equipment.
- Waste stockpiles (including any garden organics or paper based waste material) would be kept in a tidy manner prior to processing and all efforts would be made to limit exposure to ignition sources.
- All hot works would be undertaken in accordance with SITA's hot work procedure and permit system as per existing operations procedures in order to minimise the potential for flammable materials to be ignited.
- Regular maintenance of all mechanical components associated with the raw material delivery, shredding and mixing processes would also be undertaken to prevent overheating.
- Fires would be managed in accordance with SITA's emergency response procedures. If the fire cannot be extinguished immediately, local emergency services would be contacted to provide assistance.

18.5 Conclusions

With the implementation of the proposed fire prevention and management measures for both the proposal facilities and landfill, it is considered that the fire risks associated with the proposal would be mitigated to an acceptable level.

19. Biodiversity

The information presented in this chapter is based on the findings of the biodiversity assessment undertaken by GHD. The biodiversity assessment report is included in Appendix M of this EIS.

19.1 Approach and methodology

A biodiversity assessment was undertaken to identify the potential impacts of the proposal on biodiversity values using the Framework for Biodiversity Assessment (FBA) (OEH 2014). This included:

- Desktop assessment to describe the existing environment and landscape features of the study area and to identify the suite of threatened biota potentially affected by the proposal.
- Field survey to describe the biodiversity values of the proposal footprint and surrounding study area and determine the likelihood of threatened biota and their habitats occurring in the proposal footprint or being affected by the proposal.
- FBA calculations using the credit calculator v.4 to quantify the biodiversity impacts of the proposal and to determine the biodiversity credits that would be required to offset these impacts.

19.1.1 Objectives

In addition to addressing the SEARs, the biodiversity assessment provides an assessment of how well the proposal meets SITA's objectives.

The following objectives have been identified:

- No significant impacts on the natural environment and threatened biota
- Avoid or further reduce impacts on biodiversity values as far as is practicable
- Minimise the occurrence of pests, vermin and noxious weeds

19.1.2 Definitions

For the purposes of this assessment, the following definitions are employed:

- Proposal footprint – this is the area to be directly affected by the proposal. In this case it encompasses the area proposed for the ARRT and GO facilities, the access road, realignment of Mill Creek and the reprofiling of the landfill.
- Study area – the proposal footprint and adjacent areas that may be indirectly impacted by the proposal. This includes vegetation within 100 metres of the proposal boundary.
- Locality – 10 kilometre radius of the proposal footprint.
- IBRA subregion – the proposal is located within the Sydney Cataract subregion of the Sydney Basin bioregion, according to the Interim Biogeographical Regionalisation for Australia (IBRA) version 7 (Thackway and Cresswell 1995; DotE 2015).

19.1.3 Desktop assessment

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and *Fisheries Management Act 1994* (FM Act), and MNES listed under the EPBC Act, that could be expected

to occur in the locality, based on previous records, known distribution ranges, and habitats present. Biodiversity resources pertaining to the proposal footprint and locality (i.e. within a 10 km radius of the site) that were reviewed prior to conducting field investigations included:

- The Commonwealth Department of the Environment (DotE) Protected Matters Search Tool (PMST), for MNES (threatened and migratory biota) known or predicted to occur in the locality (DotE 2014a).
- DotE online species profiles and threats database (DotE 2014b).
- OEH Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the TSC Act that have been recorded within the locality of the proposal (OEH 2014a).
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH 2014b). This resource was used to identify the suite of threatened ecological communities (TECs) that could potentially be affected by the proposal and to inform habitat assessments.
- The NSW vegetation types database (OEH 2014c) to identify plant community types (PCTs) known or likely to occur in the study area as required by the FBA.
- Regional-scale vegetation mapping of the study area (Tozer *et. al*. 2010).
- Mapping and descriptions of the NSW Mitchell landscapes (DECC 2008a, 2008b).
- DPI online protected species viewer for records of threatened aquatic species in the locality (DPI 2014a).
- The NSW Department of Primary Industries (DPI) 'Threatened Fish and Marine Vegetation – Find a Species by Geographic Region' online search tool for Hawkesbury/Nepean (CMA) (DP, 2014b).
- The list of species credit-type species identified by the FBA Credit Calculator based on the initial credit calculations.
- Aerial photographs and satellite imagery of the study area.

19.1.4 Field Surveys

A number of surveys have been conducted by GHD within the study area over recent years. These have included detailed surveys on land to the east of the landfill (GHD 2011), an ecological constraints assessment of the proposal footprint in November 2012, and detailed surveys for this proposal in December 2014 and January and March 2015.

- Staged surveys of the development site were conducted with reference to the FBA and appropriate targeted survey guidelines were carried out in December 2014 and January and March 2015.
- Survey effort that has directly contributed to this biodiversity assessment is summarised in Table 19.1.

Table 19.1 Survey effort

Stage	Date	Survey Techniques
Previous surveys to the east of the landfill (eastern side of the study area) (GHD 2011)	2-3 June and 15-19 November 2010	Vegetation mapping, quadrat surveys, targeted threatened flora searches, Koala spot assessments, diurnal bird surveys, mammal trapping (Elliot, cage and harp traps), spotlighting, call playback, Anabat recording.

Stage	Date	Survey Techniques
Constraints assessment within the area proposed for the ARRT and GO facilities (GHD 2012)	11 November 2012	Vegetation mapping, targeted threatened flora searches
Targeted threatened fauna surveys, opportunistic fauna surveys within the proposal footprint.	8, 9, 11, 15 December 2014	Three nights of Anabat recording; four nights of spotlighting and call playback; opportunistic fauna observations; fauna habitat assessment.
BioBanking plot/transect surveys, vegetation mapping, identification of flora species, fauna habitat assessment, opportunistic fauna surveys, aquatic habitat assessment within the proposal footprint.	22 January 2015	Vegetation survey and seven plot/transects. General fauna habitat assessment, diurnal bird surveys, Koala spot assessments, hollow-bearing tree searches. Aquatic habitat assessment and water quality.
Targeted flora searches, opportunistic fauna surveys within the proposal footprint, SICTA land and along Heathcote Road.	2 March 2015	One day targeted flora searches, opportunistic fauna surveys.

Flora surveys

Flora surveys conducted within the study area and surrounds included:

- Site stratification
- Plot/transect surveys
- Targeted threatened flora surveys
- Identification of groundwater ecosystems

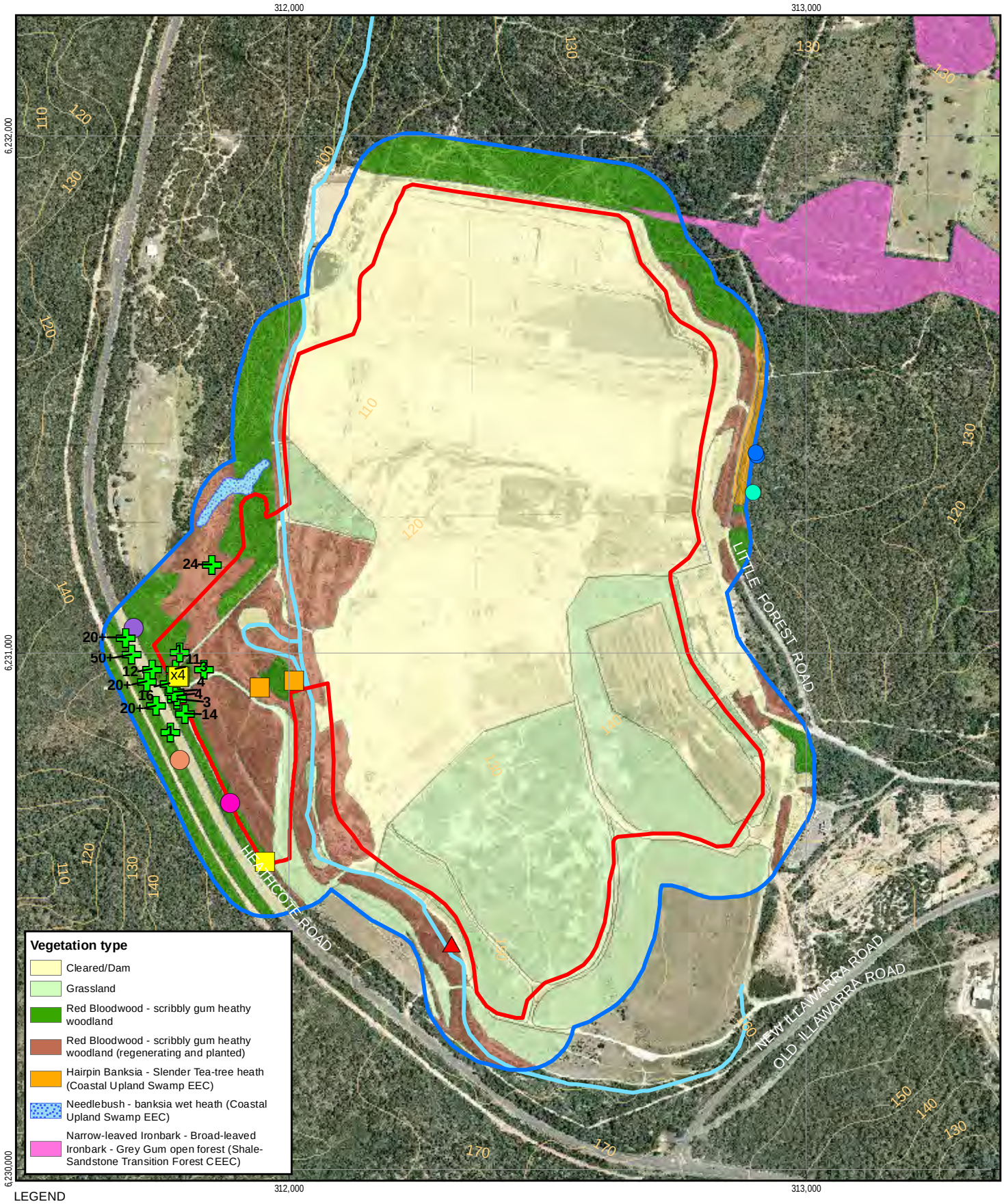
Site stratification

Pre-existing vegetation mapping (e.g. Tozer 2010, NPWS 2002) and vegetation mapping from the constraints assessment (GHD 2012) were ground-truthed in the field via systematic walked transects across the entire proposal footprint and by walking the boundary of vegetation units. Plot/transect and quadrat data was compared with Tozer (2010) diagnostic plant species lists to help confirm the presence of native vegetation and the identity of PCTs (OEH 2014c). Two native PCTs and two vegetation zones were identified in the proposal footprint as shown on Figure 19.1.

Plot/transect surveys

Plot and transect surveys were conducted on site in accordance with the FBA to confirm vegetation types, assess site condition and where required to calculate biodiversity credits. The site value was determined by assessing ten site condition attributes against benchmark values. Cover abundance data was also collected for each species within the 20 m x 20 m portion of each plot/transect. Plots were used to sample potential vegetation zones (i.e. PCTs and broad condition classes) based on the initial site stratification. Six plots were sampled within the

proposal footprint and one outside the proposal footprint as shown on Figure 19.2. Plot/transects are shown on Figure 19.2 and summarised in Table 19.1.



LEGEND

Study area
Project footprint
Mill Creek
10m Contour

Threatened species

?Greater Broad-nosed Bat
Acacia bynoeana
Eucalyptus camfieldii x *E. capitellata* hybrid
Eucalyptus (?) sp. aff. *camfieldii*
Allocasuarina diminuta subsp. *mimica*
Melaleuca biconvexa
Melaleuca deanei

Habitat feature

Hollow-bearing tree
Rock outcrop

Paper Size A4

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Job Number 21-23482
Revision A
Date 01 May 2015

Vegetation, threatened biota and habitat resources

Figure 19.1

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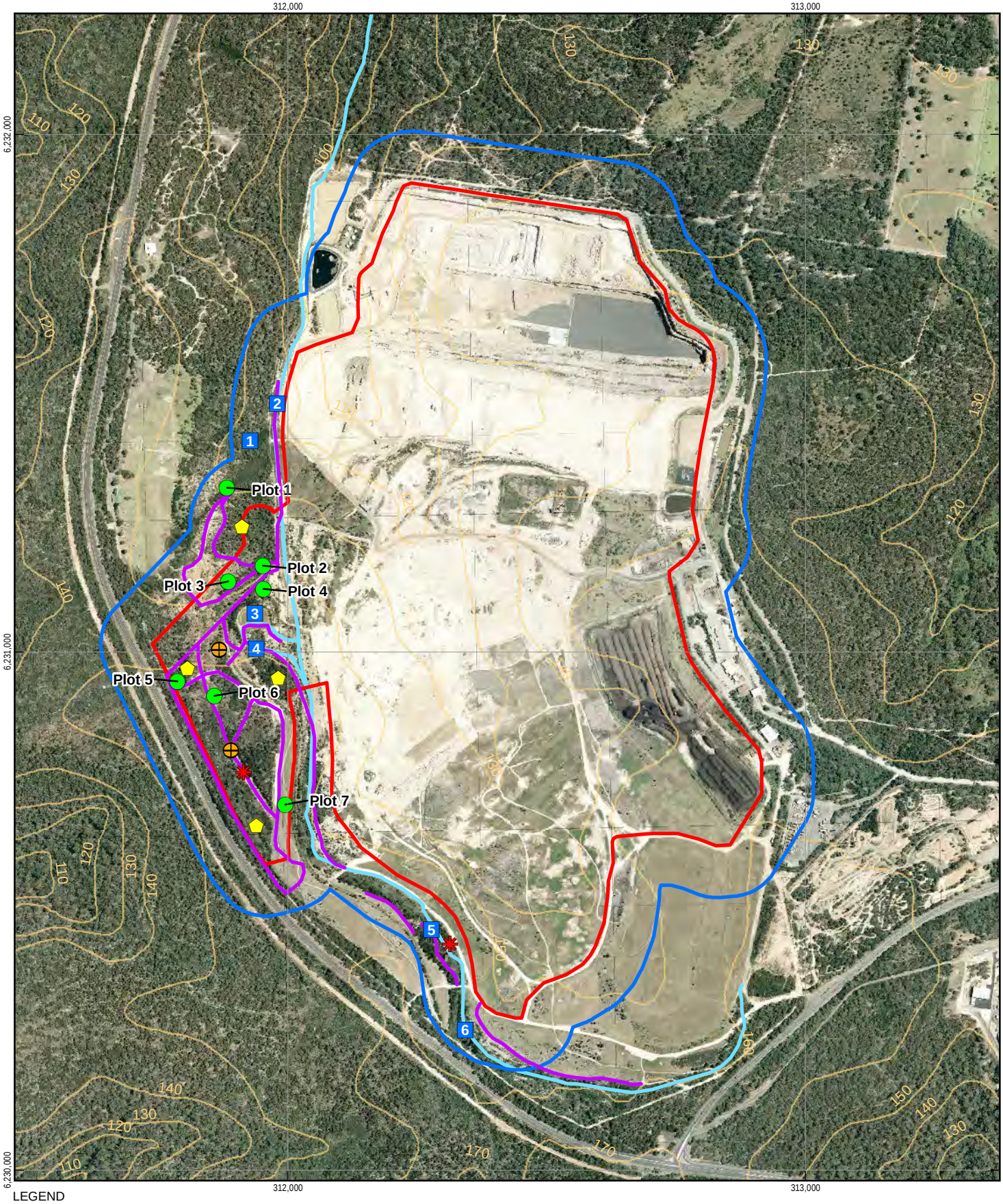
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Google Earth: Imagery- May 2014, NSW Department of Lands: contours - Jan 2012. Created by:apmiller



LEGEND

- Study area
- Project footprint
- Mill Creek
- 10m Contour

Survey effort

- Koala spot assessment
- Camera

- Anabat
- Water quality
- Plot/transect
- Spotlighting, call playback

Paper Size A4

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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SITA Australia
Lucas Heights Resource Recovery Park

Job Number 21-23482
Revision A
Date 09 Apr 2015

Survey effort

Figure 19.2

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Google Earth: Imagery- May 2014, NSW Department of Lands: contours - Jan 2012. Created by:MWeerakoon

Targeted threatened flora surveys

The suite of threatened plants potentially present was identified based on the desktop assessment results (see Appendix M) and the species credit-type species identified by preliminary FBA Credit Calculations. Areas of potential threatened plant habitat (i.e. near-intact native vegetation and areas with natural topsoil) were systematically traversed on foot and inspected for threatened plants.

Identification of groundwater dependent ecosystems

The Australian Government Atlas of Groundwater Dependent Ecosystems was used to identify any previously mapped GDEs that occur in or near the study area. This atlas identifies GDEs reliant on surface groundwater (rivers, springs and wetlands) and subsurface groundwater (vegetation). The Atlas was reviewed to ascertain whether any GDEs are likely to occur in the study area.

Fauna surveys

Fauna surveys conducted within the study area and surrounds included:

- Fauna habitat assessment
- Koala spot assessment
- Targeted frog surveys
- Anabat surveys
- Spotlighting
- Remote cameras
- Opportunistic fauna surveys
- Aquatic habitat assessment
- In situ water quality survey

Fauna habitat assessment

An assessment was made of the type and quality of habitats present in the study area for native fauna. The study area was searched for habitat features of particular relevance to threatened species, such as hollow-bearing trees, specific feed trees, termite mounds (breeding habitat for Rosenberg's Goanna), rock outcrops (potential den sites for the Spotted-tailed Quoll), and water bodies. The presence of scats, scratches on tree trucks and general sign of fauna species was also used as an indication of habitat use within the study area.

Searches for hollow-bearing trees were undertaken throughout the fauna habitat assessment and opportunistic fauna surveys. Positions of hollow-bearing trees were logged on a hand-held GPS, and details of tree species, height, diameter, and number, position and size of hollows recorded on a proforma.

Koala spot assessments

Koala spot assessments were carried out at four locations within the proposal footprint within patches of intact native vegetation. Spot assessments comprised searches for Koala scats at the base of up to 30 trees, centred on a secondary or supplementary feed tree identified within DECC (2008). In some areas, trees were very scattered or restricted in distribution, meaning that fewer than 30 trees were searched.

Targeted frog surveys

Giant Burrowing Frog surveys were completed following the Commonwealth Department of the Environment (DotE) survey guidelines for the species. Targeted surveys consisted of nocturnal streamside searches along Mill Creek within the study area for signs and presence of this species, nocturnal searches (walked and driven) along access tracks in the study area, call playback through a megaphone to illicit an audible response and visual searches for tadpoles. A GPS was used to record the locations where call playback techniques were conducted

Targeted Green and Golden Bell Frog and Red-crowned Toadlet surveys were conducted simultaneously with the nocturnal streamside searches and call playback surveys for the Giant Burrowing Frog described above.

Anabat surveys

Microbat ultrasonic echolocation call recordings (Anabat surveys) were undertaken at two locations in the study area. Anabat detectors were placed in a flyway between native vegetation running parallel to Heathcote Road and also adjacent to the dam in the southern portion of the study area. Calls were identified using zero-crossing analysis and AnalookW software (version 3.8v, Chris Corben 2012). *The Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Pennay et al 2011; Churchill 2008; van Dyck and Strahan 2008) and records from the Atlas of NSW Wildlife (OEH 2013a).

Spotlighting

Spotlighting for nocturnal fauna was also carried out on all four nights of frog surveys. Spotlighting was conducted within the riparian vegetation of the creekline, around dams and drainage lines, and along tracks and in disturbed areas of native vegetation. Some areas of vegetation were very dense and spotlighting was not possible in these areas.

Remote cameras

Two infrared cameras were placed in the study area for a period of one week. One infra red camera was placed in a flyway between native vegetation running parallel to Heathcote Road, the other camera was placed in a patch of open vegetation adjacent to the boundary fence separating the gun club from the SITA land. Cameras were set to take three pictures over one minute when triggered by movement, with at least five minutes between each set of photographs. Cameras were baited with chicken wings, targeting Spotted-tailed Quolls (*Dasyurus maculatus*) and Rosenberg's Goanna.

Opportunistic fauna surveys

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Casual fauna observations were made in suitable areas of habitat throughout the course of the survey and while incidentally traversing the development site. This included visual inspection of trees and woody debris, active searches for small fauna and opportunistic observation of scats, tracks, burrows or other traces. Skeletal remains of mammals were identified by their dental and cranial anatomy and with reference to Triggs (1996).

Aquatic habitat assessment

Habitat descriptions were documented with reference to the NSW Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual (Turak *et al*, 2004), and included assessment of different instream habitat types, and the structure and condition of riparian vegetation. The information recorded was used to describe the nature of aquatic habitats

present within the study area, and identify any areas of potential habitat for threatened aquatic fauna species.

In situ water quality

In situ physical and chemical parameters were measured at four locations along Mill Creek and within two dams (see Figure 19.2), using a Hydrolab MS5 water quality meter with the standard sensor suite. This meter was calibrated in accordance with GHD's Quality Assurance requirements and the manufacturer's specifications prior to its use in the field.

19.2 Existing environment

19.2.1 Flora species

A total of 236 flora species from 56 families were recorded within the study area, comprising 183 native and 53 exotic species. Poaceae (grasses, 31 species, 17 native), Myrtaceae (flowering shrubs and trees, 30 species, all native), Fabaceae (28 species, 24 native) and Proteaceae (shrubs or trees, 27 species, all native) were the most diverse families recorded.

One threatened flora species and one endangered flora population were recorded in the proposal footprint:

- *Acacia bynoeana*, listed as an endangered species under the TSC and as a vulnerable species under the EPBC Act.
- *Allocasuarina diminuta* subsp. *mimica*, listed as an endangered population under the TSC Act.

19.2.2 Noxious and environmental weeds

A range of weed species occur within the proposal footprint. Weeds of National Significance (Thorp and Lynch 1999) include Bitou Bush (*Chrysanthemoides monilifera* subsp*. rotundata*), Lantana (*Lantana camara*), and Fire Weed (*Senecio madagascariensis*). Noxious species for the Sutherland Local Government Area that are present include Ludwigia (*Ludwigia peruviana*), Pampas Grass (*Cortaderia selloana*), Lantana (*Lantana camara*) and Fireweed (*Senecio madagascariensis*).

19.2.3 Vegetation

The majority of the vegetation in the proposal footprint and surrounding study area comprises cleared land or exotic grassland on highly modified landforms. Much of the area proposed to be developed as the ARRT facility and the GO facility has been previously disturbed and is currently vegetated with regrowth and, in several locations planted vegetation. Small patches of intact native vegetation are present in this area.

One native vegetation type is present in the proposal footprint: Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux (ME 014). This vegetation type is not a threatened ecological community.

Three additional native vegetation types are present in the study area but not in the proposal footprint:

- Needlebush - Banksia wet heath on sandstone plateaux of the Sydney Basin (ME015), which is commensurate with Coastal Upland Swamps endangered ecological community listed under the TSC Act and EPBC Act.
- Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux (ME013), which is commensurate with Coastal Upland Swamps endangered ecological community listed under the TSC Act and EPBC Act.

- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (ME021), which is commensurate with Shale-Sandstone Transition Forest critically endangered ecological community listed under the TSC Act and EPBC Act.

Red Bloodwood - Scribbly Gum heathy woodland occurs in small patches in the western portion of the proposal footprint. A linear patch is present as a narrow strip along the boundary with Heathcote Road, extending into the SICTA land to the north. A second patch is present along the boundary fence between SITA and SICTA. A small patch of this vegetation type is also present south of the nearby dam. This vegetation type is also the dominant vegetation type surrounding the proposal footprint. Common canopy species include Red Bloodwood (*Corymbia gummifera*), Scribbly Gum species *Eucalyptus racemosa* subsp. *racemosa* at the northern end of the ARRT facility area and, less commonly *Eucalyptus haemastoma* at the southern end of the GO facility. Over-mature, hollow-bearing trees are not present, and it is likely that most of the canopy species are less than 40 years old. The shrub layer is variable in height and density, possibly in response to previous disturbances and fire. Patches of the endangered population of *A. diminuta* subsp*. mimica* occur along the boundary fence adjacent to Heathcote Road (see Figure 19.1). Groundcover is sparse. One individual of the threatened *Acacia bynoeana* was recorded in this vegetation type, alongside the boundary track near Heathcote Road.

Red Bloodwood - Scribbly Gum heathy woodland (regenerating and planted) occurs over much of the area proposed for the ARRT and GO facilities, as well as adjacent areas of the existing landfill, and along much of Mill Creek. This vegetation type varies from the self-recruiting sandstone heath-woodland described above in response to previous disturbance and supplementary planting. The canopy is generally no more than 8 m in height and often less than 4 m. Trees may be spaced up to 10 m apart and the shrub layer is also sparse. A small patch of the endangered population of *A. diminuta* subsp*. mimica* occurs a disturbed track margin in this community in the proposal footprint, as well as in a disturbed area in SICTA land to the north.

