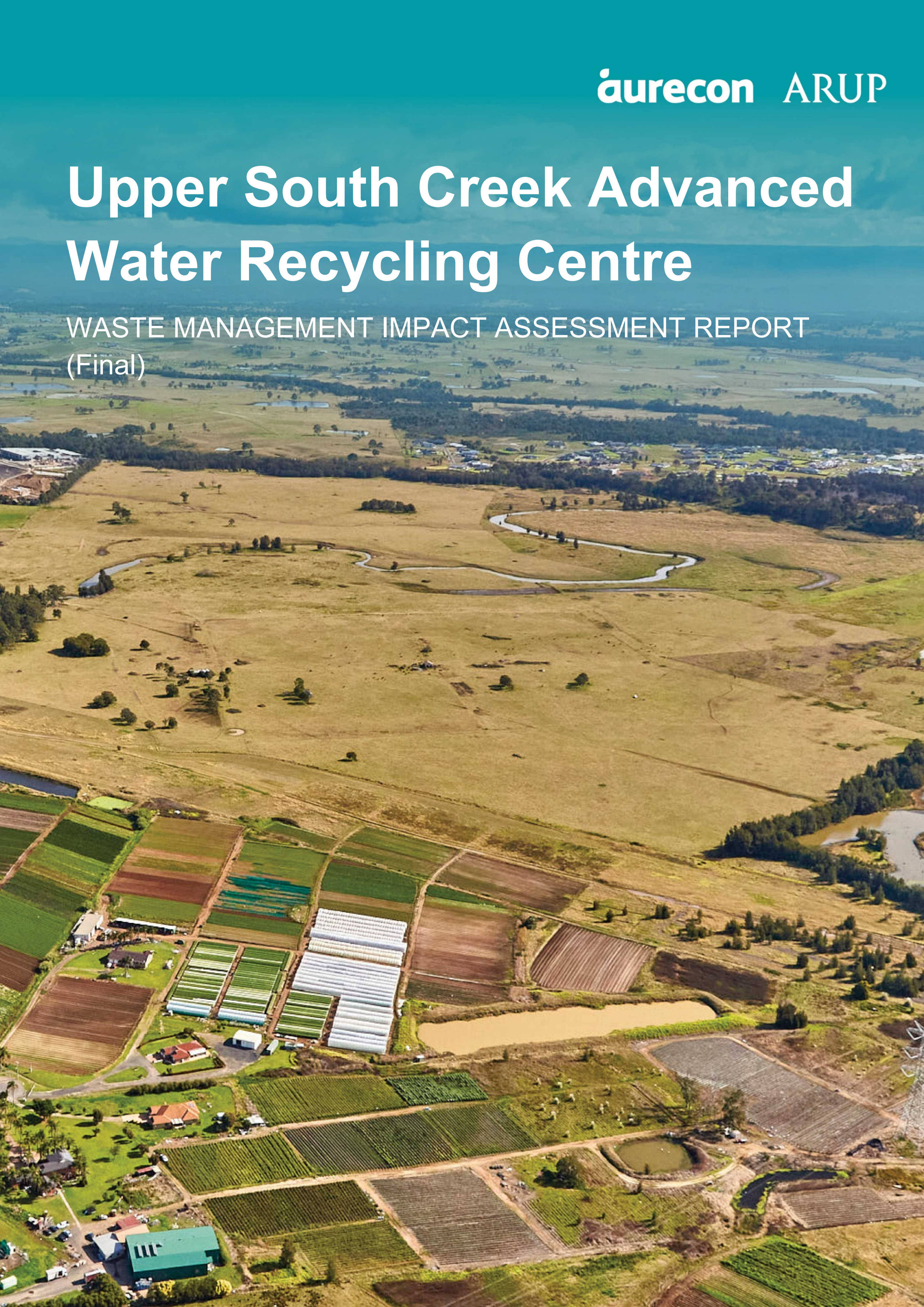
Sydney WATER

Appendix Z Waste Management Impact Assessment

aurecon ARUP

Upper South Creek Advanced Water Recycling Centre

WASTE MANAGEMENT IMPACT ASSESSMENT REPORT
(Final)



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Acronyms and definitions

Acronym	Meaning
ASS	Acid Sulfate Soils
CEMP	Construction environmental management plan
COWMP	Construction and Operational waste management plan
EIS	Environmental Impact Statement
ENM	Excavated Natural Material
EPA	Environment Protection Authority
EPL	Environment protection licence
ISCA	Infrastructure Sustainability Council of Australia
RO	Reverse osmosis
kg	Kilogram
km	Kilometre
LGA	Local government area
ML	Megalitres
ML/year	Megalitres per year
m	Metre
mm	Millimetre
m^2	Square metres
m^3	Cubic metres
NSW	New South Wales
PASS	Potential Acid Sulfate Soils
PFAS	Per-and poly-fluoroalkyl substances
POEO	Protection of the Environment Operations Act 1997
SEARs	Secretary's environmental assessment requirements
SSI	State significant infrastructure
tonne	Metric tonne (i.e. 1,000 kg)
VENM	Virgin Excavated Natural Material

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1 Introduction and background

1.1 Project background

The Upper South Creek Advanced Water Recycling Centre, pipelines and ancillary infrastructure (the project) supports the growth of the Western Parkland City with the development of new wastewater infrastructure in the Upper South Creek area. The project involves the development of a new wastewater treatment centre (i.e. the Upper South Creek Advanced Water Recycling Centre) and an effluent management system to regulate the release of treated water to local natural waterways such as the Nepean and Warragamba Rivers. It also includes a brine pipeline connecting the Malabar Wastewater Treatment Plant through the Malabar wastewater system near Liverpool.