Needlebush – Banksia wet heath is located to the north of the proposed ARRT facility within SICTA land. The vegetation type occurs in a narrow band which follows a drainage line from the formed access track around the existing infill area to a dam in the SICTA land. The vegetation includes components of sedgeland, restioid heath and cyperoid heath in the drainage line bed, to sparse fringing eucalypt woodland and mallee-heath on the sandstone slopes above the drainage line.

Hairpin Banksia – Slender Tea-tree heath is located to the east of the existing landfill where it intergrades with the Red Bloodwood–Scribbly Gum heathy woodland. It occurs on shallow, damp Hawkesbury Sandstone derived soils, on a ridge top, with very slight cross-slopes and impeded drainage. This community is a closed heath of sclerophyllous shrubs to 2m tall with very occasional small trees. There is a very dense, near continuous cover of tall shrubs, and a dense, species rich groundcover.

Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest is located as a narrow strip to the northeast of the existing landfill, outside the proposal footprint. The majority of the stand is located over 200 metres from the proposal footprint. A second, smaller stand is located further to the north. This vegetation has a canopy of Broad-leaved Ironbark (*Eucalyptus fibrosa*), White Stringybark (*Eucalyptus globoidea*), Thin-leaved Stringybark (*Eucalyptus eugenioides*), Turpentine (*Syncarpia glomulifera*) and occasional Grey Gum (*Eucalyptus punctata*). There is a sparse small tree layer and a dense grassy groundcover.

19.2.4 Groundwater dependent ecosystems

A literature review found conflicting information on the likelihood of GDEs being present in the study area. The Atlas of Groundwater Dependent Ecosystems maps vegetation in most of the study area as having no or low potential for groundwater interaction. Conversely, the vegetation

types present are likely to be GDEs according to Kuginis et al (2012). According to that study, groundwater dependency can be inferred for many parts of the landscape as there is a strong association between floristic composition, topography and groundwater. Coastal Sandstone Ridgetop Woodland (with which Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux is commensurate), Shale Sandstone Transition Forest and Coastal Upland Swamps are all identified as having a high probability of being a GDE (Kuginis et al 2012). These three vegetation types are present in the study area. As such, and as a precaution, it is assumed that all native vegetation types in the study area are groundwater dependent to some degree. Further downstream, outside the project footprint, vegetation in the Mill Creek gully is mapped in the Atlas of Groundwater Dependent Ecosystems as having been identified in a previous study as a GDE.

Mill Creek is not mapped by the Atlas of Groundwater Dependent Ecosystems as being groundwater dependent. The only waterway in the vicinity of the proposal with potential dependence on groundwater is the Woronora River. Given its position near the top of the ridge, much of the water flow in Mill Creek is likely to be dependent on rainfall within the immediate area. As such, Mill Creek in the proposal footprint is not likely to be a groundwater inflow dependent ecosystem.

Downslope of the dam, flows were generally absent, but intermittent pools were present. This suggests that groundwater inputs into Mill Creek may be negligible, however, as a precaution for the purposes of the biodiversity assessment, aquatic flora and fauna in Mill Creek downslope of the study area are considered to be potentially dependent on groundwater inflow.

19.2.5 Fauna species

A moderate diversity of fauna species were recorded in the proposal footprint, likely due in part to the presence of impacts from a highly modified environment arising from the landfill works and historical clearing. A total of 54 native species were recorded, which included 33 bird species, eight mammal species, seven reptile species and six frog species.

No threatened species have been positively recorded in the proposal footprint. One threatened species, the Greater Broad-nosed Bat (*Scoteanax rueppellii*) was possibly recorded during anabat surveys.

Feral species observed in the study area include Red Foxes (*Vulpes vulpes*), Feral Cats (*Catus familiaris*), European Rabbits (*Oryctolagus cuniculus*) and House Mice (*Mus musculus*). Fox numbers are controlled by SSC with shooting and baiting.

19.2.6 Fauna habitats

Four broad fauna habitats were recorded within the study area:

- Grassland on landfill
- Native woodland, including regrowth
- Upland Swamps
- Dams and creeks

Grassland on landfill

Exotic grasses and weeds within the study area provide foraging resources for opportunistic insectivorous and granivorous bird species typical of open grassland. Some threatened microbats (such as the Eastern Bentwing Bat) may forage over these areas, as may threatened birds such as the Little Eagle (*Hieraaetus morphnoides*) and Masked Owl (*Tyto novaehollandiae*).

The exotic grassland also provides habitat for small mammals and is likely to provide habitat for a range of reptile species.

Woodland

The study area contains a number of myrtaceous trees which accommodate a range of birds, including cockatoos, parrots and honeyeaters, and arboreal mammals. Canopy species may provide foraging habitat for the threatened Swift Parrot (*Lathamus discolor*) and Grey-headed Flying Fox (*Petropus poliocephalus*). The woodland does not provide suitable Koala habitat with secondary, supplementary and feed trees only occurring in low densities or as plantings (i.e. Grey Gum *Eucalyptus punctata*). The habitat in the proposal footprint is not considered habitat critical to the survival of the Koala according to the referral guidelines (DotE 2014) though it may utilise the site on occasion.

Extensive stands of *Allocasuarina* spp throughout the study area in native woodland and regrowth may provide foraging resources for the Glossy Black-cockatoo (*Calyptorhynchus lathami*). Glossy Back Cockatoos or signs of use by this species were not observed during surveys. The native woodland provides foraging habitat for a variety of microchiropteran bat species including the threatened Greater Broad-nosed Bat (*Scoteanax rueppellii*), possibly recorded in the proposal footprint. The threatened Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) was recorded to the east of the proposal footprint during previous surveys (GHD 2011), and would also likely forage in the proposal footprint on occasion.

The absence of senescent or mature trees within the native woodland reduces the number of hollow-bearing trees and fissure-bearing trees available for nesting or denning by fauna. Only five hollow-bearing trees were recorded in the proposal footprint, and these only contained small hollows suitable for species such as the Eastern Pygmy Possum and Sugar Glider.

Rock outcrops in the woodland contain denning habitat for the Red Fox, observed by the number of carcasses left in these areas. These rock outcrops are also potential den habitat for the threatened Spotted-tailed Quoll (*Dasyurus maculatus*) however the presence of foxes is likely to make these unsuitable for this species. Termite mounds within the woodland are potential foraging habitat for Echidnas (*Tachyglossus aculeatus*) and breeding habitat for the threatened Rosenberg's Goanna (*Varanus rosenbergi*).

Fallen debris and leaf litter in the less disturbed areas of the proposal footprint provide habitat for a variety of reptiles. The threatened Giant Burrowing Frog (*Heleioporus australiacus*) could forage and shelter in this vegetation. This species is known to travel more than 500 metres from water (Lemckert and Brassil 2003), and has previously been recorded in the study area (OEH 2014a).

Upland Swamp

The Upland Swamp contains a matrix of small pools in shallow depressions within wet heath which provide habitat for a number of frogs. Potential habitat for the threatened Giant Burrowing Frog (*Heleioporus australiacus*) and Red-crowned Toadlet (*Pseudophryne australis*) is present at this swamp, although neither species was recorded during targeted surveys in appropriate conditions.

High levels of lead shot from the adjacent clay target club are present within the swamp and surrounding area which may reduce habitat quality present at this swamp. The effects of lead intake on fauna can result in histopathological indications of lead poisoning, and reduced haemoglobin levels (Stansley and Roscoe 1996).

Dams

Two dams are located along the previously realigned Mill Creek. The dam in the south (outside the proposal footprint) is heavily vegetated at its southern end with a dense patch of Broad-leaved Cumbungi (*Typha orientalis*). The dam in the area proposed for the ARRT facility has no emergent vegetation, but does contain extensive beds of opportunistic submerged and emergent macrophytes.

Fringing vegetation includes *Allocasuarina* and eucalypts, as well as grasses. A range of common waterbirds, frogs and reptiles were recorded at these dams. These dams are not likely to be potential habitat for the threatened Giant Burrowing Frog and Red-crowned Toadlet.

Mill Creek

Mill Creek in the proposal footprint is a first order stream. As noted elsewhere, Mill Creek has previously been realigned within the study area and does not follow its natural course. In the southern portion of the study area, the creek has a generally natural form, with planted vegetation present in the riparian zone. Occasional patches of emergent vegetation including *Typha* are present. In the proposal footprint (near the proposed ARRT and GO facilities), Mill Creek typically occurs over sandstone bedrock with a number of small, shallow pools present.

Adjacent vegetation includes Allocasuarinas and heathy shrubs and there is limited leaf litter. Downstream of the proposed ARRT facility, Mill Creek is located in an artificial drain, and travels through short pipes in some locations. Emergent vegetation is often present at the interface between the drain and the pipes.

A previous record of the Giant Burrowing Frog exists along the southern section of Mill Creek in the study area. This species could forage and shelter in the riparian leaf litter, and also potentially breed in ephemeral ponds. The species may use Mill Creek and adjacent vegetation to disperse between better quality vegetation to the south and north, although the unnatural stream bed to the north of the proposed ARRT facility is likely to limit the movement of the species in this location. Tadpoles have been recorded in clear water with a pH 4.3–6.5 (Recsei 1997). Measurements of pH in the study area found the pH in Mill Creek and the two dams to range between pH 6.87-9.7, averaging around pH 8. Not including the dams, the pH of Mill Creek averaged at 7.19. This may mean that Mill Creek is unsuitable for breeding for the Giant Burrowing Frog.

The Red-crowned Toadlet breeds in ephemeral feeder creeks or flooded depressions, requiring unpolluted water between 5.5 and 6.5 pH. The pH levels recorded along Mill Creek make this waterway unsuitable for this species. Given the disturbance of vegetation in the study area, high pH levels recorded, and lack of evidence of the species during targeted surveys, this species is unlikely to occur in the proposal footprint.

Common families of dragonfly (Aeshnidae, Libuliidae) and damselfly (Coenagrionidae, Megapodagrionidae) were observed flying above Mill Creek. No threatened species listed under the FM Act are likely to occur along Mill Creek in the study area. Mill Creek in the study area is not mapped as key fish habitat.

19.2.7 Conservation significance

Threatened Ecological Communities

No TECs have been identified within the proposal footprint. Two TECs have been recorded in or near the study area:

- Coastal Upland Swamp: Needlebush - Banksia wet heath on sandstone plateaux (ME015) and Hairpin Banksia - Slender Tea-tree heath (ME013) are commensurate with

Coastal Upland Swamps in the Sydney Basin Bioregion, listed as an endangered ecological community under the TSC Act and EPBC Act. This community is located about 40 m downslope of the proposed detention pond that would be located north of the ARRT facility, and about 70 m to the east of the existing landfill (see Figure 19.1).

- Shale-Sandstone Transition Forest: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (ME021) is commensurate with this critically endangered ecological community CEEC. A narrow strip of this CEEC is located to the north-east of the existing landfill, outside the proposal footprint. This extends into a large stand further to the east of the proposal footprint. A second stand is mapped by SSC to the north of this stand (see Figure 19.1).

Threatened flora species

The Protected Matters Search predicts 25 threatened flora species that may occur in the locality. Of these, 11 species have been previously recorded in the locality (OEH 2014a). One threatened flora species was recorded in the proposal footprint during surveys:

- *Acacia bynoeana,* listed as an endangered species under the TSC Act and a vulnerable species under the EPBC Act. One individual was recorded alongside the boundary track in the area proposed as the ARRT facility.

Three threatened flora species occur near the study area. These comprise:

- *Eucalyptus camfieldii* (listed as a vulnerable species under the TSC Act and EPBC Act). A stand of *E. camfieldii* (including hybrid specimens) was identified about 100 metres to the east of the proposal footprint during surveys in this area in 2010 (GHD 2011). This species was identified within Hairpin Banksia - Slender Tea-tree heath.
- *Melaleuca deanei* (listed as a vulnerable species under the TSC Act and EPBC Act). Two *M. deanei* were recorded about 200 metres to the east of the proposal footprint during surveys in this area in 2010 (GHD 2011). One individual was recorded about 200 metres to the south of the proposal footprint near Heathcote Road (GHD 2012) and one individual was recorded during the March 2015 survey on the western side of Heathcote Road approximately 400 m to the north-west of the intersection with New Illawarra Road.
- *Melaleuca biconvexa (*listed as a vulnerable species under the TSC Act and EPBC Act). One individual was recorded during the March 2015 survey on the eastern side of Heathcote Road, on slopes leading down to a culvert and a tributary of Mill Creek. This individual is growing on a section of road reserve within occasionally mown grassland, adjacent to a dense patch of *Allocasuarina littoralis*.

The study area and proposal footprint contain broadly suitable habitat for a number of other threatened plants that are known or predicted to occur in the locality based on the results of the desktop assessment (see Appendix M) and/or the FBA credit calculations (Section 19.3.4). Based on the historical clearing, small area of native vegetation and natural soil profiles that could comprise threatened plant habitat in the proposal footprint, and the survey effort employed, these species can be reliably discounted as occurring in the proposal footprint or being affected by the proposal.

Threatened flora populations

Allocasuarina diminuta subsp. mimica

One threatened flora population has been identified within the proposal footprint. *Allocasuarina diminuta* subsp. *mimica*, listed as an endangered population under the TSC Act, About 200 ramets *Allocasuarina diminuta* subsp. *mimica* were recorded during the March 2015 targeted survey for the species, including 58 individuals in the proposal footprint

Seed collection by the on-site nursery volunteers was recommended and preliminary seed collection has been undertaken (see Section 19.4.2).

Prostanthera saxicola

The SEARs highlighted the *Prostanthera saxicola* endangered population in the Sutherland and Liverpool LGAs as an endangered population of possible concern for the proposal. This population occurs mainly between Holsworthy station and Sutherland station, north from Lucas Heights and south of the Georges River. This species was not recorded during surveys in the proposal footprint and adjacent areas. No individuals of this species have been observed in the study area by the nursery volunteers. Given the lack of preferred habitat and lack of any evidence of its occurrence, this population is unlikely to be present in the proposal footprint.

Threatened fauna species

Only one threatened fauna species was possibly recorded during the field surveys in the proposal footprint:

- The Greater Broad-nosed Bat (*Scoteanax rueppellii*), listed as a vulnerable species under the TSC Act, was possibly recorded during anabat surveys. There are a small number of records of the Greater Broad-nosed Bat in the locality, and it could occur in the study area.

Four threatened species have been recorded to the east of the study area during previous surveys (GHD 2011), and could occur on occasion in the proposal footprint:

- Grey-headed Flying-fox (*Pteropus poliocephalus*), listed as a vulnerable species under the TSC Act and the EPBC Act, was recorded flying over the study area.
- Black-chinned Honeyeater (*Melithreptus gularis*), listed as a vulnerable species under the TSC Act, was recorded in Red Bloodwood – Scribbly Gum heathy woodland east of the proposal footprint and could forage in the proposal footprint on occasion.
- Scarlet Robin (*Petroica boodang*), listed as a vulnerable species under the TSC Act, was recorded in woodland east of the proposal footprint and could forage in the proposal footprint on occasion.
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), listed as a vulnerable species under the TSC Act, was recorded near a dam to the east of the proposal footprint.

No suitable habitat is present for threatened aquatic fauna species listed under the FM Act.

Migratory species

No migratory species listed under the EPBC Act were recorded in the study area. Three migratory species are considered likely to occur on occasion and on a transient basis: the Rainbow Bee-eater (*Merops ornatus*), Satin Flycatcher (*Myiagra cyanoleuca*) and Rufous Fantail (*Rhipidura rufifrons*). These species are nomadic woodland birds that disperse widely across south-eastern Australia in response to seasonal cues and food availability. Accordingly, individuals of these species could occur within the woodland habitats in the study area on a seasonal or opportunistic basis.

However, their occurrence on the site is likely to be transient and the site would represent only marginal foraging habitat for these highly mobile species. Vegetation within the study area is highly modified, fragmented and would have only limited value for migratory species listed under the EPBC Act. Habitat in the study area is not likely to support an ecologically significant proportion of the population of any of these species, be of critical importance to the species at particular life-cycle stages, located at the limit of any of the species' range, and/or be located

within an area where the species is declining. As such, potential habitat in the study area is not 'important habitat' for any of these species, as defined in DotE (2013).

19.3 Assessment of potential impacts

19.3.1 Construction and operation of the proposal

Direct impacts

Clearing of vegetation

The proposal would directly affect up to 13.03 hectares of mainly regenerating Red Bloodwood - Scribbly Gum heathy woodland for the construction of the ARRT and GO facilities, access road and realignment of Mill Creek. Of this, only 2.55 hectares is in good condition. A small section of Mill Creek, which was previously realigned in the 1980s would again be realigned.

The area of proposed vegetation removal within the proposal footprint is summarised in Table 19.2.

There would be no direct impacts on any threatened ecological communities (TECs). The sediment pond adjacent to the ARRT facility is located about 6 metres from the Needlebush - Banksia wet heath on sandstone plateaux of the Sydney Basin (ME015) (Coastal Upland Swamp).

The proposal would remove one *Acacia bynoeana* individual (listed as an endangered species under the TSC Act and the EPBC Act) for construction of the ARRT and GO facilities. This individual was inspected during the March 2015 survey and was found to be mostly necrotic, despite the protection of fencing. No other individuals were recorded in the proposal footprint.

The proposal would remove up to 58 ramets of *Allocasuarina diminuta* subsp. *mimica* (listed as an endangered population under the TSC Act) for construction of the ARRT and GO facilities. Further assessments of impacts on this endangered population are provided in section 19.3.4.

The proposal would not directly impact any individuals of *Eucalyptus camfieldii, Melaleuca deanei* or *Melaleuca biconvexa* recorded outside the proposal footprint. No individuals were recorded in the proposal footprint despite targeted surveys. No other threatened flora species are likely to occur within the proposal footprint given the historical clearing and disturbance, and lack of evidence of any individuals.

Construction within the remainder of the site would remove non-threatened native plants and noxious and environmental weeds within highly modified habitat that does not support a native vegetation community.

Table 19.2 Proposed removal of vegetation within the proposal footprint

Vegetation Community	PCT / NSW Veg. Type ID (OEH, 2014d)	Condition	Area within the proposal footprint (ha)
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux	ME014	Moderate/good	2.55
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux (regenerating and planted)	ME014	Moderate/good (low)	10.48
Total native vegetation			**13.03**
Exotic grassland			26.68
Total vegetation			**39.71**

Cleared land			71.77
Total area			**111.48**

Note: Vegetation to be removed is inclusive of APZs.

Impacts on threatened ecological communities

There would be no direct impacts on any threatened ecological communities.

Impacts on threatened flora

The proposal would remove one individual of *Acacia bynoeana.* Impacts on this species have been assessed using the credit calculator (see section 19.3.4).

The proposal would remove up to 58 ramets of *Allocasuarina diminuta* subsp*. mimica*. A sub-population of about 24 ramets was recorded in SICTA land north of the proposal boundary. Sub-populations of *Allocasuarina diminuta* subsp. *mimica* were also recorded on both sides of Heathcote Road, between the intersection with New Illawarra Road and the Mill Creek crossing. About 12 ramets were recorded on the eastern side of Heathcote Road and greater than 100 ramets on the western side of Heathcote Road.

Removal of habitat resources

The 13.03 ha of native vegetation and 26.68 ha of exotic grassland that would be removed provides foraging, breeding, roosting and nesting resources for a range of fauna species, including threatened species. Eucalypts and other native canopy species would provide nectar resources as well as foraging substrate for a diverse range of arboreal species, such as birds, reptiles (varanids), arboreal mammals and bats. The magnitude of impact is likely to be low given extensive areas of similar habitat in surrounding protected areas.

The proposal would remove five hollow-bearing trees containing very small hollows (~ 5 cm diameter). These may be utilised by mammal species such as the Eastern Pygmy Possum and Sugar Glider and some microbat species, as well as tree frogs. The removal of these trees within the construction footprint is unlikely to comprise the removal of a significant proportion of the total resource, such that any local populations of fauna would experience significant negative impacts, given the expansive tracts of vegetation containing hollow-bearing trees that are present in the locality.

The proposal would remove fallen logs and rock outcrops, and termite mounds, which represent potential den habitat for the Spotted-tailed Quoll and potential nest sites for Rosenberg's Goanna, respectively. The removal of vegetation would also lead to the loss of potential foraging habitat for these and other ground-dwelling species.

The realignment of Mill Creek would result in the loss of riparian, stream and dam habitat for a range of frog, reptile and macroinvertebrate species. This potentially includes the loss of breeding habitat for the Giant Burrowing Frog, although this habitat is likely to be suboptimal, given the surrounding disturbance.

Fauna injury and mortality

As described above, the proposal footprint provides habitat resources for native fauna species and would contain mainly foraging and shelter resources for common native fauna. Construction is likely to result in the injury or mortality of some individuals of less mobile fauna species and other small terrestrial fauna that may be sheltering in vegetation within the proposal footprint during clearing activities.

There are few hollow-bearing trees in the proposal footprint, and hollows are very small, which reduces the risk of injury or mortality of larger arboreal mammals or hollow-nesting birds. Alternative habitat resources and refuge from construction activities is available in native

vegetation adjoining the site. The potential injury or mortality of individuals within a maximum of 39.71 hectares of habitat (including 26.68 ha of exotic grassland), is highly unlikely to affect an ecologically significant proportion of any local populations.

Recommendations have been made in Section 19.4 to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

Fragmentation or isolation of habitat

The removal of native vegetation would occur to the west of the existing cleared landfill. There would be no isolation of habitat as a result of the proposal. A narrow band of vegetation (up to 10 m wide) would remain along the road reserve of Heathcote Road. This would connect to the existing narrow band of vegetation to the south of the study area along Heathcote Road. Large expanses of vegetation occur on the western side of Heathcote Road. There would be negligible impact on the movement of mobile species such as the Grey-headed Flying-fox and Swift Parrot.

Koalas may utilise the road reserve on occasion for dispersal. There would be no isolation of habitat for these species as a result of the proposal. The realignment of Mill Creek would allow continued connectivity along the creekline. Giant Burrowing Frog (if present) would be able to continue to move along Mill Creek, although the unnatural creek bed and bank downstream of the proposed ARRT facility may limit this movement.

Aquatic habitats

The proposal would remove a section of the previously realigned Mill Creek and a dam. Mill Creek is already highly modified through previous realignment and disturbance. These aquatic habitats are not potential habitat for threatened fish or dragonflies and are not classified as Key Fish Habitat.

19.3.2 Indirect and operational impacts

Weed invasion and edge effects

The proposal would create a new edge around the proposed ARRT and GO facilities. The Coastal Upland Swamp is only 6 m from the edge of the footprint and this may potentially be affected. Construction activities may, in general, increase the degree of weed infestation through dispersal of weed propagules (seeds, stems and flowers) into areas of native vegetation via erosion (wind and water), via workers shoes and clothing or through construction vehicles. The proposal is unlikely to impact TEC's and most of the threatened biota potentially occurring in the study area because of existing edge effects, area of impact, the disturbed nature of the vegetation and the distance of some species to the proposal footprint.

However, habitat quality in vegetation adjacent to newly cleared areas may be reduced. The proposal would increase edge effects for *Allocasuarina diminuta* subsp. *mimica* on the retained population within SICTA land and the adjacent individuals retained in the Heathcote Road reserve. This species likely benefits from disturbances, and possibly from increased light levels afforded along an edge, therefore it is possible that some edge effects are beneficial to the survival of *Allocasuarina diminuta* subsp. *mimica.*

Given the level of existing disturbance, the proposal would have a minor impact on the degree of weed infestation in the study area.

There is potential for edge effects on Coastal Upland Swamp, as this is located about 6 m from the proposal at its closest. This small swamp is already subject to existing edge effects due to adjacent cleared areas to the west and east. The swamp may be impacted by erosion and sedimentation during construction due to the proximity of the construction area.

Surface water

The proposal includes a number of best practice erosion and sediment control measures to achieve compliance with the EPA's surface water discharge requirements. The proposal is not expected to have a significant effect on the peak rate of discharge from the site, resulting in no significant increase to flooding risks downstream (refer chapter 13 for the soils and surface water assessment).

Other indirect potential impacts to surface water in regard to leachate and from a reduction in catchment area as a result of clearing of vegetation for construction of facilities are addressed in chapter 13 and chapter 15, corresponding to the soils and surface water assessment and leachate assessment respectively.

Aquatic disturbance

The proposal may introduce pollutants and sediments from the proposal footprint into the surrounding environment, and if uncontrolled, could potentially impact on water quality and aquatic habitats.

The potential for water quality impacts on Mill Creek outside the proposal footprint are likely to be low.

Indirect impacts may also include the disturbance of large woody debris, and changes to water quality downstream of realignment works.

Based on the details above, and the limited impacts the existing LHRRP is currently having on downstream environments, the proposal is likely to have a minor impact on aquatic habitats within the immediate area only. There would be no impact on Key Fish Habitat as a result of the proposal. No endangered aquatic communities, aquatic fauna or marine vegetation listed under the FM Act or EPBC Act occur in the study area and no significant impacts on riparian vegetation or habitats downstream of the proposal footprint are anticipated as a result of the proposal.

Groundwater impacts

Impacts to GDEs and aquatic ecosystems in Mill Creek and Deadmans Creek associated with reduced groundwater infiltration are likely to be negligible due to the size of the ARRT and GO facilities relative to the creek catchments.

Vegetation within the proposal footprint and adjacent areas is likely to be groundwater dependent to some degree. In particular, Coastal Upland Swamps located outside the proposal footprint are highly likely to be groundwater dependent. The impacts to sub-surface groundwater dependent ecosystems (vegetation communities) and the potential groundwater inflow dependent ecosystems (such as Mill Creek, Deadmans Creek and Woronora River) due to operation of the ARRT and GO facilities are expected to be localised and minor.

Pests and pathogens

Construction activities within the proposal footprint have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) into adjacent native vegetation through vegetation disturbance and increased visitation.

Mitigation measures would be included in the construction EMP to prevent the introduction or spread of disease that could potentially impact threatened biota in the study area.

Dust generation

Dust as a result of wind and vehicle movement may currently affect native vegetation located adjacent to the existing landfill, however there was little evidence of dust in adjacent vegetation. Dust is likely to be generated during clearing and construction activities. High dust levels could reduce habitat quality for flora and fauna species by reducing plant and animal health in areas of retained vegetation.

Noise

There would be noise impacts during the construction and operation phases as a result of vegetation clearing, the movement of vehicles and operation of plant. The proposal footprint currently experiences ongoing noise from vehicles travelling along Heathcote Road, and from the activities in the landfill. There is the potential for individuals that nest in trees that are close to the proposal edge abandoning their nests as a result of noise during construction and operation. Noise may also affect general fauna activity in these areas. Given the existing noise levels in the vicinity of the proposal, any localised and temporary increase in noise levels during the construction activities are unlikely to substantially impact on native biota.

Vibration

Vibration impacts may result from works associated with the proposal, such heavy vehicle movement and construction and operational activities. Vibration may deter native fauna from using the area surrounding the source of vibration. This may potentially interrupt dispersal within the locality if an individual is unwilling to travel through an area where vibration is detectable, or may cause some species to abandon an area in search of areas where vibration is not detectable.

Impacts would be localised and temporary during construction. No works would be conducted at night and thus construction is unlikely to impact the behaviour of nocturnal fauna.

19.3.3 Cumulative impacts

The proposal would increase the extent of vegetation clearing in the locality, and increase the removal of habitats for flora and fauna species, including threatened species. Other developments in the locality would also lead to a reduction in vegetation and habitats available and include a proposed development at Heathcote Ridge in the West Menai area by the GALC.

The GALC proposal would impact similar vegetation types to those present in the proposal footprint being assessed in this Biodiversity Assessment Report, further reducing habitats available for flora and fauna in the area. In particular, it would also result in the loss of individuals of the threatened flora species *Acacia bynoeana* and *Allocasuarina diminuta* subsp. *mimica,* and would further remove habitat for a range of threatened fauna species, if approved.

19.3.4 FBA assessment

Credit calculations

A FBA assessment and credit calculations have been performed in accordance with the methodology (OEH 2014) and using credit calculator Version 4.0. The FBA includes thresholds for assessing and offsetting impacts of development (see table 4 of OEH 2014). With reference to these thresholds the proposal:

- Would remove 82 ramets of the endangered population of *Allocasuarina diminuta* subsp. *mimica*. Note that this species has not yet been added to the credit calculator and thus no credits can be calculated for it.

- Includes a total of 13.03 ha of impacts for which the assessor is required to determine an offset, comprising:
  - 459 ecosystem credits for impacts on Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux (ME014).
  - 77 species credits for *Acacia bynoeana*
  - 169 species credits for the Giant Burrowing Frog
  - 430 species credits for Rosenberg's Goanna
  - 261 species credits for the Eastern Pygmy-possum
- Includes a total of 98.45 ha of impacts for which the assessor is not required to determine an offset, comprising the removal of exotic grassland and cleared land.

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of biodiversity credits as calculated in accordance with the FBA. The offsets would be within the Sutherland Shire where practicable.

Impacts requiring further consideration

There would be no direct impact on Shale Sandstone Transition Forest. The existing approved landfill boundary had been located to avoid impacts on this community, and there would be no change to this boundary. No additional areas of vegetation would be cleared from near this community. Large tracts of vegetation are present to the northeast, south and east of the site, and connectivity with these areas would not be affected. The edge of the stand of Shale Sandstone Transition Forest is located adjacent to the existing landfill void. Currently this is approximately 40 m deep.

The landfill would eventually be reprofiled, with the surface matching nearby areas in about 2025. A perimeter drain would be located around the edge of the reprofiled landfill to prevent transfer of leachate into the adjacent vegetation. Any impacts on groundwater and surface water have already occurred. There would be no additional impacts on groundwater and surface water related to the proposal that could impact this CEEC. There would be no change in extent or condition of the community within the IBRA subregion as a result of the proposal.

The proposal would remove up to 58 ramets of *Allocasuarina diminuta* subsp*. mimica*. A sub-population of about 24 ramets was recorded in SICTA land north of the proposal boundary. Sub-populations of *Allocasuarina diminuta* subsp. *mimica* were also recorded on both sides of Heathcote Road, between the intersection with New Illawarra Road and the Mill Creek crossing. About 12 ramets were recorded on the eastern side of Heathcote Road and greater than 100 ramets on the western side of Heathcote Road.

There is also a conserved population of *Allocasuarina diminuta* subsp. *mimica* in a Council Reserve, just to the north of the LHRRP, which has many hundreds of ramets present (B. Graham, SSC, pers. comm.). A large proportion of the known population may be removed for the proposed Heathcote Ridge development further to the north, however this proposal has not yet been assessed under NSW legislation, although a strategic assessment (Cumberland Ecology 2012) has been approved by the Commonwealth.

As such, the status of this proposal is not known. Based on these numbers the subpopulation present in the proposal footprint is estimated to represent less than 3% of the total endangered population (including the Heathcote Ridge population). The stand of *Allocasuarina diminuta* subsp. *mimica* immediately to the north of the proposed ARRT facility may be impacted by changes to water flow at this location. This stand is located on skeletal soils in a previously cleared area, and a number of dead ramets were observed. Reduction in water could cause further death of ramets at this location.

The pollination cycle, seedbank and recruitment opportunities of the larger subpopulation (>100 ramets) along the western side of Heathcote Road are unlikely to be impacted by the proposal. Mycorrhizal associations in these areas are unlikely to be disturbed. The subpopulations in the proposal footprint are connected to or are located near subpopulations present along Heathcote Road. A narrow band of vegetation would remain along Heathcote Road, adjacent to the proposal site, providing connectivity between the main population to the north and records to the south. No area of vegetation would be isolated as a result of the proposal. Despite the removal of stands of *Allocasuarina diminuta* subsp. *mimica*, the proposal should also contribute to the recovery of the species.

The on-site nursery would assist with the cultivation of individuals of the species, through collection of seed prior to clearing, and propagation of plants from seed and collection of ramets from the proposal footprint. Preliminary seed collection took place in early March 2015, following the targeted survey. A management plan for the collection of seed, propagation of plants and translocation of plants would be prepared as part of the CEMP for the proposal (see section 19.4).

No individuals of the *Prostanthera saxicola* endangered population have been recorded during surveys in the proposal footprint and adjacent areas. No individuals of this species have been observed in the study area by the nursery volunteers. Given the lack of preferred habitat and lack of any evidence of its occurrence, this population is unlikely to be present in the proposal footprint. The loss of vegetation from the proposal footprint is not likely to affect the available habitat for the species, as no individuals were recorded in the proposal footprint and preferred habitat is not present.

Vegetation to be removed as a result of the proposal is located alongside the existing landfill and Heathcote Road. The proposal would not isolate any habitat for the species. The proposal would cause an incremental increase in fragmentation in the locality. Given the distance of the proposal from the known population and comparatively small area of vegetation that would be removed, the proposal is unlikely to interfere with the pollination cycle, local seedbanks, recruitment, and interactions with pollinators.

19.4 Mitigation and management measures

19.4.1 Avoidance of impacts

The key impact avoidance measures for the proposal include:

- Locating the footprint of the ARRT and GO facilities to the west of the existing landfill in vegetation that has been previously cleared and disturbed, and generally avoiding impacts on large stands of good quality vegetation.
- Locating access roads within already disturbed areas of the existing landfill.
- Siting of construction compounds and other construction infrastructure in already cleared areas would also avoid impacts on native biodiversity values.

19.4.2 Mitigation of impacts

Construction

In order to address the potential impacts of the proposal on biodiversity, the mitigation and management measures outlined in Table 19.3 would be implemented as part of the CEMP for the site.

Table 19.3 Biodiversity mitigation measures (construction)

Impact	Mitigation
General	• Ensure all workers are provided an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches. • Prepare a flora and fauna management sub-plan as part of the CEMP, incorporating recommendations below, and expanding where necessary. • Measures to suppress dust would be put in place during clearing, construction and operation.
Flora species	• Collection of seeds of the *Acacia bynoeana* individual should be carried out in the appropriate season (September to January) prior to vegetation clearing occurring. Seeds should be planted in the nursery and any individuals grown used for on site plantings. Propagation of all Acacia species is from scarified seed or using boiling water treatment (Wrigley and Fagg 2007). Cuttings may also be an option for propagation. • The *Acacia bynoeana* individual should be carefully removed and transferred to the on-site nursery. Soil adjacent to the individual should also be transferred as this species has little local dispersal of seed and presumably a long-term soil seed bank (Benson and Macdougal 1996). Efforts should be made to translocate this individual and soil to the on-site nursery for care before being replanted at the proposed offset site or other suitable location. The location of this proposed offset site would be discussed with OEH during the preparation of the offset strategy. • Collection of seeds and propagules of *Allocasuarina diminuta* subsp. *mimica* should be carried out in March prior to vegetation clearing occurring. Seeds should be planted in the nursery and any individuals grown used for on site plantings. Species of this genus can be propagated from seed (Wrigley and Fagg 2007). Preliminary seed collection was carried out in March 2015 by the on-site nursery staff. • Ramets of *Allocasuarina diminuta* subsp. *mimica* and associated soil should be collected prior to vegetation clearing and transferred to the on-site nursery for propagation and replanting. Replanting should be undertaken in areas that are not likely to be impacted by future development, including the proposed offset site. The location of the proposed offset site would be discussed with OEH during the preparation of the offset strategy. Planting of ramets along the realigned Mill Creek where the ironstone soil is present is recommended. No *Allocasuarina littoralis* should be planted near these plants as this species can shade out *Allocasuarina diminuta* subsp. *mimica* and mycorrhyzial associations may be different. Any removal and replanting should be carried out with input from the SSC bushcare staff. • A management plan for the collection of seed and translocation of plants would be prepared as part of the CEMP for the proposal (see section 19.4.2) and would include monitoring and assessment of the success of the program.
Vegetation clearing	• Limit disturbance of vegetation to the minimum necessary to construct the proposal. • Vehicles must be appropriately washed prior to work on site to prevent the potential spread of Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust (*Pucciniales fungi*) in accordance with the national best practice guidelines for Phytophthora (DEH 2006) and the Myrtle Rust factsheet (DPI 2011c) for hygiene control. • Where the proposal footprint adjoins native vegetation mark the limits of clearing and install fencing around the construction footprint area prior to the commencement of construction activities to avoid

Impact	Mitigation
	unnecessary vegetation and habitat removal. • Stockpiles of fill or vegetation should be placed within existing cleared areas (and not within areas of adjoining native vegetation). • Sediment fences should be installed to prevent transfer of sediments into adjacent vegetation.
Weeds	• Develop weed management actions to manage weeds during the construction phase of the proposal. This would include the management and disposal of the weeds that were recorded within the proposal footprint, including the noxious weeds listed in Table 10 of Appendix M in accordance with the NW Act. • Vehicles and other equipment to be used on site should be cleaned to minimise seeds and plant material entering the site to prevent the introduction of further exotic plant species or disease. • Incorporate control measures in the design of the proposal to limit the spread of weed propagules downstream of study area. Sediment control devices, such as silt fences, would assist in reducing the potential for spreading weeds.
Fauna habitat	• Protocols to prevent introduction or spread of chytrid fungus should be implemented following Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECCW 2008). • A trained ecologist should be present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable. Clearing surveys should include: • Staged vegetation clearing, commencing in the south of the GO facility and progressing northwards to increase the opportunity for fauna to vacate the site and move into areas of 'secure' habitat to evade injury. • Any hollow-bearing trees to be felled should be marked prior to clearing of vegetation. The removal of hollow bearing trees is to be undertaken in accordance with a hollow-bearing tree management protocol and would include the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna. • Habitat features (fallen logs and tree hollows) removed from site would be salvaged and relocated within adjacent areas of vegetation. • Inspections of native vegetation for resident fauna and/or nests or other signs of fauna occupancy • Deferral of vegetation removal and associated construction activity in areas occupied by more mobile threatened fauna until the fauna has vacated the proposal footprint • An ecologist should be present during works along Mill Creek to rescue and relocate any frogs to other locations along Mill Creek. Any handling of frogs should be undertaken with respect to the Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECCW 2008).
Water Quality and aquatic habitats	• Erosion and sediment control plans should be prepared in accordance with Volume 2D of Managing Urban Stormwater: Soils and Construction (DECC 2008). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. • Erosion and sediment control measures should be established prior to construction. • Erosion and sediment control measures would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality. • Stabilised surfaces should be reinstated as quickly as practicable after construction. • Water should be applied to exposed surfaces that are causing dust generation. Surfaces may include unpaved roads, stockpiles,

Impact	Mitigation
	hardstand areas and other exposed surfaces (for example recently graded areas). • Vehicles must follow appropriate speeds to limit dust generation. • All stockpiled material should be stored in bunded areas and kept away from waterways to avoid sediment entering the waterway. • Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place. • Plague Minnow (if present) must not be released into local waterways as a result of draining of dams. Plague Minnow should be eradicated from dams prior to decommissioning using humane methods and under an appropriate licence from NSW Primary Industries (Animal Welfare branch and Fishing and Aquaculture branch). • Any large woody debris removed from the realigned creek should be salvaged and placed in the new alignment to maintain habitat values. • The new section of the creek should be constructed to mimic a natural ecosystem and revegetated with locally endemic species. Consideration should be given to using propagated *Allocasuarina diminuta* subsp. *mimica*.

Operation

A comprehensive list of prevention, mitigation and rectification measures has been identified and they are detailed in the OEMPs for the LHRRP (Appendix S), GO facility (Appendix T) and the ARRT facility (Appendix U).

As described in Section 19.3.2, the proposal would have a minor increase in existing impacts on native biodiversity values during operation. Little mitigation of the proposal is therefore likely to be required for biodiversity during this phase. Mitigation measures are provided in Table 19.4.

Table 19.4 Biodiversity mitigation measures (operation)

Impact	Mitigation
Vegetation and weeds	• Ongoing management of noxious weeds according to legislative requirements. • Ongoing suppression of dust within the landfill and ARRT and GO facilities. • Ongoing water quality management.
Feral animals	• Ongoing control of feral animals. • Minimise sources of food and habitat for pest species.

Post closure

A post closure EMP (Appendix V) has been prepared for the project. As part of this EMP, the site would be landscaped and there would be management of surface water, leachate and gas. Mitigation measures proposed for biodiversity are provided in Table 19.5.

Table 19.5 Biodiversity mitigation measures (post closure)

Impact	Mitigation
Vegetation and weeds	• Exposed soil should be sown with native seed immediately to prevent colonisation by weeds. • Revegetation should use locally sourced native species. • Use of propagated individuals of *Allocasuarina diminuta* subsp. *mimica* from the site should be incorporated into the landscaping plan. • Ongoing management of noxious weeds according to legislative requirements. • Revegetation areas, including planted *Allocasuarina diminuta* subsp. *mimica,* should be monitored and managed as per the EMP.

19.4.3 Draft offset strategy

The credit calculator has been used to determine the number and type of biodiversity credits required to offset impacts of the proposal. The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the following biodiversity credits as calculated in accordance with the FBA:

- Would remove 82 ramets of the endangered population of *Allocasuarina diminuta* subsp. *mimica*. Note that this species has not yet been added to the credit calculator and thus no credits can be calculated for it.
- Includes a total of 13.03 hectares of impacts for which the assessor is required to determine an offset, comprising:
  - 459 ecosystem credits for impacts on Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux (ME014).
  - 77 species credits for *Acacia bynoeana*
  - 169 species credits for the Giant Burrowing Frog
  - 430 species credits for Rosenberg's Goanna
  - 261 species credits for the Eastern Pygmy-possum.
- Includes a total of 98.45 hectares of impacts for which the assessor is not required to determine an offset, comprising the removal of exotic grassland and cleared land.

The proponent would finalise the Biodiversity Offset Strategy in consultation with the determining authorities, either through:

- Surveying and assessing a suitable offset site in accordance with the BBAM, an application for a BioBanking agreement and then the purchase and retirement of matching biodiversity credits.
- Purchasing and retiring matching biodiversity credits from an established biobank.
- Providing supplementary measures if appropriate biodiversity credits or appropriate like for like offsets are not available.

The Biodiversity Offset Strategy would be developed in consultation with the determining authorities and SSC. The offset would be within Sutherland Shire where practicable.

19.5 Conclusions

The majority of the proposal footprint is located within the existing landfill, which has been cleared and substantially modified. The proposed ARRT and GO facility have been positioned within vegetated land of which much had been previously cleared but is now regenerating. The proposal's impacts are therefore substantially less than would be associated with an undisturbed 'green field' site. The proposal has been purposefully designed to avoid or further reduce impacts on biodiversity values as far as is practicable.

Other specific mitigation measures are also proposed to minimise impacts on the natural environment and threatened biota (Section 19.4).

Despite measures taken to avoid and mitigate impacts, the proposal would result in some unavoidable residual adverse impacts imposed upon some elements of the natural environment, including removal of native vegetation, a threatened plant and ramets of a threatened population, fauna habitat resources and imposition of edge effects on adjoining areas of native vegetation. These residual impacts are small in extent and magnitude and would comprise a minor reduction in biodiversity values in the study area.

No threatened ecological communities would be directly impacted. The proposal may have a minor indirect impact on a nearby Coastal Upland Swamp, however this is unlikely to change the species composition of the community or reduce its extent. The stand of Shale Sandstone Transition Forest located to the north of the existing landfill is unlikely to be impacted by the proposal given its distance from the proposal footprint and lack of any clearing in this area.

One individual of the endangered plant *Acacia bynoeana* would be removed as a result of the proposal. 82 ramets of the *Allocasuarina diminuta* subsp. *mimica* that form part of the endangered population in the proposal footprint would be removed.

The proposal would remove a very small proportion of available habitat resources for local populations of native fauna. Impacts would include the removal of:

- 13.03 ha of potential foraging habitat for mobile threatened fauna species, including the Grey-headed Flying-fox, birds and microbats
- 13.03 ha of potential foraging, shelter and nest or den sites for the Eastern Pygmy-possum and the Spotted-tailed Quoll
- 13.03 ha of potential shelter, foraging and low quality potential breeding habitat for the Giant Burrowing Frog.
- The loss of five hollow-bearing trees and two rock outcrops
- The removal of one artificial dam and a section of Mill Creek. Mill Creek would be realigned to allow continued flow.

The proposal would not impact any threatened biota listed under the FM Act.

The Biodiversity Offset Strategy (Section 19.4.3) for the proposal would include the purchase and retirement of biodiversity credits as calculated in accordance with the FBA thresholds for assessing and offsetting of impacts of developments. The offsets would be within the Sutherland Shire where practicable.

20. Landuse

20.1 Existing environment

The land on which the LHRRP is situated is fully owned by SITA and ANSTO and surrounded by predominately vegetated areas. Key adjacent land uses include:

- Lucas Heights Research Facility (to the east and south)
- Holsworthy Military Reserve (to the north, west and south)
- The Ridge Sports Complex, a major regional sporting facility being developed on the site of the former Lucas Heights Waste and Recycling Centre (approximately 2.5 km to the north east)
- Lucas Heights Conservation Area (to the north west)
- The suburbs of North Engadine (approximately 2 km to the east) and Barden Ridge (approximately 3 km to the north east).

Land uses within the LHRRP include:

- Waste management and resource recovery (landfill, GO facility, RRC and ancillary infrastructure)
- Community use (SICTA gun club and PCYC mini-bike club)
- Renewable energy production (currently operated by EDL).

The proposal site would be contained entirely within the existing LHRRP including a portion of land currently leased to SICTA. Leachate is transported to Lucas Heights 1 for treatment.

ANSTO's Lucas Heights Research Facility is located to the south east of the proposal site on the southern side of New Illawarra Road. The facility has a 1.6 km buffer boundary zone, in which lies approximately 116 ha (57%) of the LHRRP (as shown on Figure 20.1). ANSTO land comprises the land within the ANSTO buffer zone. The remainder of the LHRRP is owned by SITA. The ANSTO land is leased to SITA for landfilling and operations associated with the existing RRC, GO facility and the PCYC mini bike club. Under the current lease agreement between SITA and ANSTO, it is the intention that post expiry of the existing consent the site would be made available as parkland[9].

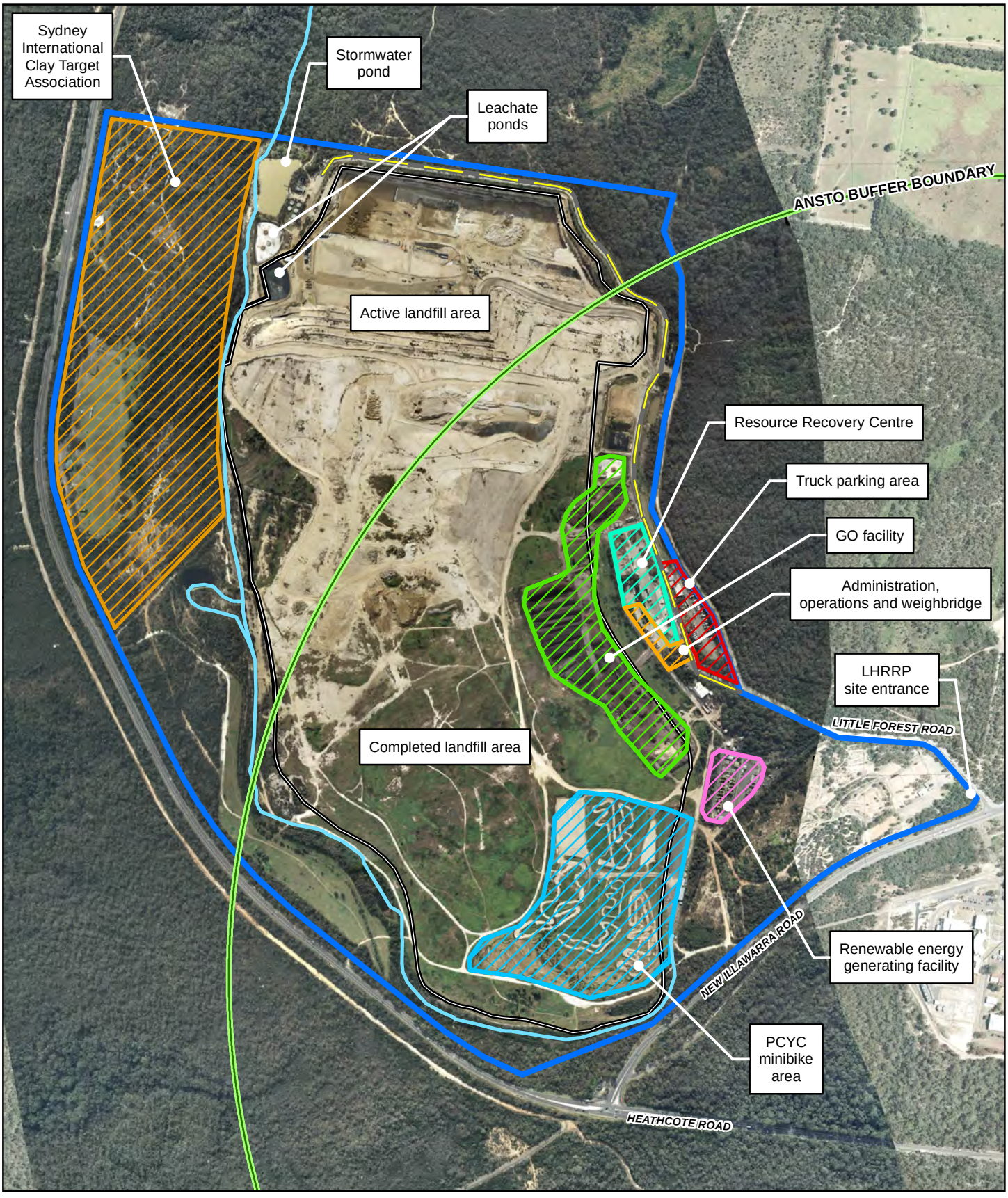
Other areas within the LHRRP are leased to third parties including SICTA in the north west of the LHRRP site, the PCYC which operates a minibike club in the southern precinct of the LHRRP site and the renewable energy production facility in the south west of the LHRRP.

A new masterplanned community at West Menai (known as Heathcote Ridge) is proposed for the area to the north of the proposal. The proposed new community would include 2,400 residential dwellings in a number of discrete pockets and commercial and business areas. Much of the masterplanned area is set aside for conservation purposes. The nearest new residential area is proposed to be located approximately 1 to 1.5 km to the north-east of the proposal site adjacent to New Illawarra Road.

As shown in Figure 20.2, the proposal is located in the following zones under the SLEP:

- SP1 – Special activities (Waste and Recycling)
- RE1 – Public Recreation

[9] With individual uses subject to approval by ANSTO as per the 1999 EIS



LEGEND

- ANSTO buffer boundary
- Internal access road
- Approved landfill footprint
- Lucas Heights Resource Recovery Park boundary
- Sydney International Clay Target Association
- GO facility
- Resource Recovery Centre
- Administration, operations and weighbridge
- Renewable energy generating facility
- PCYC minibike area
- Truck parking area

Paper Size A4

0 75 150 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Job Number	21-23482
Revision	A
Date	28 May 2015

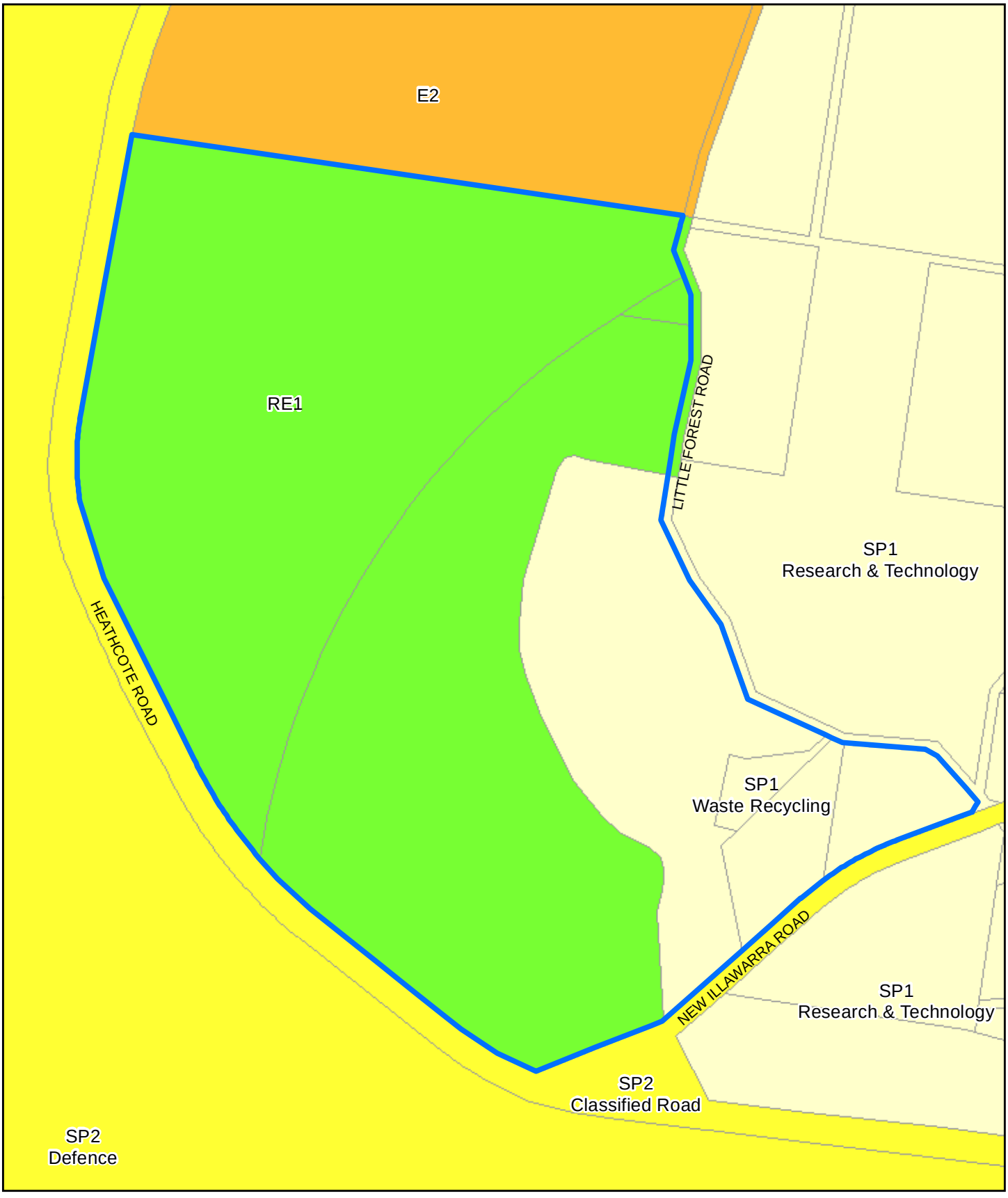
Land ownership

Figure 20.1

15/133 Castlereagh Street Sydney NSW 2000 Australia T 61 2 9239 7100 F 61 2 9239 7199 E sydmail@ghd.com W www.ghd.com

N:\AU\Sydney\Projects\21\23482\GIS\Maps\MXD\21-23482-Z012_ExistingKeyInfrastructure6.mxd

Aerial Imagery: ESRI, 2014. Works: GHD/SITA, 2014. Roads: NSW LPMA, 2012. Created by:jrichardson



Legend

- Lucas Heights Resource Recovery Park boundary
- E1
- E2
- RE1
- SP1
- SP2

Paper Size A4

0 37.5 75 150 225 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Existing zones for the site under the Sutherland LEP

Job Number 21-23482
Revision A
Date 08 Jul 2015

Figure 20.2

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

G:\21\23482\GIS\Maps\MXD\21-23482-Z027_CadastreZones3.mxd

Data source: SITA Australia. Created by:apmiller

20.2 Assessment of potential impacts

Impact on existing landuse

The proposal is not considered to significantly impact on existing land uses as the proposal would be entirely confined to lands which are currently used for the existing LHRRP. The potential indirect impacts to surrounding land uses, including noise, odour and others have been assessed in Chapters 9 through 22.

Part of the proposal associated with the ARRT facility would be located on land leased to SICTA and which is currently used as a shooting range. The land take associated with this new facility is estimated to be approximately 1.2 hectares and has been initially located to be outside of the danger zone (approximately 200 m from the firing points) and therefore should not impact on SITCA activities. Preliminary discussions have been undertaken with SICTA regarding the proposed use of this land. The land also contains native vegetation which would need to be cleared as part of the proposal. These impacts have been assessed as part of the biodiversity assessment (Chapter 19).

Part of the proposal is also located within ANSTO's Lucas Heights Research facility buffer boundary zone. The impacts of the proposal being located within this zone are considered to be minimal as these works would be similar to works conducted in the same location previously. The proposal to relocate the existing GO facility further to the north and west would also move it further from ANSTO and therefore likely to result in reduced odour impacts.

Future parkland

As outlined previously, the current consent allows for a future parkland covering most of the site. The proposal recognises that the amenity of the parkland would be improved once landfilling and other operations are discontinued in adjacent areas and seeks to have all waste activities cease at the site before the intended parkland becomes available in 2039. Although the availability of the parkland for community uses would be delayed (14 years later than currently intended), as a result of incorporating the existing GO facility into the future parkland area, the overall area available for passive recreation in the future would be increased by 25 ha.

The final uses for the parkland have not been determined, however uses may include viewing areas, general open space, recreational trails, water bodies and vehicular access. The parkland has been designed to be compatible with the existing adjacent facilities.

The site would contain extensive areas of open space. The parkland would provide primarily for passive recreational uses. The detailed design of the parkland would not fully emerge until completion of the final stage of reprofiling in 2037.

Grading and landscaping of all site areas has been developed to provide maximum flexibility to accommodate the possible needs of future generations. Large, gently undulating and sloping spaces edged with trees and pathways would be able to cater for a range of different activities.

Future uses of the open space areas could include (but are not limited to):

- A model aeroplane flying area
- Dog training and dog walking
- Picnic areas
- Walking and cycling tracks
- Kite flying
- Equestrian uses / stables
- Archery

- Tai-chi
- Informal ball-games
- Grass skiing
- Family recreation areas

A model aeroplane flying area would be located in a section on the northern boundary of the site in accordance with a Council resolution on the matter.

The final uses of the parkland would be determined by SSC based on community needs at the time. This would be undertaken in 2035 in accordance with the Voluntary Planning Agreement and in consultation with the community and ANSTO as appropriate.

Further information about the proposed parkland and future use options are included in Appendix R.

Post closure responsibilities

As discussed in Chapter 23, SITA would enter into VPA with SSC in accordance with the requirements of the EP&A Act. The Minister for Planning would consider the VPA along with the DA and EIS and would be the consent authority for the proposal. All SITA entities (SembSITA, WSN Environmental Solutions and SITA Australia) and SSC would be signatories to the VPA.

The VPA commits SITA to providing significant financial resources to SSC and the community to enable it to develop additional community facilities throughout the Sutherland Shire like the Ridges Sporting Complex and golf course. Under the VPA, SITA is committing to meet a number of environmental obligations in terms of actions it will take based on the site's environmental performance.

Once the GO facility and ARRT facility have been decommissioned and the parklands facilities established by 2039. SITA would maintain the landscaping of the landfill area for two years (2040 and 2041) prior to the transferal of maintenance responsibilities to SSC.

The post closure EMP (Appendix V) has been prepared and outlines the environmental and operational activities associated with the management of various aspects at the LHRRP site following the cessation of waste related activities. This includes the management of:

- Landscaping
- Stormwater infrastructure
- Roads and cycle paths
- Facilities, including composting toilets
- Landfill cap

Further detail on the post closure arrangements is contained in Appendix R. Details are provided in the VPA attached as Appendix W. Post closure responsibilities are also summarised in Chapter 23 and detailed in the VPA.

Planning proposal

The proposed reprofiling of the landfill is considered a prohibited development type within the SP1 and RE1 zones under the SLEP. The proposed ARRT and GO facilities are considered a prohibited development within the RE1 zone. Therefore a planning proposal has been prepared to enable the proposed activities at the proposal site. Details of the planning proposal are provided in Section 2.2.2. It is noted that the planning proposal does not apply to the entire

LHRRP. It applies to the proposal site and excludes the majority of the SICTA leased land and the PCYC land.

As a result of the potential impacts of the proposal on land currently occupied by ANSTO (Commonwealth-owned land), a referral under the EPBC Act was prepared and submitted to the Commonwealth Minister for the Environment.

On 13 April 2015 a decision was recorded that the proposal is not a controlled action and that no further assessment and approval under the EPBC Act is required before it can proceed (EPBC Ref: 2015/7432). Since this decision was received, the proposed stormwater pond to the north of the ARRT facility has been extended to the north slightly, and the Commonwealth Department of the Environment was advised in writing and given opportunity to respond. To date, no further advice has been received to contradict this original ruling. As the changes to pond size and shape were minor, it is concluded that the proposal continues not to be considered a controlled action. Should this not be the case, and advice is received from the Department to this effect following or during exhibition of the EIS, this would be noted in the Submissions Report.

A copy of the referral correspondence is included in Appendix B.

20.3 Mitigation and management measures

The main mitigation measure proposed is the submission of a planning proposal to enable proposed activities under the SLEP.

21. Greenhouse gas

The information presented in this chapter is based on the findings of the greenhouse gas assessment undertaken by GHD. The greenhouse gas assessment report is included in Appendix O of this EIS.

21.1 Approach and methodology

The greenhouse gas assessment was prepared in accordance with the general principles of:

- *The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, Revised Edition,* developed by the World Resource Institute and the World Business Council for Sustainable Development (GHG Protocol).
- The Commonwealth National Greenhouse and Energy Reporting (Measurement) Determination 2008.
- The Commonwealth Department of the Environment *National Greenhouse Accounts (NGA) Factors*, July 2014 (DoE 2014).

These are considered to represent current good practice in Australian greenhouse gas accounting.

Scenarios assessed

Two scenarios were included in the greenhouse gas assessment:

- Baseline scenario: do nothing scenario with the existing landfilling operating for a further 12 years
- Proposal scenario: as defined in Chapter 6 (landfill reprofiling, GO facility relocation and expansion and ARRT facility operation)

Greenhouse gases considered

The greenhouse gases and associated global warming potential considered in this assessment are listed in Table 21.1. The global warming potentials were sourced from the National Greenhouse Accounts Factors - July 2014.

Table 21.1 Greenhouse gases and 100 year global warming potentials

Greenhouse gas	Global warming potential
Carbon dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 – 11,700
Perfluorocarbons (PFCs)	6,500 – 9,200
Sulphur hexafluoride (SF_6)	23,900

Emission scopes

Emissions have been separated into Scopes 1, 2 and 3 in accordance with the GHG Protocol. These scopes are defined as follows:

1. Scope 1 emissions are greenhouse gas emissions created directly by a person or business from sources that are owned or controlled by that person or business.

2. Scope 2 emissions are greenhouse gas emissions created as a result of the generation of electricity, heating, cooling or steam that is purchased and consumed by a person or business. These are indirect emissions as they arise from sources that are not owned or controlled by the person or business who consumes the electricity.
3. Scope 3 emissions are greenhouse gas emissions that are generated in the wider economy as a consequence of a person's or business's activities. These are indirect emissions as they arise from sources that are not owned or controlled by that person or business but they exclude Scope 2.

Boundary of assessment

The assessment included emissions from the following activities:

- fuel combustion during waste collection
- fuel combustion by vehicles at the facility
- fugitive emissions from the landfill
- combustion of landfill gas
- composting
- electricity sourced from the grid.

The boundary of the assessment did not consider the consequential impacts on greenhouse gas emissions due to the recovery of materials at the ARRT facility. It is likely that the recovery and reuse or recycling of such materials would be less emissions intensive than the production of equivalent material.

21.1.1 Objectives

In addition to addressing the SEARs, the greenhouse gas assessment proves an assessment of how well the proposal meets SITA's objectives.

The following objectives have been identified:

- No significant impacts on the community or environment
- Minimising landfill gas emissions to the atmosphere
- Recovery of energy from gas
- Efficient landfill gas extraction.

21.2 Existing environment

The Commonwealth Department of the Environment estimates annual greenhouse gas emissions for Australia in order to fulfil reporting requirements of the United Nations Framework Convention on Climate Change and the Kyoto Protocol. The latest breakdown of Australia's GHG emissions by state and territory was published by the Department of the Environment for 2011/12 (DoE 2014).

Australian and NSW total greenhouse gas emissions for 2011/12 were estimated as 554.6 million tonnes of carbon dioxide equivalent (Mt CO_2-e) and 154.7 Mt CO_2-e respectively. A breakdown of greenhouse gas emissions by sector is provided in Table 21.2.

Table 21.2 Australia and NSW greenhouse gas emissions in 2011-12

Sector	Australia emissions (Mt CO_2-e)	Percentage of Australia emissions	NSW emissions (Mt CO_2-e)	Percentage of NSW emissions
Energy	413.4	74.5%	116.8	75.5%
Industrial processes	31.2	5.6%	11.1	7.2%
Agriculture	87.4	15.8%	17.2	11.1%
Waste	11.7	2.1%	3.8	2.5%
Land use, land use change and forestry	10.9	2.0%	5.8	3.7%
Total	**554.6**	**-**	**154.7**	**-**

21.3 Assessment of potential impacts

The greenhouse gas emissions for the operations phase of the proposal were calculated based on fuel consumed by collection vehicles, fuel and electricity consumed at the facility, fugitive emissions from the landfill and composting, and emission from the combustion of landfill gas.

Scope 1, 2 and 3 emissions for the baseline and proposal scenarios are summarised in Table 21.3. Total emissions were estimated at approximately 5.3 million t CO_2-e for the baseline and 14 million t CO_2-e for the proposal. The greater estimated emissions for the proposal compared to the baseline scenario is due to the increased life of the landfill and the increase in waste received over the life of the landfill.

Average annual emissions for the baseline scenario (based on 10 years of operation and 50 years post operations) were estimated as 88,950 t CO_2-e.

Average annual emissions for the proposal scenario (based on 23 years of operation and 50 years post operations) were estimated as 191,548 t CO_2-e. The entire greenhouse gas inventory is included in Appendix O.

Table 21.3 Summary of greenhouse gas emissions for the proposal

Phase	Scope 1 (t CO_2-e)	Scope 2 (t CO_2-e)	Scope 3 (t CO_2-e)	Total (t CO_2-e)
Baseline	5,327,456	2,705	6,860	5,337,021
Proposal	13,751,813	187,746	43,479	13,983,039

The emissions intensities were estimated at approximately 1.24 t CO_2-e per tonne of waste received for the baseline scenario and 0.77 t CO_2-e per tonne of waste received for the proposal scenario. Therefore the emissions intensity of the proposal is lower than the baseline scenario.

The same quantity of waste proposed to be sent to the LHRRP would be sent to an alternative facility in the absence of the proposal. The emissions from the disposal of waste in an alternative landfill have not been considered as part of this assessment.

The emission sources contributing the most to the overall inventory are listed in Table 21.4 for the baseline scenario and Table 21.5 for the proposal scenario.

Fugitive emissions from the landfill, the combustion of landfill gas and diesel consumed in vehicles at the facility were predicted as the greatest emission sources for the baseline scenario. These emission sources were predicted to contribute 99% of the total greenhouse gas emissions for the baseline scenario.

Fugitive emissions from the landfill, electricity sourced from the grid and the combustion of landfill gas were predicted as the greatest emission sources for the proposal scenario. These

emission sources were predicted to contribute 97.2% of the total greenhouse gas emissions for the proposal scenario.

Table 21.4 Summary of major greenhouse gas emissions sources (baseline scenario)

Emission source	GHG emissions (t CO_2-e)	Percentage of proposal emissions
Fugitive emissions from landfill	5,075,801	95.1%
Combustion of landfill gas	146,322	2.7%
Diesel consumption by vehicles at the facility	62,485	1.2%
Total	5,075,801	99.0%

Table 21.5 Summary of major greenhouse gas emissions sources (proposal scenario)

Emission source	GHG emissions (t CO_2-e)	Percentage of proposal emissions
Fugitive emissions from landfill	13,102,416	93.7%
Composting	275,540	2.0%
Electricity sourced from the grid	216,127	1.5%
Total	13,594,082	97.2%

The greenhouse gas emissions over the life of the proposal were estimated at approximately 13,983,039 t CO_2-e. The proposal scenario included 23 years of operations and 50 years of methane emissions post closure of the landfill. The average annual emissions over this time period were estimates as approximately 191,548 t CO_2-e per year. The 2011/12 greenhouse gas emissions for NSW (which is the latest available National Inventory Report) were approximately 154.7 Mt CO_2-e per annum.

Therefore the average annual emissions for the proposal are estimated to be approximately 0.12 percent of total annual emissions in NSW. Australia's 2011/12 greenhouse gas emissions were approximately 554.6 Mt CO_2-e per year. Therefore, the average annual emissions for the proposal were estimated to be approximately 0.035 percent of Australia's annual emissions.

In the absence of the proposal, the same quantity of waste proposed to be sent to the LHRRP would be sent to an alternative landfill facility. The emissions from the disposal of waste in an alternative landfill have not been considered as part of this assessment.

Currently, the average methane capture rate for landfills in New South Wales is approximately 37%, whilst it has been estimated that 67% of methane generated by the landfill would be captured for combustion and energy generation purposes. Thus the proposal has a positive impact compared to disposal of the same amount of waste at an 'average' landfill.

This greenhouse gas assessment did not consider the consequential impacts on greenhouse gas emissions due to the recovery of materials at the ARRT facility. Since it is likely that the recovery and reuse or recycling of such materials would be less emissions intensive than the production of equivalent material, the greenhouse gas impacts of the proposal would be additionally beneficial for the environment.

21.4 Conclusions

The average annual emissions for 23 years of operations of the proposal (2015 to 2037) and 50 years of methane emissions post closure of the landfill was estimated at approximately 191,548

t CO_2-e per year. This is approximately 0.12 percent of total annual 2011/12 emissions in NSW and approximately 0.035 percent of Australia's annual emissions.

The emissions intensity of the proposal was estimated to be approximately 0.77 t $CO_{2\text{-}e}$ per tonne of waste received, which is lower than the estimated emissions intensity of the baseline scenario (1.24 t CO_2-e per tonne of waste received).

The greenhouse gas assessment addresses the SEARs and concludes that the proposal would meet the following objectives:

- No significant impacts on the community or environment
- Minimising landfill gas emissions to the atmosphere
- Recovery of energy from gas
- Efficient landfill gas extraction.

21.5 Mitigation and management measures

Increasing the rate of capture and combustion of methane from the landfill from its predicted level of 67% to an even higher efficiency would be the most significant greenhouse gas mitigation option available for the proposal. Opportunities to increase the methane capture rate would be investigated on an ongoing basis, as the landfill gas system is progressively modified to accommodate the new final landfill profile during the entire operational life of the proposal. Improvements could therefore be made as new knowledge/techniques/technology becomes available.

Since the EIS studies were commenced, SITA has installed twenty nine additional landfill gas collection wells at the LHRRP. In addition, as part of the site specific odour monitoring, a number of localised emission points were identified. Subsequent surface gas monitoring has confirmed that they have since been rectified.

Furthermore, SITA would continue to work with its landfill gas management contractor to refine the landfill gas extraction and oxidation system in identified major emissions contributing areas – which are currently the existing northern batter and two areas of intermediate cover.

SITA would also continue to undertake regular testing and monitoring to identify any other major emissions contributing areas to ensure the ongoing landfill gas management system is effective. This would include subsurface gas and accumulation monitoring in accordance with environment protection licence frequency requirements (currently bi-monthly). Should gas monitoring identify any other major emission contributing areas, rectification measures would be implemented to improve gas extraction and oxidation in these areas.

Other greenhouse gas mitigation strategies that could possibly be implemented at the LHRRP are listed below:

- implement energy efficient practices and equipment to minimise electricity consumption
- install solar panels on large roof areas e.g. ARRT buildings.
- utilise biofuels used in collection and facility vehicles.

These additional strategies would be investigated at the detailed design stage.

Furthermore, a comprehensive list of prevention, mitigation and rectification measures for landfill gas management have been identified and are detailed in the LHRRP OEMP (Appendix S). The identified mitigation and rectification measures would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

Examples of key measures that are included in the LHRRP OEMP include:

- Installation of landfill gas extraction wells in the completed areas to control gas migration
- Progressive installation of landfill gas wells in operational areas as the landfill develops
- Preparation and regular review of the emergency plan and emergency procedures
- Implementation of a program for scheduled monitoring of landfill gas (surface and subsurface).

22. Litter, illegal dumping and other issues

This chapter provides an assessment of other issues including:

- Heritage
- Riparian corridors
- Litter and illegal dumping
- Socio-economic
- Cumulative impacts

22.1 Heritage

The information presented in this section is based on the findings of the Heritage Assessment undertaken by Artefact Heritage. The full report is attached as Appendix P.

22.1.1 Existing environment

Aboriginal heritage searches

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on 26 February 2015 for an area that included the entire proposal site and some of the surrounding area. The search identified a total of 48 items. The most frequent site feature identified was art sites, followed by areas of potential archaeological deposit.

There were four registered sites located within the search area. These sites are summarised in Table 22.1. The sites are located within the central portion of the landfill area and have all been impacted by landfill activities.

Table 22.1 Registered AHIMS sites within LHRRP

Site name	AHIMS #	Site feature
Mill Creek 13; Engadine	52-2-1029	Artefact
Mill Creek 12; Engadine	52-2-1030	Artefact
Mill Creek 11; Engadine	52-2-1031	Art (pigment or engraved)
M14; Upper Mill Creek	52-2-1108	Artefact

Non-Aboriginal heritage searches

A search of the following heritage databases or lists was undertaken on 17 April 2014:

- Register of National Estate (National Heritage List)
- National Trust Register
- State agency Section 170 registers (searched via the State Heritage Inventory)
- State Heritage Register
- Sutherland Local Environmental Plan 2006
- Draft Sutherland Local Environmental Plan.

No heritage items listed under the Register of National Estate, National Trust Register, State Heritage Registers or Section 170 registers were identified on the site or in the surrounding area.

The SLEP was gazetted on 23 June 2015. A search of the SLEP was undertaken on 1 July 2015. A single item listed on the SLEP is located partly within the north-eastern portion of the study area:

- Item no. 2802 - *Eucalyptus paniculata* (Grey Ironbark)

Only a very small part of this item is located within the north-eastern tip of the LHRRP site (blue boundary on Figure 22.1) as shown in brown on Figure 22.1.

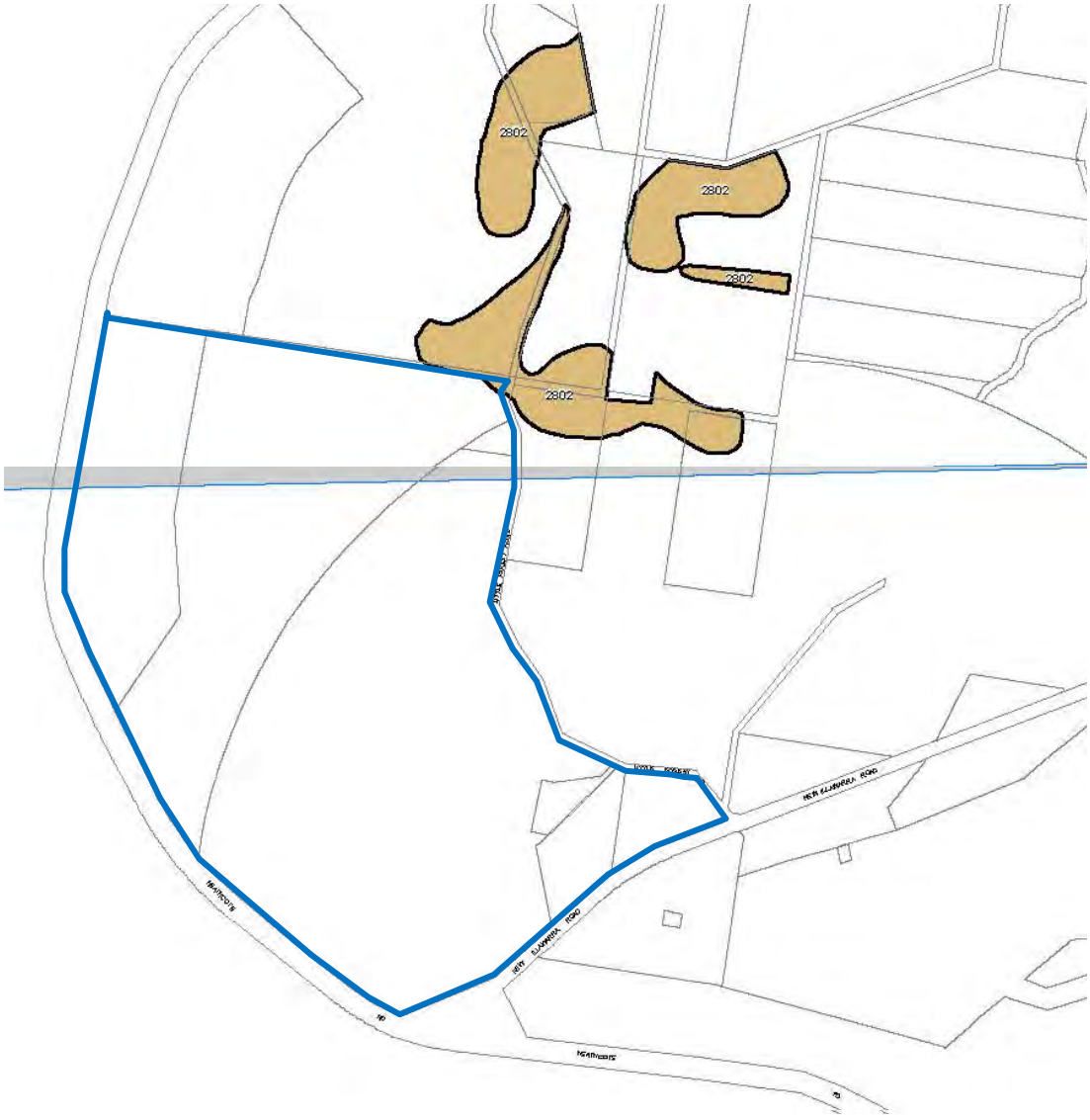


Figure 22.1 Heritage under the Sutherland Local Environmental Plan

Source: Extract from Sutherland Local Environmental Plan 2015 – (NSW Legislation Website)

22.1.2 Assessment of potential impacts

Site inspection

An inspection of the study area was conducted on foot by Artefact on 2 March 2015. SITA provided a representative for the inspection. The study area was inspected to determine whether there are Aboriginal objects or non-Aboriginal relics on the surface or beneath the ground surface. The central portion in which the AHIMS registered sites are located and the location for the proposed ARRT and GO facilities were the main focus of the site visit.

AHIMS sites

The AHIMS sites were visited and were found to be within the footprint of the former landfill zone. The entire landscape within this footprint has been completely disturbed and reformed to its present state. The sandstone formations in which the rock shelters at AHIMS sites 52-2-1030, 52-2-1031 and 52-2-1029 are no longer visible and have been destroyed. Likewise the open artefact scatter at 52-2-1108 was destroyed in the construction of the landfill site. It is understood permits were obtained for the destruction of these sites (permit numbers 69,636).

As such there has been a total loss of heritage values for the sites. A Site Impact Recording form would be submitted to OEH for each site to update their status on the AHIMS.

ARRT facility and GO facility areas

The location for the proposed ARRT facility and GO facility was inspected. This area was originally cleared as part of the original landfill construction and included the redirection of Mill Creek. Artefact (2015) identified that no Aboriginal objects or areas where Aboriginal objects are likely to occur beneath the ground surface were identified within the study area. Similarly no non-Aboriginal heritage items or areas of archaeological potential were identified within the areas inspected.

Aboriginal heritage values and non-Aboriginal archaeological potential

The preliminary heritage assessment found that there are no known Aboriginal objects within the study area. The proposed impact area has a low archaeological potential. There are no known intangible or cultural Aboriginal heritage values associated with the study area. It has been a landfill site for many years therefore any values are likely to have been previously impacted. It is therefore unlikely that Aboriginal heritage values would be impacted by the proposal.

There is one LEP listed item partially within the study area. The stand of *Eucalyptus Paniculata*, or Grey Ironbark would not be impacted by the proposal. As the site has been used for a landfill for many years, additional visual impacts to the LEP item are unlikely.

The study area has been assessed as having low non-Aboriginal archaeological potential and therefore impacts to relics are unlikely.

22.1.3 Mitigation measures

The following mitigation measures are proposed:

- An unexpected finds procedure would be developed and included in the CEMP. This would outline the procedures to follow if unexpected Aboriginal objects or non-Aboriginal relics were uncovered during construction.

- Site Impact Recording Forms for the previously impacts sites, AHMS 52-2-1108, 52-2-1029, 52-2-1030 and 52-2-1031 would be submitted to OEH.

22.2 Riparian corridors

22.2.1 Existing environment

The LHRRP occupies a sandstone plateau that is drained by the upper reaches of Mill Creek. Based on the current Land and Property Information GIS hydroline dataset, Mill Creek is a first order waterway. At the downstream extent of the LHWMC, Mill Creek has a catchment area of approximately one square kilometre.

As a result of the construction of the landfill the original stream line of the site has been progressively shifted west. This new channel has been largely excavated into the surrounding sandstone and is trapezoidal in cross-section. The channel adjacent to the GO/ARRT facility has typical bankfull dimensions in the order of 12 to 15 m wide and 1.5 to 2.5 m deep.

In its upstream extent Mill Creek exhibits a densely vegetated swamp environment inset within a narrow valley incised into the sandstone plateau. The stream gradients here are relatively gentle (less than 1 %) resulting in relatively low stream flow energies. Downstream from the proposed GO/ARRT facility the creek gradient increases up to 20 % and the creek is currently lined with fabriform. This steep gradient generates high flow velocities that limit the deposition of sediments within the channel.

22.2.2 Assessment of potential impacts

Under the WM Act the NOW is required to assess the impact of any proposed controlled activity undertaken on waterfront land. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary. This means that a Controlled Activity Approval must be obtained from NOW before commencing any controlled activity within waterfront land.

NOW have developed the Guidelines for Riparian Corridors on Waterfront Land 2012 (the RC guideline) to provide flexibility and certainty for the developer/landholder by providing for the minimum requirements. The RC guideline outlines a set of criteria for riparian corridors based on the Strahler stream order, including requirements for Vegetated Riparian Zone (VRZ) widths and a riparian corridor matrix which enables applicants to identify certain works and activities that can occur on waterfront land and in riparian corridors. Where suitable, applicants may undertake non-riparian corridor works or development within the outer 50 per cent of a VRZ, as long as the encroachments are offset by connecting an equivalent area to the riparian corridor within the development site.

Based on the current Land and Property Information (LPI) spatial hydroline dataset, Mill Creek is a first order waterway through the LHRRP. Under the RC guideline, first order streamlines are to have minimum riparian corridor widths consisting of the channel zone which comprises the bed and banks of the watercourse (to the highest bank) and a 10 m VRZ either side of the channel zone.

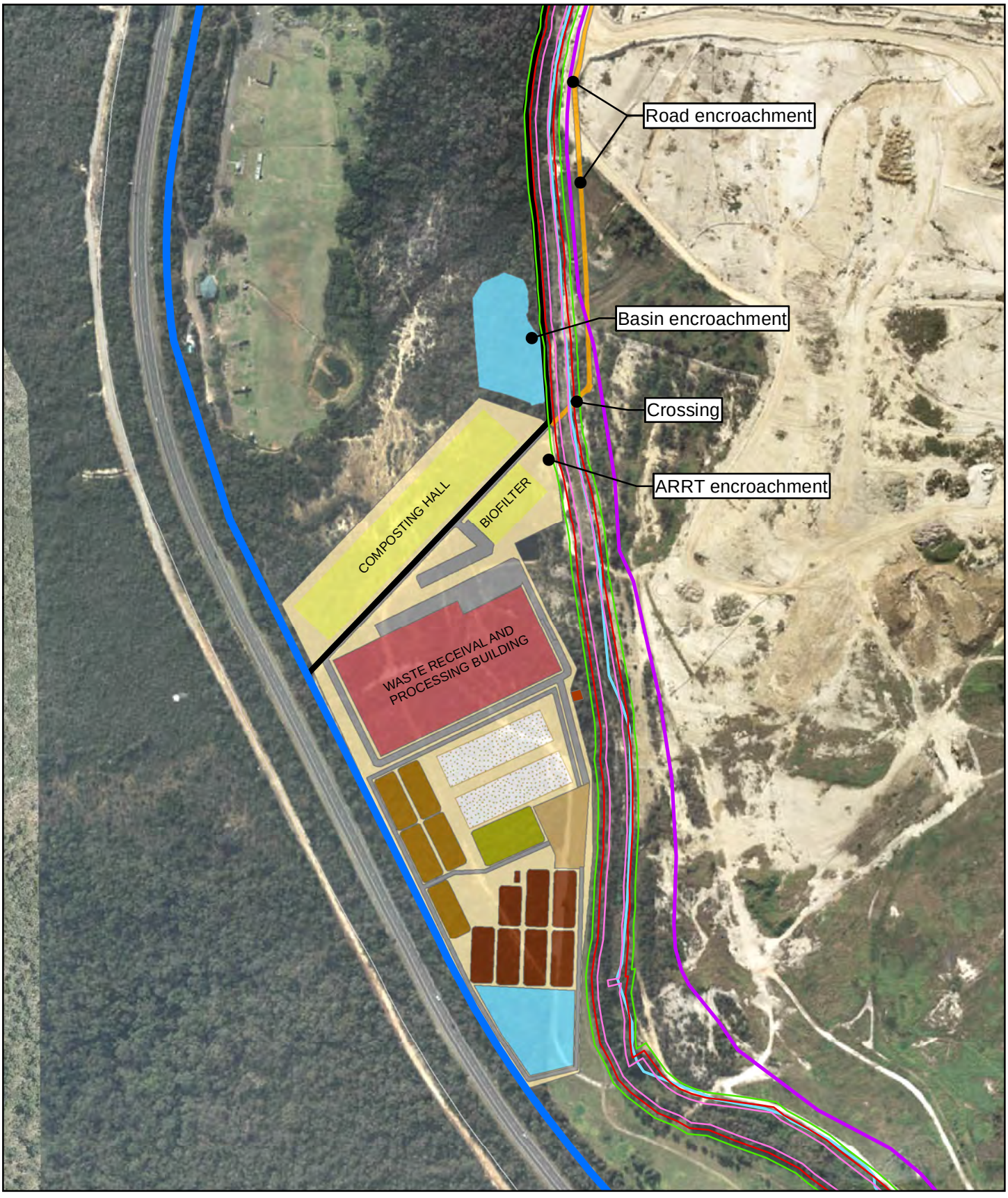
Table 22.2 provides the details for first order streamlines from the riparian corridor matrix contained within the RC guideline. This sets out the certain works and activities that can occur on waterfront land and in the riparian corridors of first order streamlines.

Table 22.2 Riparian Corridor matrix for first order streamlines – permitted activities

Vegetated Riparian Zone Width (VRZ)	Off-setting for non-riparian uses	Cycleways and paths	Detention basins		Stormwater outlet structures and essential services	Stream realignment	Road crossings
			Within outer 50% of the VRZ	Online			
10 m	Yes	Yes within outer 50% of the VRZ	Yes	Yes	Yes	Yes	Culverts or bridges permitted

To apply the RC guideline requirements to the proposal, the top of bank of Mill Creek was mapped based on a combination of GPS points recorded during a site inspection, topographic survey and aerial imagery interpretation. The top of bank line was subsequently amended to reflect the proposed approximate 120 m realignment of Mill Creek associated with the proposal. The revised top of bank lines were then offset by 5 and 10 m to delineate the inner and outer 50 % of the VRZ.

The resultant outputs of the riparian corridor mapping are displayed in Figure 22.2. Comparison with the proposal layout indicates a number of encroachments by the proposal into the delineated riparian corridor as displayed in Figure 22.2 and summarised in Table 22.3. This includes encroachments into both the outer and inner 50 % of the VRZ.



LEGEND

- LHRRP boundary
- Access road
- SICTA boundary
- Creek
- Landfill area
- Top of Bank

VRZ Buffers

- 10 metre
- 5 metre

Paper Size A4

0 15 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

SITA Australia
Lucas Heights Resource Recovery Park

Riparian Corridors

Job Number	21-23482
Revision	A
Date	05 May 2015

Figure 22.2

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

N:\AU\Sydney\Projects\21\23482\GIS\Maps\MXD\21-23482-Z057_Riparian.mxd

Aerial Imagery: GOOGLE, 2014. GO&ARRT: GHD/SITA, 2014. Roads/Suburb: NSW LPMA, 2012. Created by:jrichardson

Table 22.3 Proposal encroachments into the Riparian Corridor

Item	Activity permitted in VRZ	Area in outer 50 % of VRZ (m^2)	Area in inner 50 % of VRZ (m^2)
ARRT facility	Yes, if within outer 50 %	90	0
Stormwater Basin	Yes, under detention basins if within outer 50 % in RC matrix	75	0
Road	Yes, if within outer 50%	435	0
Bridge	Yes, under road crossings in RC matrix.	120	155
TOTALS		720	155

All encroachments within the outer 50 % of the VRZ are considered permitted activities which would require offsetting on site. The encroachment of the bridge within the inner 50 % of the VRZ is also a permitted activity that would require offsetting. As a result, a minimum total of 875 m^2 would require offsetting on site.

22.2.3 Mitigation measures

A minimum of 875 m^2 of riparian offsets would be provided on site for the permitted activities. These offsets would be integrated into the overall biodiversity offsets strategy for the proposal (refer Section 19.4.3).

22.3 Litter and illegal dumping

22.3.1 Existing environment

Combating litter and illegal waste dumping is a major priority for the NSW Government. Goal 22 (Protect our Natural Environment) in the NSW 2021 plan identifies the reduction in illegal dumping as a priority and the NSW EPA has a strategic waste enforcement and compliance program. The program also supports and provides assistance to public land managers and councils to help them combat litter and illegal dumping.

SITA is committed to support the Local and State Government's goal to reduce litter and illegal dumping. It is SITA's goal to prevent litter from entering Mill Creek, spreading off the site into bushland such as the Lucas Heights Conservation Area and other areas adjacent to the site including sections of Little Forest Road, Heathcote Road and New Illawarra Road.

22.3.2 Assessment of potential impacts

Litter

Transportation of waste to the LHRRP has the potential to generate litter via improper containment of loads. SITA vehicles accessing the site would be suitably enclosed in accordance with Clause 70 of the Protection of the Environment Operations (Waste) Regulation 2014 which requires waste transported by a vehicle to be covered during its transportation. This prevents:

- spills onto the road which creates dust and litter
- pollution of waterways due to dust, soil and litter escaping from uncovered vehicles

It is also possible for wind-blown material from the landfill to escape from the site. Litter can spread throughout the surrounding area during windy conditions. By taking appropriate precautions during landfilling operations, wind-blown litter will be predominantly contained and managed within the landfill area.

Receipt of mixed waste and processing at the ARRT would occur within buildings and therefore potential litter impacts from the ARRT are low. The GO facility would continue to receive source separated garden organic with low potential for litter.

Through this proposal, SITA would continue to implement and improve management/mitigation of litter through implementation of the measures documented in the LHRRP OEMP and summarised in Section 22.3.3 below. This will therefore reduce the possibility of litter entering the surrounding areas.

Illegal dumping

Illegal dumping has been prioritised by the NSW Government. In July 2015, the NSW EPA published an Illegal Dumping Research Report (NSW EPA, 2015) which explores the motivations of people who dump waste illegally, and the influential factors which may bring about a change in behaviour among these groups of people. This research provides a benchmark for monitoring changes in attitudes, behaviours and experiences relating to illegal dumping.

Key findings from the report are:

- illegal dumping is a growing problem
- household waste on the kerbside is the most common form of illegal dumping
- illegal dumping is not necessarily confined to any particular demographic

The relatively isolated nature of the LHRRP means that illegal dumping can occur in the surrounding area. It is more difficult to control illegal dumping and materials that emanates from transportation.

Through this proposal, SITA would work closely with SSC and relevant stakeholders to combat illegal dumping. Details of the initiatives are described in Section 22.3.3 below.

In addition, the NSW EPA and Roads and Maritime Services have programs and responsibilities for managing litter and illegal dumping external to the site.

22.3.3 Mitigation measures

SITA is committed to preventing litter and support the reduction of illegal dumping in the Sutherland Shire. A range of mitigation measures are proposed and described below.

Support to Regional Illegal Dumping (RID) squads

Regional Illegal Dumping (RID) squads are regionally based teams that specialise in dealing with illegal dumping and illegal landfilling. The squads are funded by the NSW EPA and the member local councils who opt to work together and pool resources to tackle illegal dumping.

Working across local government boundaries, the squads use a strategic, coordinated approach to preventing illegal dumping and focus on the particular issues within their region.

RID Squads:

- identify and patrol illegal dumping hotspots

- investigate illegal dumping incidents and take action against offenders
- organise clean-ups
- track down illegal landfills
- identify changes and trends in illegal dumping across a regional area
- deter and educate community members about illegal dumping
- run joint compliance campaigns with the EPA, WorkCover, NSW Police and other regulatory authorities

SSC has recently joined the RID Squad program and committed $70,000 a year for a two-year trial period.

Engage with stakeholders regarding illegal dumping

SITA has participated in workshops and forums that involves a range of stakeholders including the following government agencies and community groups to combat litter and illegal dumping:

- Roads and Maritime Services (RMS)
- NSW Rural Fire Service (NSW RFS)
- NSW Police Force
- LHRRP Community Reference Group (CRG)
- Gandangara Local Aboriginal Land Council (Gandangara LALC)
- ANSTO
- NSW EPA
- RID Squad
- Local residents

Recent workshops include:

- Workshop held on 30 October 2014 to address illegal dumping on Gandangara Land. A suggested project plan was put forward to addressing the issues.
- Workshop held on 29 July 2015 to discuss grant funding for illegal dumping and prevention measures in and around Heathcote Road, Old Illawarra Road, New Illawarra Road and GLALC site.

SITA will continue its participations and engagement with neighbours and stakeholders and contribute to tackling the issue of illegal dumping in the area.

LHRRP Operations Environmental Management Plan

A comprehensive list of prevention, mitigation and rectification measures for litter and illegal dumping have been identified and are detailed in the LHRRP OEMP (Appendix S). The OEMP details the facilities, operations, and environmental conditions at the LHRRP as well as emissions applicable to each site, and guides employees on the ways in which these are to be managed.

The identified mitigation and rectification measures in the OEMP would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

Examples of key measures in relation to litter management are included in the LHRRP OEMP include:

- Monitor weather conditions to anticipate upcoming high wind periods
- Continuous waste compaction and daily covering of all waste
- Operation of wheel wash facility to remove any mud and potential litter from landfilling related transport vehicles leaving the site during wet weather
- Ensuring that trucks transporting material from the premises have their loads covered and tailgates securely fixed
- Implementation of a customer awareness campaign including signs and handouts
- All loads to be covered during transport to and within the site
- Take all actions necessary to prevent the generation of litter
- Providing litter bins for personnel on the site
- Implementation of a user awareness campaign including signs and handouts
- Screening in and around the site

SITA in consultation with SSC has established the following key performance indicator (KPI) for litter:

- No litter arising from landfill operations or the transportation of waste to and from the facility, in the surrounding areas including:
  - Mill Creek, Environmental Buffer Area and Lucas Heights Conservation Area
  - New Illawarra Road (both sides from Heathcote Road to the hill past the ANSTO entrance gate)
  - Heathcote Road (the LHRRP side along the site boundary)
  - Little Forest Road (main entrance road)
  - General site and boundary fence

As a safeguard, if SSC identifies a need for litter to be removed, it would contact SITA advising of type of litter to be removed and its location. If the litter is not removed in a timely manner, SSC would collect the litter and SITA would fund the clean up cost. Details are provided in the LHRRP OEMP (Appendix S).

Internal audits

SITA's commitment is supported through various internal audits undertaken at the site which cover all licence and compliance related issues. Internal audits are carried out by operational staff and Environment and Workforce Safety Officers, and include daily and weekly reporting checklists, Environmental Compliance Audits and a Management System Audit. The internal audits monitor a range of environmental parameters, with a key performance parameter for landfill operations being litter.

SSC and SITA Litter and Illegal Dumping Fund

In addition to the commitments stated in the OEMP and specific actions undertaken by SITA, SSC and SITA have agreed to the establishment of a Litter and Illegal Dumping Fund dedicating in excess of $60,000 per annum for five years for preventing and combatting illegal

dumping and litter in the Sutherland Shire. SSC and SITA will form a committee to determine how the Fund will be utilised on an annual basis.

The funds would be specifically directed towards a Litter and Illegal Dumping Program to be undertaken along New Illawarra Road and Heathcote Road as well as illegal dumping hotspots within the SSC area. Fund initiatives may include:

- Establish anti-litter and illegal dumping signage on major roads
- Establish awareness signages
- Intelligence gathering and increase surveillance through patrols and/or camera surveillance to identify illegal dumping hot spots
- Community education programs and promotion campaigns for local residents to communicate key information to residents. This may be in the form of distributing pamphlets and other general advertisements to deter littering and illegal dumping. Key messages would be in line with the recommendations stated within the Illegal Dumping Research Report (NSW EPA 2015):
  - reinforce the social norm that illegal dumping is unacceptable
  - create a social norm around reporting illegal dumping
  - raise the profile of the personal consequences (i.e. magnitude of fines, prison sentences)
- Communication to LHRRP customers via pamphlets and signage at the weighbridge

22.4 Socio-economic

22.4.1 Existing environment

Sutherland Shire is located at the southern coastal border of the Sydney metropolitan area, about 26 kilometres from the Sydney central business district. Sutherland Shire is bounded by Bankstown City and the Georges River in the north, the South Pacific Ocean in the east, Wollongong City and Royal National Park in the south and Deadman's Creek, Woronora Dam and Campbelltown and Liverpool Cities in the west. It has a total area of 369 km^2

The Census population of Sutherland Shire in 2011 was 210,861, living in 82,773 dwellings with an average household size of 2.65. The Sutherland Shire Estimated Resident Population for 2013 is 223,192, with a population density of 6.05 persons per hectare. 110,466 people living in Sutherland Shire in 2011 were employed, of which 64% worked full time and 34% part time. 18% of the population earned an income of $1,500 or more per week in 2011.

More than 100 people are currently employed at the LHRRP with 40% living in the Sutherland Shire and neighbouring areas.

22.4.2 Assessment of potential impacts

Delay in availability of site for community use

Availability of the site for community uses would be delayed, however its size would be larger than the current approved parkland. The parkland would be handed back to the community once the site has been rehabilitated and landscaped. This is expected to occur in 2039.

Community benefits

Parts of the LHRRP have already been returned to the community and are used by groups such as the PCYC Mini Bike Club and SICTA. A number of additional community benefits are expected as a result of the proposal, these are summarised in the following sections.

Financial resources for the development of community infrastructure

As detailed in Chapter 23, SITA has committed to entering into a VPA with SSC. The VPA would include a $100 million financial contribution to help SSC fund community infrastructure for community use throughout the whole council area now and into the future.

Community parkland

The proposed parkland, although delayed in its availability would have the following community benefits:

- It would be approximately 25 ha larger in area than the currently approved parkland, providing more area for passive recreation and community use
- The currently approved GO facility and other waste recycling activities would have ceased and therefore the parkland would not be adjacent to these activities.

Job creation

The ARRT facility would provide opportunities for employment of up to 100 personnel during construction and an additional 50 personnel during operation.

The relocation and expansion of the GO facility is expected to provide employment for an additional 5 personnel during operation.

The landfill is expected to provide employment for up to an additional 7 personnel during peak years of operation.

Since the proposal would operate for up to 20 years, long term operational positions would be available. Most staff would be recruited locally rather than transferred from other SITA facilities.

Community and school tours

Community and school tours would continue to be run at the LHRRP for educational purposes.

Improved environmental and amenity outcomes

The proposal would have a number of improved environmental and amenity outcomes for the community. Each proposal component would deliver different benefits, as outlined below. In addition, as part of the VPA, SITA would make commitments to a number of ‘environmental undertakings’ to improve environmental management at the site in accordance with best practice principles. Further details of the environmental undertakings and the VPA are provided in Chapter 23.

Landform reprofiling:

- Reducing the generation of leachate by reducing stormwater infiltration, thereby reducing the risk of surface and groundwater impacts
- Improving the efficiency of the gas extraction system by reducing the potential for stormwater to affect the gas wells as a result of reducing the quantity of infiltrating surface water which can otherwise interfere with the efficient extraction of landfill gas (by

clogging the gas extraction system) resulting in reduced potential odour and greenhouse gas emissions

- Capturing an increased amount of landfill gas which would be used to generate power equivalent to the needs of approximately 5,700 homes
- Providing a final landform suitable for passive recreational activities

GO facility:

- Reducing odour levels at the nearest receivers through increased offset distance and improved environmental controls
- Using concrete 'bunkers' rather than standard open windrows, which is considered to be best practice
- Aeration of compost contained in bunkers which has been shown to decrease odour emissions significantly and is considered to be best practice
- Covering of the initial composting processes (which is in bunkers) where the majority of odours are normally generated, which is considered to be best practice
- Providing a long term resource recovery solution for garden organics waste from Sutherland and the Sydney region

ARRT facility:

- Providing a fully enclosed facility to reduce the potential for odour emissions from the site
- Recovering additional resources from the waste stream and diverting up to 70% of waste from landfill, using best practice technology
- Producing a compost product suitable for use on degraded soils
- Producing a PEF – which can replace gas and coal in existing power stations, cement kilns or industrial furnaces, with improved greenhouse gas impacts compared to standard fossil fuels

Amenity

Potential amenity impacts have been considered and addressed in relevant chapters of the EIS. SITA is committed to implementing best practice prevention, mitigation and rectification measures as part of the proposal. The assessments have shown that with appropriate mitigation and management, amenity impact of the proposal would not exceed the relevant performance goals and criteria identified within the relevant guidelines and policies.

SITA would continue to engage with the community throughout construction and operation of the proposal to address amenity concerns.

Economic impacts

The proposal forms a key part of SITA's business growth strategy to remain a leader in resource recovery and waste management in Australia.

The proposal has an estimated capital investment value of $94,950,000 (ex GST), current as at March 2015. Justification for the capital investment value of the proposal is included in Appendix Q.

This investment would be spent in the Sydney region through the design, construction and commissioning of the proposed new facilities and the ongoing landfilling operations.

As discussed in Chapter 5, the proposal would increase diversion of waste from landfill and lift resource recovery rates. The proposal would avoid the need to transport waste generated in the Sydney region that currently is disposed of at Belrose and Eastern Creek landfills, to distant landfills outside of Sydney and the costs associated with long-haul transport.

The proposal would also help address a current short-fall in garden organics processing capacity in Sydney's south-west by providing increasing the GO facility capacity.

As discussed in the previous section, the SITA has committed to entering into a VPA with SSC which includes a $100 million financial contribution to help SSC fund community infrastructure for community use throughout the whole council area now and into the future.

22.4.3 Mitigation measures

The following mitigation measures are proposed to address socio-economic issues associated with the proposal:

- Implementation of measures to reduce the potential for amenity impacts during construction and operation, as identified in the relevant chapters of the EIS and compilation of mitigation measures (Section 24.2) and the OEMPs and post closure EMP.
- SITA has committed to entering into a VPA with SSC. The VPA would provide a $100 million financial contribution . SSC would be able to use this package during the operation of the proposal to develop community facilities in the Sutherland Shire. A minimum of 20% of this will be spent within a 7.5 km radius of the proposal.
-
- Ongoing engagement with the community. A stakeholder engagement plan would be developed for the proposal construction and operation. This would include how information would be disseminated, communication channels including for feedback on the proposal and protocols for responses to feedback or enquiries.

22.5 Cumulative impacts

Cumulative impact assessment for the proposal has been provided in the relevant environmental impact assessment sections. This included consideration of the cumulative impact with other activities and/or developments in the area and the existing landfill operations.

The following sections provide a summary of findings for key issues which requires consideration of cumulative impacts. Details are provided in individual chapters and technical studies.

22.5.1 Air quality

Odour

As specifically requested in the SEARs, GHD undertook a quantitative assessment of all potential air quality impacts and odour impacts for the development, including cumulative, on surrounding land and sensitive receptors. The assessment considered odour emission from the landfill, proposed GO facility and the proposed ARRT facility.

Cumulative impacts due to other sites were not required to be modelled due to the fact that there are no other significant odour sources in the immediate vicinity of the proposal site. The cumulative impact of different odour sources onsite has been considered in this assessment.

Lucas Heights 1 is not a significant contributing source of odour in the area and would have a negligible influence on the odour predictions based on the odour complaint history provided by SITA.

The assessment demonstrates that the total odour emissions from the proposal site would decrease from the existing situation and that odour receptors around the proposal site are predicted to be subject to lower potential odour impacts because of the proposal. The predicted odour levels at the nearest residential receptors are below the strictest 2 OU criteria.

Dust

There is potential for dust emissions during the construction and operational phases of the project. An indicative worst-case dust modelling scenario was undertaken for the proposal site. The worst-case dust scenario considers the cumulative operations which includes both construction of the GO / ARRT facilities and operational (reprofiling) activities.

As the proposal is far from other significant operations and screened by trees, dust contribution from offsite operations are not considered in the assessment.

Dust dispersion modelling shows that potential dust impacts from the proposal will not impact adversely on any surrounding dust sensitive receptors.

22.5.2 Noise

The noise assessment has been undertaken to consider the ‘worst case’ scenario. The assessment considered noise associated with construction, operational and traffic.

For construction noise, the predictions assume that all equipment operates continuously over the construction site area. The construction of the ARRT facility and the relocation of the GO facility also occur at the same time. In reality, construction machinery would move around the proposal area altering noise patterns with respect to individual receivers.

Also, the prediction assumption was that during any given period, the machinery to be used would operate at maximum power levels whereas it is more likely that machinery would produce lower noise levels while carrying out activities not requiring full power. It is therefore highly unlikely that all construction equipment would be operating at maximum power levels at any one time and also certain types of construction machinery would be present in the study area for only brief periods. For these reasons, the construction noise predictions are considered to be conservative.

Construction activities are predicted to comply with the construction noise management levels at all residential and sensitive receivers during standard recommended hours.

For operational noise levels, the assessment was undertaken under the basis that the GO facility, ARRT facility and reprofiling activities would occur at the same time. The predicted cumulative operational noise levels at all surrounding residential sensitive receivers are below the recommended maximum operational noise criteria. It is therefore not expected to be any significant operational noise impact associated with the proposal.

The additional traffic generation due to the landfill, GO facility and ARRT facility is predicted to be not noticeable (<0.1 dB(A)). As the increase to road traffic noise emission levels is less than 2 dB(A), road traffic noise levels are predicted to comply with the noise criteria at sensitive receivers along the traffic routes.

22.5.3 Traffic

The SEARs require the traffic impact assessment to consider the safety and capacity of the surrounding road network, including consideration of cumulative traffic impacts from other developments.

The traffic impact assessment considered the background traffic growth factors from RMS as well as traffic associated with non-waste inputs.

The assessment predicts that the overall traffic increase on the New Illawarra Road and Heathcote Road is minimal and the road network has the capacity to deal with the increase. The proposal should not adversely impact the road network as long as the mitigation measures are implemented.

22.5.4 Leachate

Leachate generated at the LHRRP is transferred to the leachate treatment plant holding pond which temporarily stores leachate before it is pumped to pumped to Lucas Heights 1 for treatment and sewer discharge.

The existing leachate treatment system at Lucas Heights 1 is a sequencing batch reactor (SBR) treatment system that discharges directly to sewer at Lucas Heights 1. The leachate treatment plant also treats leachate from Lucas Heights 1 landfill and Harringtons Quarry.

The leachate assessment considered the cumulative impact of leachate from all three sources (LHRRP, Lucas Heights 1, Harringtons Quarry). The assessment predicts that the existing leachate management system has the capacity to manage the cumulative volumes of leachate from the three sources.

The leachate generated from the GO facility and the ARRT facilities are independent systems to the LHRRP operations and are therefore assessed separately.

22.5.5 Biodiversity

The proposal would increase the extent of vegetation clearing in the locality, and increase the removal of habitats for flora and fauna species, including threatened species. Other developments in the locality would also lead to a reduction in vegetation and habitats available and include a proposed development at Heathcote Ridge in the West Menai area by the GALC. The West Menai development would impact similar vegetation types to those present in the proposal footprint being assessed in this EIS, further reducing habitats available for flora and fauna in the area. In particular, it would also result in the loss of individuals of the threatened flora species *Acacia bynoeana* and *Allocasuarina diminuta* subsp. *mimica,* and would further remove habitat for a range of threatened fauna species, if approved. However the proposal is not expected to have a significant cumulative impact. The West Menai development has not yet been assessed under NSW legislation, although a strategic assessment (Cumberland Ecology 2012) has been approved by the Commonwealth. The West Menai development is currently being assessed by the Department of Planning and Environment.

22.5.6 Litter and illegal dumping

The assessment in Section 22.3 considered cumulative impacts of both wind-blown litter from the LHRRP and litter associated with transportation of waste. SITA's strategy addresses both litter generated from internal operations and litter / illegal dumping external to the LHRRP. In addition, a joint litter campaign between SITA and SSC would further contribute towards

reduction of litter and illegal dumping. Refer to Section 22.3 and the OEMPs (Appendix S, Appendix T and Appendix U for details.

Part D
Proposal Justification and Conclusions

23. Voluntary Planning Agreement

This chapter provides an overview of the Voluntary Planning Agreement that SITA entities and SSC would be signatories to and submitted along with the EIS. A copy is provided in Appendix W.

23.1 Overview

In recognition of the critical role that the LHRRP plays in managing Sydney's waste, SITA has committed to entering into a VPA with SSC in accordance with the requirements of the EP&A Act. The Minister for Planning would consider the VPA along with the Development Application and EIS and would be the consent authority for the proposal. All SITA entities (SembSITA, WSN Environmental Solutions and SITA Australia) and SSC would be signatories to the VPA. Furthermore, SSC and all SITA entities will enter into a deed of variation to the existing Deed of Agreement which would set out the contractual enforcement provisions for compliance with their obligations under the VPA.

23.2 Development contribution

By entering the VPA, SITA would provide, or procure the provision of, the following development contributions:

1. Monetary contributions as referred to in Schedule 1A, 1B and 1C of the VPA
2. The environmental undertakings as referred to in Schedule 1D of the VPA
3. The landscaping of the proposal area as referred to in schedule 1E of the VPA
4. The post-closure responsibilities as referred to in schedule 1F of the VPA
5. The dedication of the land free of cost for public open space as referred to in schedule 1G of the VPA

SITA is also committed to providing other material public benefit as described in the VPA, including preferential treatment of waste generated in the Sutherland Shire LGA as described in schedule 1H of the VPA. A summary of each of the above development contribution is provided below.

23.2.1 Monetary contributions

The VPA includes a $100 million financial contribution from SITA to help SSC fund capital projects or community assets across the Sutherland LGA. These funds may be applied for new projects or facilities, as well as for the upgrade or renewal of community assets. A minimum of 20% of this will be spent within a 7.5 km radius of the proposal.

23.2.2 Environmental undertakings and reporting

SITA is committed to meet a number of environmental commitments in terms of actions it would take based on the proposal site's environmental performance. Under the VPA, these commitments would be administered through the OEMPs, which describe SITA's approach to best practice, including prevention, mitigation and rectification of the operation and management of the LHRRP. OEMPs have been developed as part of the EIS preparation for the:

- LHRRP, superseding the existing Landfill Environmental Management Plan
- Proposed ARRT facility

- Relocated GO facility

The OEMPs would be updated and finalised upon receiving the Development Consent for this proposal (if approved). In the event that the Development Consent conditions differ from the OEMP conditions, the more onerous environmental obligation will apply. Further details are provided in Section 24.1.2.

As an additional level of safeguard, Schedule 1D of the VPA prescribes the reporting and external audit process that applies to the LHRRP. SITA would provide SSC with monthly, quarterly and yearly reports regarding environmental and other aspects of the LHRRP. There is a significantly higher level of rigour associated with the data reporting for this proposal in comparison with standard industry practice.

In addition, SITA and SSC have established an Agreed Methodology for assessing and actioning complaints. The Agreed Methodology would be reviewed every two years and at the request of any party, but any changes to the Agreed Methodology would only be made by agreement between them. The Complaint Investigation and Rectification Process is included in Appendix S of the LHRRP OEMP.

23.2.3 Landscaping of the proposal area

The VPA states that the landscaping of the proposal area would be in accordance with the EIS, EMP and the landscaping plan (provided in Section 6.5 and Figure 6.15).

23.2.4 Post-closure responsibilities

A post-closure EMP has been prepared which details requirements regarding the management of the rehabilitated landform and parkland area during post-closure of the LHRRP. Similar to the OEMPs, the post-closure EMP forms part of the VPA.

While SSC would be responsible for maintaining the parkland, SITA would continue to have responsibility for the environmental performance of the disposed waste for a minimum 30 year period after site closure (or per the EPA post closure licence requirements, whichever is longer) and in accordance with the closure requirements administered by the NSW EPA. This includes monitoring and management of landfill gas and leachate.

As detailed in the VPA, SITA has made a number of commitments to maintaining assets at the LHRRP. SITA's post closure responsibilities include:

- Landscaping - including repair or replacement of damaged or dead vegetation[10] for a period of care of two years
- Stormwater management structures - including repair or replacement of structures that fail to perform in accordance with the requirements[11] of the EIS for a period of care of five years
- Facilities (e.g. composting toilets) - including repair or replacement of damaged facilities due to excessive settlement of the landfill mass for a period of care of 15 years
- Roads and cycle paths - including repair or replacement of damaged roads or cycle paths due to excessive settlement of the landfill mass for a period of care of 5 years
- Landfill cap - including repair or replacement of the landfill cap and any landscaping which is damaged as a result of failure in the landfill cap[12] for a period of care of at least 30 years

[10] Where damage or death is not related to SSC activities, a third party's activities, public use or recreational activity

[11] Where failure is not due to reasons related to SSC activities, a third party's activities, public use or recreational activity

The above are summarised in Table 23.1.

Table 23.1 Period of care

Asset	Period of care (from 1 January 2040)
Landscaping	2 years
Stormwater infrastructure	5 years
Roads and cycle paths	5 years
Facilities (composting toilets)	15 years
Landfill cap	Minimum 30 years

23.2.5 The dedication of the land for public open space

SITA is under an existing obligation to transfer part of the site to SSC and this obligation would continue under the VPA. SITA would also be obliged under the VPA to transfer a larger part of the site to SSC.

Following completion of works to establish the parkland, the SITA owned land would be transferred to SSC for the purpose of public recreational use.

The process and details of transfer of land is described in schedule 1G of the VPA.

Other important details regarding the proposed parkland are also described in Section 6 of this EIS.

[12] But only to the extent that it must re-perform its obligations as originally contemplated by the landscaping plan. Noting that this applies where damage is not due to reasons related to SSC activities, a third party's activities, public use or recreational activity

24. Environmental management

SITA is committed to achieving better environmental outcomes from all its facilities based upon compliance with all relevant legislation and guidelines and through the application of best practice prevention, mitigation and rectification measures. This chapter provides an overview of the proposed environmental management and mitigation measures for the proposal which would form part of any approval granted for the project. In addition, the obligations and practices outlined in the facility OEMPs which include additional, broader environmental management objectives would also be employed to reduce the potential for impacts on the community. Rectification measures for foreseeable and contingency events, should they occur, are also provided.

24.1 Environmental management framework

24.1.1 Site regulatory requirements

The operation of the GO facility, ARRT facility and landfill would be subject to, and be required to operate in accordance with EPLs issued for each facility/operation. EPLs are issued by the NSW EPA to owners or operators of premises under the POEO Act. EPLs are a regulatory measure to control impacts of pollution in NSW. The EPL would place conditions on the operation of each facility, which may include types of waste, allowable throughput, storage quantities, odour, noise, dust, litter, monitoring and reporting requirements, requirements for managing complaints, etc.

24.1.2 Environmental management plans

SITA is committed to best practice, prevention, mitigation and rectification of the operation and management of the LHRRP. Individual OEMPs have been prepared for the LHRRP (Appendix S), GO facility (Appendix T) and the ARRT facility (Appendix U). A post closure EMP has also been prepared, which is contained in Appendix V.

The OEMPs describe the activities on site that have, or are likely to have, an impact on the environment, and measures to be undertaken to minimise those impacts. These OEMPs have been developed to reflect the regulatory requirements and provide a basis for NSW EPA to assess the environmental performances of the operations. The OEMPs also contain objectives which extend beyond regulatory requirements, providing a broader basis for environmental management which would support SITA's commitment to best practice environmental management resulting in no significant impacts on the community throughout the construction, operation and following closure of the proposal.

A comprehensive list of prevention, mitigation and rectification measures has been identified and is detailed within the OEMPs. The identified mitigation and rectification measures would be implemented as required and their exact details would be based on a case by case situation depending on the issue and technical solutions available at the time.

The OEMPs are structured to first provide sufficient background to the operations occurring at the LHRRP as well as the local environment. They then establish key environmental features that may be sensitive to SITA operations, including surface water, groundwater, leachate, landfill gas and odour. SITA has adopted the following approach in order to manage each potentially sensitive environmental aspect:

1. Define environmental goals and principles
2. Define management strategies

3. Define control activities and frequency of action
4. Define performance indicators and targets
5. Establish management responsibilities
6. Define reporting and review procedures

The OEMPs document the controls and procedures for minimising impacts from odour, leachate, groundwater, surface water, fire, dust, litter, noise, pest, vermin, noxious weeds as well as procedures for general emergency preparedness.

Where applicable, the measures in the various OEMPs have been hierarchically categorised as follows:

- Preventative measures - aim to eliminate or reduce any environmental aspect that is likely to cause a negative impact. These would be developed and implemented as soon as practicable following any approval granted.
- Mitigation measures - aim to pre-emptively minimise any negative environmental impacts. These would be implemented as soon as practicable following any approval granted.
- Rectification measures - aim to retrospectively control any negative environmental impacts and would be implemented if, and when required.

In addition to establishing SITA's approach to responsible environmental management, the OEMPs also serve to provide guidance for all the staff and contractors that may be undertaking operations at the LHRRP. They document the monitoring locations on site, as well as the reporting, staffing, training as well as environmental auditing requirements so each staff member or contractor can be aware of their responsibilities.

The OEMPs are 'living documents' and would be updated periodically in the light of emerging technology and new standards for environmental performance. They would be reviewed by and approved by SSC and also provided to the NSW EPA and the Community Advisory Committee for discussion and comment.

The OEMPs are provided in Appendix S, Appendix T and Appendix U of this EIS.

The post closure EMP is provided in Appendix V of this EIS.

24.1.3 Environmental undertakings

SSC has an important role in ensuring that operations at the LHRRP are conducted in an environmentally responsible manner.

As discussed in Chapter 23, SITA has committed to entering into an agreement with SSC in the form of a VPA which includes 'environmental undertakings'. The environmental undertakings made by SITA to SSC have been developed to demonstrate SITA's commitment to protecting the environment and the local community while constructing, operating and during the post closure period for the proposal. The agreed undertakings or commitments relate to the environmental management of the LHRRP, complaints handling and environmental reporting.

SITA has committed to entering into a VPA with SSC. The VPA would provide a $100 million financial contribution. SSC would be able to use this package during the operation of the proposal to develop community facilities in the Sutherland Shire. A minimum of 20% of this will be spent within a 7.5 km radius of the proposal

24.2 Summary of mitigation and management measures

The following summarises the proposed mitigation and management measures.

24.2.1 Design

Final landform (reprofiling)

The NSW EPA (1996) Environmental Guidelines: Solid Waste Landfills, Benchmark Technique no. 28 states the following, 'The final settlement of the seal-bearing surface should leave a gradient of 5% to defined drainage points'.

The proposed final landform would provide a final surface that has a minimum grade of 5% towards defined drainage points. Details of the design basis for the final landform and settlement analysis are contained in Appendix C.

GO facility

The relocated GO facility would be partially enclosed with breathable membranes used as part of the active composting phase and aerated concrete 'bunkers' used during the active composting phase to reduce the potential for odour

A perimeter bund would be constructed around the whole GO facility, with all stormwater that comes into contact with garden organics being captured and treated as leachate

A designated pond would be used for the containment of water from the GO facility that comes in contact with the garden organics. Leachate generated from the GO facility would be treated in a separate system to the leachate from the LHRRP and reused to the maximum extent possible

ARRT facility

The proposed ARRT facility would utilise existing best practice technologies in use by SITA both in Europe and locally in Australia, which would include:

- Fully enclosed buildings under negative air pressure, with self closing roller doors to reduce the potential for odour
- Use of suitably sized biofilters to capture and treat air from the ARRT facility prior to release

24.2.2 Construction

The OEMPs for the LHRRP, ARRT facility and GO facility contain detailed prevention, mitigation and rectification measures to address as potential impacts associated with existing operations at LHRRP and the proposal.

Table 24.1 summarises mitigation and management measures outlined in the technical studies undertaken for this EIS. These should be read in conjunction with the management strategies (prevention, mitigation and rectification) detailed in the OEMPs.

Table 24.1 Construction mitigation and management measures

Potential issue	Mitigation and management measures
Waste management	• Prepare a waste management sub-plan for the landfill, ARRT facility and GO facility as part of the CEMP
Traffic, transport and access	• Undertake a Community information and awareness program during construction • Prepare a Traffic Management Plan for the construction phase of the proposal including the following key measures: – Consultation with RMS and SSC to ensure that general signposting of construction access roads are appropriate and provide adequate warning of heavy vehicle and construction activity – Distribute construction activity warning notices to advise local road users of scheduled construction activities – Provide advance notice of road/lane closures and advice on alternative routes (if required) – Whenever practical, promote the use internal and haulage access roads rather than public roads by construction vehicles – Manage the transportation of construction materials to maximise vehicle loads and minimise vehicle movements in consultation with RMS and SSC and the NSW Police Service
Noise	• Select plant and equipment to minimise noise emissions where possible whist maintaining efficiency of function. Fit residential grade silencers and maintain all noise control equipment in good order • Restrict noisy activities to daylight hours • Use reverse quackers with a low decibel output rather than beepers for excavators and wheel loaders
Visual	• Implement 'early works' rehabilitation and maintenance measures, including substantial woodland and understory planting to screen the LHRRP from ANSTO land and adjacent roads including along Heathcote Road and around the boundary of the existing PCYC area • Apply hydromulch on exposed batter areas
Dust	• Prepare a dust management plan sub-plan as part of the CEMP
Soils and surface water	• Develop erosion and sediment control plan or soil and water management plan for the GO and ARRT facilities • Continue surface water monitoring as prescribed in EPL 5065 • Develop a soil and water management plan for the GO / ARRT facility and incorporate into the construction contractor's environmental management plans • Continue use of existing measures in place to minimise demand for potable water including reuse of water captures in site basins for dust suppression • Construct the ARRT facility so that there is not a significant increase in demand for potable water during construction • Construct the GO facility so that there is no increase in potable water demand in addition to current demands
Groundwater	• Develop appropriate site management practices and emergency response procedures to be detailed in a construction and environmental management plan (CEMP) for the ARRT and GO facility to minimise water quality impacts associated with construction activities • Install and monitor six additional groundwater wells for the ARRT and GO facility, comprising four shallow wells and two deeper wells. These would characterise deeper flow directions and identify short term water quality impacts in the deeper aquifer system from the ARRT and GO facility. The two deeper wells would be located at the northwest corner of the proposal site on Heathcote Road and east of the GO sump
Contamination	• After development approval and prior to the GO facility and ARRT facility development, conduct targeted soil sampling and subsequent lead analysis on the ARRT area which is adjacent to, and proposed to extend

Potential issue	Mitigation and management measures
	onto SICTA • As recommended in the groundwater assessment, install new monitoring wells around the GO facility and ARRT facility prior to construction • Monitor these wells during construction of the GO facility and ARRT facility to provide early indication of any additional impacts from construction or operation on the proposal site • Undertake a general site inspection in conjunction with the soil sampling and well installation to identify any visual or olfactory signs of potential contamination on the proposal site, primarily in the form of stockpiled materials or previously unknown land use activities. • If unexpected material (including waste materials or evidence of filling) is encountered during construction, seek advice from an appropriately qualified Environmental Consultant in regard to the management of this material • Develop and detail in the CEMP appropriate site management practices and emergency response procedures prior to construction to minimise water quality impacts associated with GO facility and ARRT facility construction • If required by the planning authorities, prepare a Statutory Site Audit report to approve any remediation works required to make the land suitable for construction of the ARRT or GO facilities.
Hazards and risk	• Undertake a detailed safety study to confirm the safety exclusion zone from SICTA operations and identify any hazards associated with constructing and operating the ARRT facility in the proposed location • Propose suitable mitigation measures to be incorporated in building design and construction
Fire prevention and management	• Apply the relevant fire safety requirements of the Building Code of Australia to any buildings, including provision of smoke detectors, fire extinguishers, fire blankets, fire hose reels and sprinklers where applicable • Design the buildings on site to meet the requirements of the Planning for Bushfire Protection guidelines to protect staff and minimise the potential for building damage, including provision of a 10 m APZ. • Identify and incorporate appropriate construction standards for buildings and refuge areas during the detailed design phase. • Ensure that bushfire management procedures are included in the CEMP. This would include: – Requirements for emergency access and egress including nomination of an alternative access route. – Formal preparedness procedures for staff and contractors to maintain awareness of and respond to escalating forecast fire danger – Formal pre-rehearsed procedures for staff and contractors to respond to respond to a formal bushfire warning being issued by emergency services, including identification of escape routes and refuge areas
Biodiversity	General • Ensure that all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the proposal site, protection measures to be implemented to protect biodiversity and penalties for breaches • Prepare a flora and fauna management sub-plan as part of the CEMP incorporating recommendations below, and expanding where necessary • Put in place measures to suppress dust during clearing and construction Flora species • Collect seeds of the *Acacia bynoeana* individual in the appropriate season (September to January) prior to vegetation clearing occurring. Plant seeds in the nursery and use any individuals grown for onsite plantings. Propagate Acacia species from scarified seed or using boiling water treatment (Wrigley and Fagg 2007) • Carefully remove the *Acacia bynoeana* individual and transfer it to the on-

Potential issue	Mitigation and management measures
	site nursery, along with soil adjacent to the individual which may include a long-term soil seed bank (Benson and Macdougal 1996). Replant it at the proposed offset site or another suitable location • Collect seeds and propagules of *Allocasuarina diminuta* subsp. *mimica* in March prior to vegetation clearing occurring. Plant seeds in the nursery and use any individuals grown for on site plantings. • Collect ramets of *Allocasuarina diminuta* subsp. *mimica* and associated soil prior to vegetation clearing and transfer them to the on-site nursery for propagation and replanting. Undertake replanting in areas that are not likely to be impacted by future development, including the proposed offset site. Plant ramets along the realigned Mill Creek where the ironstone soil is present. Do not plant *Allocasuarina littoralis* near these plants as this species can shade out *Allocasuarina diminuta* subsp. *mimica* and mycorrhyzial associations may be different. Carry out any removal and replanting with input from the SSC bushcare staff. • Prepare a management plan for the collection of seed and translocation of plants as part of the CEMP for the proposal and include monitoring and assessment of the success of the program Vegetation clearing • Limit disturbance of vegetation to the minimum necessary to construct the proposal • Ensure that vehicles are appropriately washed prior to work on site to prevent the potential spread of Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust (*Pucciniales fungi*) in accordance with the national best practice guidelines for Phytophthora (DEH 2006) and the Myrtle Rust factsheet (DPI 2011c) for hygiene control • Where the proposal footprint adjoins native vegetation mark the limits of clearing and install fencing around the construction footprint area prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal • Place stockpiles of fill or vegetation within existing cleared areas (and not within areas of adjoining native vegetation) • Install sediment fences to prevent transfer of sediments into adjacent vegetation Weeds • Actively manage weeds during the construction phase of the proposal, including managing and disposing of weeds that were recorded within the proposal footprint. Manage any noxious weeds in accordance with the NW Act • Clean vehicles and other equipment to be used on site to minimise seeds and plant material entering the proposal site and prevent the introduction of further exotic plant species or disease • Incorporate control measures in the design of the proposal to limit the spread of weed propagules downstream of study area. Use sediment control devices, such as silt fences, to assist in reducing the potential for spreading weeds Fauna habitat • Implement protocols to prevent introduction or spread of chytrid fungus following Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECCW 2008) • Ensure that a trained ecologist is present during the clearing of native vegetation or removal of potential fauna habitat to avoid impacts on resident fauna and to salvage habitat resources as far as is practicable • When undertaking clearing surveys: - Stage the vegetation clearing, commencing in the south of the GO facility and progressing northwards to increase the opportunity for fauna to vacate the proposal site and move into areas of 'secure' habitat to evade injury

Potential issue	Mitigation and management measures
	- Mark any hollow-bearing trees to be felled prior to clearing of vegetation. Remove hollow bearing trees in accordance with a hollow-bearing tree management protocol which includes the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna - Ensure that habitat features (fallen logs and tree hollows) removed from site are salvaged and relocated within adjacent areas of vegetation - Undertake inspections of native vegetation for resident fauna and/or nests or other signs of fauna occupancy - Defer vegetation removal and associated construction activity in areas occupied by more mobile threatened fauna until the fauna has vacated the proposal footprint - Ensure that an ecologist is present during works along Mill Creek to rescue and relocate any frogs to other locations along Mill Creek. Undertake any handling of frogs with respect to the Office of Environment and Heritage Hygiene protocol for the control of disease in frogs (DECCW 2008) Water quality and aquatic habitats • Prepare erosion and sediment control plans in accordance with Volume 2b of Managing Urban Stormwater: Soils and Construction (DECC 2008). Establish erosion and sediment control plans prior to the commencement of construction and update and managed them throughout as relevant to the activities during the construction phase • Regularly inspect erosion and sediment control measures particularly after rainfall events, to ensure their ongoing functionality. • Reinstate stabilised surfaces as quickly as practicable after construction • Apply water to exposed surfaces that are causing dust generation, which may include unpaved roads, stockpiles, hardstand areas and other exposed surfaces (for example recently graded areas) • Ensure that vehicles follow appropriate speeds to limit dust generation • Store all stockpiled material in bunded areas and keep them away from waterways to avoid sediment entering the waterways • Make spill kits available to construction vehicles and put in place a management protocol for accidental spills • Eradicate Plague Minnow (if present) prior to decommissioning to ensure that it is not released into local waterways as a result of draining of dams. Use humane methods and obtain an appropriate licence from NSW Primary Industries (Animal Welfare branch and Fishing and Aquaculture branch) • Salvage large woody debris removed from the realigned creek and place it in the new alignment to maintain habitat values • Construct the new section of the creek to mimic a natural ecosystem and revegetate with locally endemic species. Consideration should be given to using propagated *Allocasuarina diminuta* subsp. *mimica*
Landuse	• Submit a planning proposal to enable proposed activities under the SLEP.
Heritage	• Develop and included in the CEMP an unexpected finds procedure. This would outline the procedures to follow if unexpected Aboriginal objects or non-Aboriginal relics were uncovered during construction • Submit Site Impact Recording Forms for the previously impacts sites, AHMS 52-2-1108, 52-2-1029, 52-2-1030 and 52-2-1031 to OEH
Riparian corridors	• Provide a minimum of 875 m^2 of riparian offsets for the permitted activities
Socio-economic	• Implement measures to reduce the potential for amenity impacts during construction, as identified in the relevant chapters of the EIS • Maintain ongoing engagement with the community during construction. Develop a stakeholder engagement plan would be developed for the proposal construction phase. This would include how information would be

Potential issue	Mitigation and management measures
	disseminated, communication channels including for feedback on the proposal and protocols for responses to feedback or enquiries

24.2.3 Operation

Table 24.2 summarises mitigation and management measures outlined in the technical studies undertaken for this EIS. These should be read in conjunction with the management strategies (prevention, mitigation and rectification) detailed in the OEMPs.

Table 24.2 Operation mitigation and management measures

Potential issue	Mitigation and management measures
Waste management	• Include waste handling procedures, waste processing procedures, quality control procedures and protocols (including sampling and testing) and finished product storage and handling requirements in OEMPs • Carry out sampling and testing in accordance with the requirements of relevant resource recovery orders • Apply for specific resource recovery orders if required
Traffic, transport and access	• Perform a safety review in both 2020 and 2025 on the safety of the intersection of New Illawarra Road and Little Forest Road • Review signposted and non-signposted speed restrictions along the road network and where necessary, provide additional signposting of speed limitations • Consult with schools and school bus services to determine and mitigate if any school bus service use roads within the study area • Install appropriate traffic control and warning signs for areas identified to have existing potential safety risks • Consult with the NSW Police Service to mitigate impacts of heavy (multi-dimensional) vehicles on the roads • Project induction training for truck and vehicle operators • Manage queuing and prevent long queues at site entrance • Actively monitor area and have in place traffic control • Delay trucks when required • Manage dispatch timing for vehicles from SITA controlled facilities • Require SITA owned waste delivery vehicles to travel on arterial or sub-arterial roads rather than local roads (with the exception of Little Forest Road). • Discourage customer transfer trailers and B doubles from travelling on local roads
Noise	LHRRP • Limit waste receival hours • Select plant and equipment to minimise noise emissions where possible whist maintaining efficiency of function. Fit residential grade silencers and maintain all noise control equipment in good order • Maintain all machinery and equipment in proper working order in accordance with manufacturer's requirements • Do not operate heavy machinery outside site operating hours • Include noise component in site inductions GO facility • Select plant and equipment to minimise noise emissions where possible whist maintaining efficiency of function. Fit residential grade silencers and maintain all noise control equipment in good order • Restrict operations to designated areas • Restrict noisy activities to daylight hours

Potential issue	Mitigation and management measures
	• Use reverse quackers with a low decibel output rather than beepers for excavators and wheel loaders • Utilise favourable routes for accessing and exiting the facility to ensure avoidance of residential areas where possible ARRT facility • Conduct all operations within buildings • Use reverse quackers rather than alarms with a low decibel output for excavators and wheel loaders • Utilise favourable routes for accessing and exiting the facility to ensure avoidance of residential areas where possible • Fit noise reduction measures within the buildings
Visual	• Grass the final capping layer as the reprofiling works occur to further minimise visual impacts • Ensure filling does not exceed proposed final landform heights • Maintain fences and other site infrastructure • Maintain Little Forest Road • Provide screen and screen maintenance • Progressively rehabilitation and revegetation.
Odour	Landfill reprofiling • Strip back the areas of the existing landfill (south of existing active landfill area) in segments with approximately 1 ha of cover stripped in advance of the active tipping area. Of this area ensure that approximately 2,500 m^2 would be less than one day old to minimise the emission of odours from the stripped surface. - Strip back the existing areas which are capped and revegetated and do not expose previously landfilled waste - Strip back the existing areas of intermediate cover (south of the existing active landfilling area) and do not expose previously landfilled waste • Each morning further strip back the equivalent to a day's waste disposal operations (to minimise the potential for the perching of leachate) and place waste directly over this area. Ensure that there is no exposed waste during the night when the potential for odour issues off site is higher LHRRP • Cover odorous wastes as soon as possible after delivery in accordance with the requirements of the site's environment protection licence • Minimise the size of the active landfill face, taking into account the practicalities, safety, access, traffic management, etc. • Inspect and monitor the capping layer regularly • Train staff (internal and contractors) on odour management strategy and all relevant procedures • Install and operate a landfill gas collection system progressively to minimise odour as a result of landfill gas seepage GO facility • Conduct random monitoring and inspections of incoming vehicles to determine waste composition • Order manures in accordance with production schedules and blend with compost only in favourable weather conditions at any given time • Train staff (internal and contractors) on odour management strategy and all relevant procedures • Only allow up to 40,000 tonnes of composting material to be stored on site (includes receival, shredding, active composting and maturation stage) at any one time at the western GO • Measure oxygen and moisture content of compost (active phases) and control with aeration and moisture addition

Potential issue	Mitigation and management measures
	ARRT facility • Process waste daily • Carry out composting at set periods of time, to set temperatures, oxygen levels and moisture levels to provide certainty that composted material has fermented properly and has stabilized • Maintain the facility under negative pressure, ensuring odours do not escape the building • Regularly inspect biofilters and maintenance of biofilter media • Train staff (internal and contractors) on odour management strategy and all relevant procedures
Dust	LHRRP • Do not undertake dust generating activities during adverse weather conditions • Cease operations if unsafe (for example, during strong winds) • Monitor monthly dust deposition at six boundary locations on site • Limit vehicles to specified routes around the site and ensure speed limits are adhered to • Use dust suppression techniques such as watering to maintain moist conditions on exposed areas and unsealed roadways GO facility • Cover or enclose vehicles during transport around the site • Spray windrows, final compost storage areas and loading areas, particularly prior to transportation and turning • Cease operations if unsafe (for example, during strong winds) • Operate water cart(s) on trafficable areas as required ARRT facility • Conduct all operating activities within the enclosed areas of the ARRT facility • Cover or enclose vehicles during transport around the site • Spray windrows, final compost storage areas and loading areas, particularly prior to transportation and turning • Operate water cart(s) on trafficable areas as required

Potential issue	Mitigation and management measures
Soils and surface water	• Continue to use of existing measures in place to minimise demand for potable water including reuse of water captures in site basins for dust suppression • Where possible, minimise exposed areas over which sediment would be generated through maintenance of both natural and artificial ground cover such as grass or erosion control cover products • Discharge disturbed area drainage lines into a sediment basin designed in accordance with 'the Blue Book' Volume 1 (Landcom, 2005) and Volume 2b (DECC, 2008) • Divert clean upstream runoff around the actively worked areas of the proposal site to avoid mixing clean stormwater with runoff from disturbed areas • Manage vehicle movements to minimise generation and transport of sediment • Appropriately manage material stockpiles including locating them as far as possible from drainage lines • Continue general flood management practices including keeping drainage lines free of waste and debris and monitoring drainage lines during periods of heavy rainfall • Continue monitoring surface water quality in accordance with licences • Undertake further investigation of the habitat condition and macroinvertebrate populations to confirm the preliminary findings. It is recommended that this work be undertaken every three years commencing soon after reprofiling works commence in Area E. • Progressively revegetate completed reprofiling areas • Design and operate sediment dams and sediment traps to promote sedimentation • Maintain erosion and sediment control measures until the site is stabilised • Maintain drains to prevent weed build up
Groundwater	• Develop a monitoring system to assess the landfill collection system during re-profiling. This may include one or a combination of the following: – Ongoing assessment of the leachate generation volumes within the Stage 1 to 4 landfill areas during re-profiling – Ongoing assessment of the operation efficiency of the basal drainage system in Stage 1 to 4 of the landfill. This may represent some practical difficulties in given the drainage system is buried beneath waste – Characterisation and monitoring of leachate levels at the base of the landfill during re-profiling works to assess the potential for changes to leachate levels – Characterisation of changes in the hydraulic properties of the Stage 1 to 4 landfill areas during the re-profiling works – An improved collection system if water balance discrepancies are interpreted and/or overall changes in leachate levels and yields are observed and taking into account groundwater quality data. • Continue ongoing leachate management until such time as the leachate volume monitoring and or leachate and water quality monitoring suggest that risks are no longer significant • Confirm trigger levels for groundwater quality for monitoring wells around the LHRRP on which further investigations would be undertaken. • Include operational procedures and practices designed to minimise the production and spillage of impacted water and/or fluids used in operational activities in the OEMPs • Continue current groundwater monitoring activities and also monitor

Potential issue	Mitigation and management measures
	the six new wells in the ARRT and GO facility areas (refer Table 24.1 for details). If impacts occur during operation or post closure carry out further investigation and implement remedial measures which may include: - Additional investigations to isolate the source of impact and characterise the significance of the impact relative to key target criteria for the protection of surrounding sensitive systems. - Implementation of additional control measures to prevent ongoing impact. This may include: o Installation of additional monitoring wells to assess the emergence of significant impacts that may not be considered presently significant o Installation of additional wells to capture and treat impacted groundwater. This may include treating the water separately or incorporating the system into the existing leachate management system o It would be possible to use the Stage 5 groundwater drainage system located beneath the liner to intercept any impacted water
Leachate	• Continue ongoing monitoring of leachate volumes extracted from LHRRP landfill and other sources • Periodically review the leachate water balance model • Monitor groundwater and surface water impacts, as required by the proposal site EPL • Ongoing monitoring of surface water and leachate as required by EPL • Review of leachate levels daily • Inspect the site and review pumping/discharge records daily • Update standard operating procedures as site develops • Maintain relevant emergency procedures • Take action as leachate volumes and levels increase • Document corrective and preventative actions taken • Undertake regular inspections and repairs of infrastructure including removal of sludge from dams and maintenance of pumps and aerators • Compact and cover waste with daily and intermediate cover material to minimise infiltration of stormwater and further leachate generation • Remove leachate from a number of gas extraction wells using air lift pumps, flowing by gravity to the leachate collection dam • Maintain the leachate collection dam (holding capacity of 10 ML) to allow for the collection of leachate from the western ring main, central ring main, eastern ring main, Area 5-1 and Areas 5-2/5-3 • Maintain further emergency leachate containment dam (containment capacity of 9.2 ML) to contain leachate in extended wet weather events • Actively manage leachate levels in the containment dams so that they are have sufficient capacity to cope with leachate arising from wet weather events
Hazards and risk	Dangerous Goods • Transport Dangerous Goods to site and store in accordance with the Australian Dangerous Goods Code • Implement appropriate safe work procedures for the safe handling of the Dangerous Goods, including spill prevention and clean up requirements • Store and use any smaller quantities of Dangerous Goods (aerosols, paints, cleaners etc.) that may be used on site in accordance with the Australian Dangerous Goods Code, including appropriate labelling, separation where necessary and disposal

Potential issue	Mitigation and management measures
	• Implement all safeguards identified in the hazard identification process through the development and implementation of a comprehensive safety management system for the operation of the proposal or via an update of the existing safety management procedures for the existing site, taking into account any new requirements specific to the proposal Emergency preparedness • Regularly review and update the ERP
Fire prevention and management	• Manage the areas adjoining Heathcote Road adjacent to buildings as a specific APZ. • Implement bushfire management procedures as outlined in the LHRRP OEMP, including: – Requirements for emergency access and egress including nomination of an alternative access route. – Establishing an alternative access and egress route to the north-east through the existing cleared and developed areas – Implementing formal preparedness procedures for staff and contractors to maintain awareness of and respond to escalating forecast fire danger • Regularly rehearse procedures for staff and contractors to respond to respond to a formal bushfire warning being issued by emergency services, including identification of escape routes and refuge areas • Inspect and maintained all fire protection systems in accordance with AS1851-2012 Routine Service of Fire Protection Systems and Equipment. • Maintain waste stockpiles (including any garden organics or paper based waste material) in a tidy manner prior to processing and make efforts to limit exposure to ignition sources • Undertake hot works in accordance with SITA's hot work procedure and permit system as per existing operations procedures to minimise the potential for flammable materials to be ignited • Regularly maintain all mechanical components associated with the raw material delivery, shredding and mixing processes would also be undertaken to prevent overheating • Manage fires in accordance with SITA's emergency response procedures. If the fire cannot be extinguished immediately, contact local emergency services to provide assistance
Biodiversity	Vegetation and weeds • Manage noxious weeds on an ongoing basis according to legislative requirements. • Continue suppression of dust within the landfill and ARRT and GO facilities. • Manage water quality Feral animals • Provide ongoing control of feral animals. • Minimise sources of food and habitat for pest species. Post closure – vegetation and weeds • Sow exposed soil with native seed immediately to prevent colonisation by weeds. • Use locally sourced native species. • Incorporate propagated individuals of *Allocasuarina diminuta* subsp. *mimica* from the site into the landscaping plan. • Manage noxious weeds according to legislative requirements. • Monitor and manage revegetation areas, including planted *Allocasuarina diminuta* subsp. *mimica,* as per the EMP.
Greenhouse gas	• Investigate opportunities to increase the methane capture rate on an ongoing basis, as the landfill gas system is progressively modified to accommodate the new final landfill profile during the

Potential issue	Mitigation and management measures
	entire operational life of the proposal. • Continue to work with the landfill gas management contractor to refine the gas extraction and oxidation system in identified major emissions contributing areas. • Consider implementation of greenhouse gas mitigation strategies such as implementation of energy efficient practices, installation of solar panels and use of biofuels • Install gas extraction wells in completed areas to control gas migration • Progressively install gas extraction wells in operational areas as the landfill develops • Prepare and regularly review the emergency plan and emergency procedures • Implement a program for scheduled monitoring of landfill gas (surface and subsurface)
Litter and illegal dumping	• Support Regional Illegal Dumping (RID) squads • Engage with stakeholders regarding illegal dumping • Undertake internal audits • Establish a Litter and Illegal Dumping fund

24.3 Conclusion

The OEMPs for the LHRRP (Appendix S), GO facility (Appendix T), the ARRT facility (Appendix U) and for post closure (Appendix V) would be updated following any approval granted for the project to include the above measures and any other conditions of approval. The updated OEMPs would form part of the VPA (Chapter 23).

The OEMPs would be implemented which would result in the following objectives being achieved:

- Best practice design and operation
- No significant impacts on the community or environment

25. Justification and conclusions

25.1 Justification for undertaking the proposal

25.1.1 Overview of proposal justification

There is a justified need for the proposal

The proposal would expand the capacity of resource recovery processing infrastructure for organics and mixed waste in the Sydney region and also provide additional putrescible landfill capacity to cope with expected increases in waste generation associated with significant population growth.

The NSW Government has set targets for waste diversion by 2021 (as set out in the 'Waste Avoidance and Resource Recovery Strategy 2014-2021'). The target includes an increase in waste diversion in the municipal sector to 70%. This is challenging, particularly as Sydney's population is expected to increase by approximately 1.9 million people (ABS 2013) from 2015 to the end of 2037 (i.e. over the proposal's operational life). By 2037, almost 18 million tonnes of waste may be generated annually, a 50% increase on current levels.

There are limited putrescible waste disposal and processing sites within the Sydney basin, which is putting greater pressure on existing sites to accommodate current and future demand for both organics and mixed waste processing, and landfill space for disposal of residuals.

One of the main ways for local government to achieve the 70% diversion target, and to reduce waste to landfill is to recover the organic component of the waste stream. Local government is continuing to recover garden organics as part of overall strategies to increase diversion. Local government is also increasingly looking for capacity to process mixed domestic waste to meet the diversion targets.

The proposal includes the expansion of the existing GO facility to enable up to 80,000 tonnes per year of garden organics to be recovered from the waste stream. It also includes construction and operation of an ARRT facility to enable up to 200,000 tonnes of general waste to be processed and divert a significant portion from landfill. The ARRT facility would also produce a PEF which would be able to replace non-renewable fuels.

As discussed in Section 5.1.1, there are now two main active putrescible waste landfills in Sydney. The landfill at the LHRRP (expected to close in 2024) and the landfill at the Eastern Creek Resource Recovery Park (ECRRP), which is expected to close in mid-2018. The LHRRP landfill has the longest life expectancy of any Sydney putrescible landfill and plays a strategically important role in Sydney's waste disposal network.

Should the LHRRP cease to receive waste in 2024 (or possibly sooner), an alternative disposal location would be required for putrescible waste generated within the Sydney region. Unless additional local capacity can be provided, the waste would need to be transported to another site for disposal from 2025 onwards. There is no other approved putrescible landfill site within the Sydney region at present.

The proposal would also provide landfill disposal capacity (an additional 8.3 million cubic meters) and provide capacity for waste generated beyond 2024 (a further 12 years to 2037) and due to population increases. There is also a need for a site for ongoing disposal of residuals from the proposed ARRT facility. On-site disposal is preferable to transporting residual waste to other sites, particularly those located outside of Sydney.

The proposal would result in better environmental outcomes

There are also environmental benefits in undertaking the proposal at LHRRP, rather than at another site.

The proposed reprofiling of the landfill would provide additional capacity and would also improve the environmental performance of the landfill:

- **Reduce leachate generation by 25% compared to existing approval.** The improved landform and cap design would increase rainfall run off from the surface of the site, reduce water infiltration and prevent unplanned ponding from occurring. Leachate generation from the landfill would expect to reduce by at least 25% in the longer term. Generation of less leachate reduces the potential impact on the local environment.
- **More efficient collection of the gas.** Reprofiling the landfill and placing a final cap over areas that only had intermediate cover until now would also assist with more efficient collection of the gas generated by natural decomposition of deposited waste and reduce the potential odour and greenhouse emissions from the proposal site.

In addition, through the proposal, estimated odour emission would be reduced by more than 40% compared to current estimated levels through improved odour management, as described in Chapter 12. These improvements would likely be achieved as early as 2016, with the predicted odour levels dropping considerably at nearby sensitive receptors including over a 50% reduction at ANSTO when compared against existing modelled odour levels (reduction from 10.9 OU to 4.2 OU, as outlined in Section 12.3.3). The 2 OU odour performance criteria would be achieved at the nearest residential receptor. Detailed results of odour modelling are contained in Chapter 12.

The proposal would provide additional waste processing infrastructure

The current GO facility is operating at full capacity. The proposal would increase the processing capacity to 80,000 tonnes per year and provide an opportunity for SITA to invest in additional infrastructure and improve the environmental performance of its composting operations. The relocated and expanded GO facility would include partial enclosure, active aeration and covering of the waste during the first four weeks of the active composting process to enable more effective control of odour.

Establishment of a 200,000 tonne per year ARRT facility at LHRRP is proposed to address a growing need for alternative ways to process waste, extract resources and reduce waste disposal. The new fully enclosed ARRT facility would provide an additional option for sustainably managing putrescible waste in Sydney. It would be one of the most advanced facilities of its kind in the country.

The proposal would provide significant social and financial benefits

Under the proposal and following the closure of LHRRP in 2037, the site would be returned to the community and rehabilitated into parklands within two years for everyone to enjoy. The parkland would have a total area of 149 ha, which is approximately 25 ha larger in area than the currently approved parkland, providing more area for a range of recreation and community use.

Under the current approval the GO facility was to remain in its current location. As part of the proposal, the GO and ARRT facilities would cease operating in 2037 and be provided to the community as additional parkland.

In addition, the proposal provides the following additional social and financial benefits:

- **More employment opportunities.** The proposal is expected to generate an additional 100 jobs during construction and 62 jobs during operation. SITA would advertise jobs associated with the proposal in local newspapers.

- **$100 million in funding over 15 years to SSC.** As part of the proposal, SITA would contribute $100 million in funding over 15 years to SSC which would be used by SSC to fund a range of projects or facility upgrades in the Sutherland Shire.

Summary

In summary, the proposal is considered justified because it:

- Results in no significant impact to the community or the environment
- Responds to a recognised need and is consistent with strategic waste management drivers at a regional, state and national level
- Provides a number of benefits (summarised in Section 25.1.2)
- Is in the public interest and the site is suitable for the proposal (see Sections 25.1.6 and 25.1.7)
- Is consistent with the objects of the EP&A Act and the principles of ecologically sustainable development (see Section 25.2)

The consequences of not proceeding with the proposal (see Section 25.1.3) are considered to be unacceptable.

25.1.2 Summary of proposal benefits

Overall the proposal would:

- Provide critical infrastructure to manage Sydney's projected waste needs into the future as the City's population increases
- Incorporate improved technologies and operational practices, such as:
  - Implementation of an engineered staging plan for the landfill reprofiling to lower the potential for odour impacts by retaining the general proportion of capped and revegetated areas of the site and increasing these areas in time
  - Upgrading of the GO facility with partial enclosure using breathable membranes, as well as aerated concrete 'bunkers' during the active composting phase to reduce the potential for odour
  - Provision of a fully enclosed ARRT facility under negative pressure to assist with air management
- Improve environmental outcomes by the application of best practice prevention, mitigation and rectification measures
- Provide stronger environmental controls to the existing site operations
- Provide a final landform which would increase the proportion of rainfall which would run off the surface and decrease the proportion of rainfall which would infiltrate into the waste, potentially reducing the expected volume of leachate being generated by at least 25% in the modelled weather scenarios
- Provide a larger parkland area than the current approved area, which would be available for passive recreation by the community
- Provide a master plan for the site which would improve on the previously approved master plan through mitigation of identified risks
- Through the VPA, commit SITA to provide post closure care for site assets
- Create jobs, including increased opportunities for local people
- Have no significant environmental impacts on the community.

Detailed proposal benefits are discussed further in Section 5.3.

25.1.3 Consequences of not proceeding

The consequences of not proceeding are summarised below:

- An identified need to provide ongoing putrescible landfill disposal capacity for the Sydney region beyond 2024 to accommodate waste generated due to population growth would not be met.
- There would be no emergency waste disposal capacity for Sydney after 2024.
- The identified need to provide additional GO facility processing and ARRT facility capacity for the Sydney region would not be met. This includes provision of resource recovery capacity to meet 2021 state diversion targets.
- The environmental improvements associated with the landfill reprofiling and relocation and expansion of the GO facility would not be realised.

25.1.4 Environmental considerations

Environmental investigations were undertaken during preparation of the EIS to assess the potential impacts. These included assessments of:

- waste management
- settlement
- traffic, transport and access
- noise
- visual
- air quality
- soils
- surface water
- groundwater
- leachate
- contamination
- hazards and risk
- fire prevention and management
- biodiversity
- landuse impacts
- greenhouse gas
- future use
- other issues including heritage, riparian corridors, litter and illegal dumping, socio-economic and cumulative impacts
- post closure

The EIS has documented the potential impacts of the proposal, considering both potential positive and negative impacts, and identifies mitigation and management measures to protect the environment where required.

As noted in Chapter 24, the proposal would incorporate management measures and design features to ensure that potential impacts are managed and mitigated as far as practicable. This includes ongoing mitigation measures following the cessation of waste activities on the site.

As discussed in Section 5.1, the proposal has a number of environmental benefits. In addition as part of the VPA, SITA would make commitments to a number of ‘environmental undertakings’ to improve environmental management at the site in accordance with best practice principles. Further details of the environmental undertakings and the VPA are provided in Chapter 23.

Appendix R (Volume 7) has been prepared provide details of the proposed parkland, landscaping, final use and post closure management of the LHRRP following cessation of waste related activities. The standalone document provides a review of the original 1998 landscape master plan and identifies key changes in the 2015 to address safety, drainage, accessibility layout and facility suitability risks.

25.1.5 Social and economic considerations

Some social and economic considerations are discussed in Section 22.3. The main socio-economic consequences of the proposal are:

- An estimated capital investment of $95 million (ex GST) as at March 2015 which would be spent in the Sydney region through the design, construction and commissioning of the proposed new facilities and ongoing landfilling operations
- Avoid the need to transport waste (including that generated within southern Sydney) to landfills outside of Sydney
- Improved resource recovery processing capacity and waste disposal capacity for the region
- A $100 million financial contribution by SITA to help the SSC to fund community infrastructure
- A larger parkland following site closure, providing approximately 25 ha more area for passive recreation and community use
- Increased local employment during construction and operation
- Amenity related impacts, including improved management of existing odour sources.

In relation to amenity impacts, as noted in the various assessment chapters, implementation of the 'environmental undertakings' and the CEMP, OEMPs and post-closure EMP would improve management of the LHRRP operations. This would reduce potential environmental impacts by the application of best practice prevention, mitigation and rectification measures.

25.1.6 Suitability of the site

The LHRRP site is considered to be suitable for the proposal for the following reasons:

- It is located at an existing resource recovery park
- It is central to a number of waste generating areas of Sydney
- It is close to major transport routes
- The footprint of the proposal is predominantly on already disturbed areas of the site
- ANSTO as part land-owner and SSC both endorse the proposal at the site.

25.1.7 The public interest

The proposal provides for the continued provision of essential waste management and resource recovery services for Sydney and nearby local government areas. The proposal would extend the life of the existing landfill that services these local government areas. In addition, the ARRT facility and GO facility have been designed with a number of environmental safeguards to mitigate against potential amenity impacts. The proposal also creates increased employment opportunities for local people and others. Therefore the proposal is considered to be in the public and community's interest.

25.2 Consistency with the objects of the EP&A Act

Table 25.1 identifies the objects of the EP&A Act and their relevance to the proposal.

Table 25.1 Consistency with the objects of the EP&A Act

Object	Comment
(a)(i) to encourage the proper management, development and	The proposal responds to an identified need to provide ongoing waste disposal capacity for Sydney

conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment	and to provide additional resource recovery processing capacity for both garden organics and mixed waste. The proposal forms an important part of the infrastructure required to respond to the needs of the local community and provide for future growth and development. The proposal design and mitigation measures have been based on consideration of the natural and artificial resources of the study area.
(a)(ii) to encourage the promotion and co-ordination of the orderly and economic use and development of land	Waste processing and disposal forms a key part of the infrastructure necessary to support development of land. The proposal would assist in diverting significant quantities of organic waste from landfill (through the expansion of the GO facility and implementation of the ARRT facility). In addition the landfill reprofiling would provide additional landfill capacity at an already disturbed sited for continued future use.
(a)(iii) to encourage the protection, provision and co-ordination of communication and utility services	The proposal would not impact on communication or utility services.
(a)(iv) to encourage the provision of land for public purposes	The proposal would result in an expanded area of parkland for future public recreational use once the site is closed.
(a)(v) to encourage the provision and co-ordination of community services and facilities	Although a private commercial enterprise, the proposal comprises a community service and facility and meets the future need for improved resource recovery for Sydney region.
(a)(vi) to encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats	The proposal has been sited and designed to minimise the impacts to the environment. Potential impacts have been identified within the EIS and mitigation and management measures have been proposed to encourage the protection of the environment.
(vii) to encourage ecologically sustainable development	Considered in Section 25.2.1
(viii) to encourage the provision and maintenance of affordable housing	Not relevant to the proposal
(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State	Not relevant to the proposal
(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment	The proposal has involved public consultation through its development and during preparation of the EIS.

25.2.1 Consideration of ecologically sustainable development

Clause 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* lists the principles of ecologically sustainable development as:

a) ***The precautionary principle****, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*

(i) *careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and*

(ii) *an assessment of the risk-weighted consequences of various options.*

(b) ***inter-generational equity**, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations;*

(c) ***conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration; and*

(d) ***improved valuation, pricing and incentive mechanisms**, namely, that environmental factors should be included in the valuation of assets and services.*

An assessment of the proposal against these principles is provided below.

Precautionary principle

A range of environmental studies have been undertaken as part of development of the proposal and the environmental assessment process, to ensure that the potential impacts are understood. The assessment of the potential impacts of the proposal is considered to be consistent with the precautionary principle. The assessments that have been undertaken are consistent with accepted scientific and assessment methodologies, and have taken into account relevant statutory and agency requirements.

The proposal has evolved throughout the preparation of the EIS. Modifications have been made to design layouts and proposed operating practices to minimise emissions and avoid impacts wherever they have been identified by the studies undertaken.

Locating the various components of the facilities has involved consideration of potential air quality, noise and water quality impacts. The proposal incorporates design features to reduce the potential for air quality (mainly odour) impacts such as the enclosure of the ARRT facility (with a biofilter for odour treatment) and the proposed aeration and covering of the first four weeks of the composting process at the GO facility.

A number of safeguards have also been proposed to minimise potential impacts during construction and operation of the proposal. The selected construction contractor(s) would be required to prepare a construction environment management plan (CEMP) prior to commencing construction. OEMPs would be used to guide environmental management during operation. These requirements would ensure that the proposal achieves a high-level of environmental performance and is operated in accordance with best practice principles.

Inter-generational equity

It is recognised that the nature of the proposal is such that it has the potential to result in environmental impacts such as odour, increased traffic and visual impacts. The EIS has assessed these impacts and has concluded that the proposal would not adversely affect the amenity of local residents, or the quality of the surrounding environment. The potential for environmental impacts of any project has to be balanced against the long-term benefits of providing essential waste management infrastructure for the region and improving resource recovery.

The proposal would facilitate improved diversion of waste from landfill into a potential use with a higher resource value (value adding). This would be achieved through a combination of improved recycling and processing of organics. Recovering recyclable materials from a waste stream, that would otherwise have gone to landfill, conserving resources such as iron ore,

bauxite and fossil fuels (used for production of steel, aluminium and plastics), and saving trees due to recovery of paper and cardboard. This is a direct benefit to future generations.

Diversion of waste from landfill also delays the need for a new site for landfilling/disposal of wastes from Sydney, and avoids the associated costs and potential impacts. Recycling also captures the embodied energy contained within the recyclates – significantly reducing the energy demand that would be required to manufacture the same products using virgin materials.

Production of marketable compost has potential to reduce the need for chemical fertilisers, which improves water quality in rivers and streams. Its use may also improve the water retention characteristics of soils, which reduces the need to water plants/crops. This reduces the pressure on water resources.

Production of PEF from the ARRT facility has potential to reduce the future demand for non-renewable fuel sources such as coal. In addition, the proposal would improve local employment potential and contribute to economic growth in the local area.

Conservation of biological diversity and ecological integrity

The proposal has been located and designed so that the majority of the proposal footprint is on already disturbed land in order to minimise potential direct and indirect impacts on the biodiversity of the locality. The proposal would directly affect up to 13.03 ha of native vegetation, 26.68 ha of exotic grassland and 71.77 ha of cleared land. The majority of the area affected relates to the construction of the ARRT facility and GO facility, rather than the landfilling operations, which would occur primarily on the existing landfill area.

The proponent has committed to development of an offset strategy to offset the impacts of vegetation removal as a result of the proposal. The full biodiversity assessment prepared for the EIS concluded that significant impacts on the biodiversity of the area are unlikely.

Improved valuation, pricing, and incentive mechanisms

The assessment has identified the environmental and other consequences of the proposal and has identified mitigation measures where appropriate to manage any adverse impacts. The construction and operation of the proposal would be in accordance with relevant legislation and the construction and operation environmental management plans.

Requirements imposed in terms of implementation of these measures would result in an economic cost to the proponent. Implementation of mitigation measures increases both the capital and operating costs of the proposal, signifying that environmental resources have been given appropriate valuation.

The design of the proposal has been developed with an objective of minimising potential impacts on the surrounding environment, reducing the need for mitigation measures. This is in accordance with sustainability principles.

The economic costs of the proposal, including environmental works and management, would be reflected in gate fees and pricing of products (such as compost and recyclables), and there is an incentive to reduce the costs of operation, including potential costs of addressing environmental impacts, through pro-active rather than reactive environmental management.

25.3 Conclusion

The proposal involves:

- reprofiling of landfill areas to provide up to 8.3 million cubic metres of additional landfill airspace capacity

- relocation and expansion of the existing garden organics facility to provide up to 80,000 tonnes per year of processing capacity and incorporate enhanced odour control
- construction and operation of a fully enclosed ARRT facility to process up to 200,000 tonnes of general solid waste per year
- provision of a community parkland following cessation of waste disposal and processing activities

This EIS has been prepared in accordance with the provisions of the EP&A Act. It addresses the requirements of the Secretary of the NSW Department of Planning and Environment (the SEARs). In addition, this EIS provides an assessment of how well the proposal meets SITA's objectives of having no significant impacts on the community or environment.

As summarised in Section 25.1, the proposal justification is robust and the proposal responds to a recognised need and provides a number of benefits, including addressing existing issues associated with the site. The EIS has demonstrated that the site is suitable for the proposed use, the proposal is in the public interest and that it is consistent with the objectives of the EP&A Act and the principles of ecologically sustainable development.

Detailed environmental investigations have been undertaken to assess the potential environmental impacts of the proposal. These included specialist assessments of waste management, traffic, transport and access, noise, visual, air quality, soils, surface water, groundwater, leachate, contamination, hazards, bushfire risk, biodiversity and landuse. The EIS has documented the potential environmental impacts, considering both negative and positive impacts (and benefits).

Many of the potential issues identified in the initial risk assessment of the proposal would be effectively managed/eliminated through careful proposal design and operational features. To manage other issues, and in some cases eliminate them completely, the EIS chapters outline a range of mitigation measures that would be implemented during construction and operation of the proposal. The EIS has demonstrated that the proposal would not have a significant impact on the community or environment, with implementation of the proposed mitigation measures.

SITA is committed to better environmental outcomes by the application of best practice prevention, mitigation and rectification measures. Chapter 24 summarises the environmental management and mitigation measures that would be undertaken. The environmental performance of the proposal would be managed by the implementation of the OEMPs (Appendix S, Appendix T and Appendix U) and in accordance with the environmental undertakings as outlined in the VPA (Appendix W). The OEMPs would also ensure compliance with relevant legislation and any conditions of approval.

Part E
References, Glossary of Technical Terms and Abbreviations

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27. Glossary and abbreviations

Term	Definition
AEP	Annual exceedance probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANSTO	Australian Nuclear Science and Technology Organisation
Approved development	The development of LHRRP as outlined in the 1999 EIS and conditions of consent.
APZ	Asset protection zone
ARI	Average recurrence interval
ARRT facility	Advanced Resource Recovery Technology facility
ARRT residual	Residual material from the ARRT facility that cannot be further recycled and are to be disposed of at the LHRRP landfill (as it is expected to be classified as general solid waste)
AWT	Alternative Waste Technology
BCA	Building Code of Australia
Best practice	The best combination of eco-efficient techniques, methods, processes or technology used in a similar industry sector and environmental setting that demonstrably minimises the environmental impact and achieves the desired proposal goals for the local environmental setting
Capping material	Material that forms a barrier between the emplaced waste and surrounding environment that controls emissions, promotes sound land management and prevents hazards
CEEC	Critically endangered ecological community
Currently approved landform	The currently approved landform heights and contours outlined in the 1999 EIS
CQA	Construction quality assurance
Daily cover	Soil, earth or an EPA approved alternative material that is placed on top of a day's deposition of waste
DCP	Development control plan
Development consent	Development consent granted by the Minister on 12 November 1999 (DA No. 11- 01-99) and as subsequently updated by modifications
DPE	New South Wales Department of Planning and Environment (formerly known as the New South Wales Department of Planning & Infrastructure)
Eco-efficient	The most effective means of achieving a particular goal or set of goals, taking into consideration environmental, economic and social factors
ECRRP	Eastern Creek Resource Recovery Park
EIS	Environmental Impact Statement
EPA	New South Wales Environment Protection Authority and any successor body.
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instrument
EPL	Environmental Protection Licence
FBA	Framework for Biodiversity Assessment
FM Act	*Fisheries Management Act 1994*
GDE	Groundwater dependent ecosystem
GHG Protocol	*The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, Revised Edition,* developed by the World Resource Institute and the World Business Council for Sustainable Development

GIS	Geographic Information Systems
GLALC	Gandangara Local Aboriginal Land Council
GO facility	The garden organics facility at LHRRP, that undertakes composting of waste including green and garden waste, but excluding waste types such as food waste and biosolids
GST	Goods and services tax
HIPAP	Hazardous industry planning advisory paper
IBRA subregion	Interim Biogeographical Regionalisation for Australia
INP	Industrial noise policy
Landfill gas	A mix of different gases (methane and carbon dioxide) created by the action of microorganisms within a landfill
Landform reprofiling	Proposed changes to currently approved landform at the LHRRP.
Landscape	Human perception of the land conditioned by knowledge and identity with place (Landscape Institute and Institute for Environmental Management and Assessment, 2002).
Landscape feature	A component, part or feature of the landscape that is prominent or eye-catching, e.g. hills, buildings, vegetation
Leachate	A liquid that passes through matter, extracting solids, suspended solids or any other component of the materials through which is has passed.
LEP	Local Environmental Plan
LGA	Local Government Area
LHRRP	Lucas Heights Resource Recovery Park
LoS	Level of service
Minister	Minister for Planning
Mitigation	The application of techniques to reduce environmental impacts arising from the proposal
NES	National Environmental Significance
NPI	National pollution inventory
NPW Act	NSW National Parks and Wildlife Act 1974
NSW	New South Wales
OEH	NSW Office of Environment and Heritage.
OEMP	Operational Environment Management Plan and all relevant future documents, these will be provided for the landfill, GO and ARRT and will detail how these projects can be managed to meet the environmental outcomes for the site
OPAL	Open Pool Australian Lightwater
PCYC Mini-Bike Club	The mini-bike club operated by the Police and Community Youth Clubs NSW Limited (PCYC).
PEF	Processed Engineered Fuel is produced from specific wastes otherwise destined for landfill and has sufficient net calorific value to supplement or replace a standard fuel in an industrial process
PHA	Preliminary hazard analysis
PFM	Planning focus meeting
PCT	Plant community type
POEO Act	NSW *Protection of the Environment Operations Act 1997*
Rehabilitate/ rehabilitation	In the context of the landfill this generally means capping and grassing the landform as it meets final design levels.
RMS	Roads and Maritime Services
RNP	Road noise policy
RRC	Resource Recovery Centre is an existing area at the site where small vehicles can drop off waste for recovery and recycling

SSC	Sutherland Shire Council
SEAR	Secretary's Environmental Assessment Requirements (formerly known as Director-General's Requirements or DGRs)
SEPP	State Environmental Planning Policy
SICTA	Sydney International Clay Target Association and any successor body
SITA	SembSITA Australia Pty Ltd (SembSITA) is the holding company for the SITA Australia (SITA) group of companies in Australia. SembSITA is the parent company of both SITA and WSN Environmental Solutions Pty Ltd (WSN). WSN owns part of the land on which the LHRRP is situated, and leases the remainder from ANSTO. SITA holds the environmental protection licence (EPL), and so is the operator of the facilities at LHRRP. For simplicity, the term 'SITA' is used to refer to all of these organisations in this EIS.
SMA	Sydney Metropolitan Area
SLEP	Sutherland Local Environmental Plan
TEC	Threatened ecological community
TSC Act	NSW Threatened Species Conservation Act 1995
Visual amenity	The value of a particular area or view in terms of what is seen
Visual exposure	The visibility of parts of the landscape to sensitive receptors and viewpoints.
Visual catchment	Extent of potential visibility to or from a specific area, feature or proposal
V:H	Vertical to horizontal grade
VPA	Voluntary Planning Agreement
VRZ	Vegetated riparian zone
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
Waste and environment levy	Section 88 of the Protection of the Environment Operations Act 1997 requires licensed landfills to pay a levy on the disposal of waste to landfill. The purpose of this levy is to drive the reduction in the quantity of waste landfilled and promoting recycling and resource recovery
WSN	WSN Environmental Solutions Pty Ltd. WSN owns part of the land on which the LHRRP is situated. The previous operators of the LHRRP.

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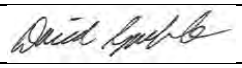
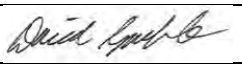
0	GHD	D Gamble		D Gamble		06.10.15

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