1.2 Purpose of this report

This Waste Management Impact Assessment Report (the report) has been prepared to:

- Support the Environmental Impact Statement (EIS) for the construction and operation of the project.
- Investigate and discuss potential impacts as a result of project wastes through assessment and analysis of the existing environment and the impacts of the project’s wastes on the environment.
- Make recommendations for the avoidance or minimisation of potential impacts caused by project wastes in accordance with the relevant environmental assessment requirements.

1.3 Report objectives

This report provides a summary of the waste streams expected to be generated by construction, operation and eventual decommissioning of the project and provides an assessment of environmental values that may potentially be impacted, and mitigation measures to achieve the environmental protection objectives.

The objectives of this report are to:

- Respond to Secretary's Environmental Assessment Requirements (SEARs) and comply with legislative requirements, see Table 1 and Table 3.
- Align with Sydney Water policy and procedures, see Table 3.
- Assess the impact of the wastes generated by the project during the construction and operational phases and demonstrate how the impact can be minimised through:
  - Minimising the waste generated throughout the project life.
  - Maximising the reuse and recycling of waste materials produced and diverted from landfill disposal.
  - The storage, handling, transportation and disposal of waste in an environmentally responsible manner that does not cause harm or contamination to soil, air or water.

Table 1: Specific project SEARS requirements for waste study

SEARS requirements	Location SEARS addressed in the report
54. Details of the predicted waste generated from the project during construction and operation, including:	
• classification of the waste in accordance with the current guidelines.	Waste streams are classified in Section 6
• estimates / details of the quantity of each classification of waste to be generated during the construction of the project, including bulk earthworks and spoil balance	Estimates of the quantities of waste are provided in Section 6. Bulk earthworks and spoil balance management is outlined in Section 6.1.6.
• handling of waste including measures to facilitate segregation and prevent cross contamination	Waste management and handling measures are provided in Section 6.1.4, Section 6.2.1 and Section 8.
• management of waste including estimated location and volume of stockpiles	Indicative stockpile locations and volumes is provided in Section 6.1.6.
• waste minimisation and reuse	The reuse of construction and operational waste is discussed in Section 8.
• lawful disposal or recycling locations for each type of waste and contingencies for the above, including managing unexpected waste volumes, excessive stockpiling of material, or dirty water volumes exceeding the storage capacity available on site	Disposal and recycling options are outlined in Section 5.5 and Section 8. Contingencies for managing unexpected waste volumes are discussed in Section 6. Dirty water volumes exceeding site storage capacity are discussed in Section 6.1.3, Section 6.2.1, and the *Surface Water Impact Assessment (Aurecon Arup, 2021)Report*.
55. The Proponent must assess potential environmental impacts from the excavation, handling, storage on site and transport of the waste.	Potential environmental impacts associated with the handling, storage and transport of waste are discussed in Section 7. Potential environmental impacts associated with the excavation of waste are described in the separate Geotech Report.
56. Details of the measures that would be implemented to ensure that the construction and operation of the project is consistent with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2014-2021.	Details of the measures to ensure the project is consistent are outlined in Section 6 and Section 8.

1.4 Report structure

The report is structured as follows:

- Section 1 – introduction outlining the background and purpose of the report.
- Section 2 – project description of key features and study specific considerations.
- Section 3 – description of the existing environment specific to this study.
- Section 4 – review of legislation and policy context.

- Section 5 – description of the assessment methodology.
- Section 6 – results of the assessment (waste generation estimates and management).
- Section 7 – identification and risk assessment of impacts (incl. residual and cumulative).
- Section 8 – mitigation and management measures of identified impacts.
- Section 9 – monitoring requirements of mitigation and measurement measures.
- Section 10 – a conclusion of the assessment is presented.

2 Project description

2.1 General description

Sydney Water is planning to build and operate new wastewater infrastructure to service the South West and Western Sydney Aerotropolis Growth Areas. The proposed development will include a wastewater treatment plant in Western Sydney, known as the Upper South Creek Advanced Water Recycling Centre. Together, this Water Recycling Centre and the associated treated water and brine pipelines, will be known as the 'project'.

Sydney Water is planning to deliver the project in stages, with Stage 1 comprising:

- Building and operating the Centre to treat an average dry weather flow of up to 50ML per day.
- Building all pipelines to their ultimate capacity, but only operating them to transport and release volumes produced during Stage 1.

The timing and scale of future stages will be phased to respond to drivers including population growth rate and the most efficient way for Sydney Water to optimise its wastewater systems.

An overview of the location of the proposed infrastructure is provided in Figure 1-1. Further details of each component of the project are provided below.

2.1.1 Advanced Water Recycling Centre

The project will include an Advanced Water Recycling Centre (wastewater treatment plant) with the capacity to treat up to 50 ML of treated water per day, with ultimate capacity of up to 100ML per day. The EIS is seeking approval for the first stage of 50 ML per day.

- The Advanced Water Recycling Centre (hereafter referred to as 'the AWRC') will produce:
  - High-quality treated water suitable for a range of uses including recycling and environmental flows.
  - Renewable energy, including through the capturing of heat for cogeneration.
  - Biosolids suitable for beneficial reuse.
  - Brine, as a by-product of reverse osmosis treatment.

2.1.2 Treated water pipeline

The treated water pipeline infrastructure will include:

- A pipeline approximately 17 km long from the Centre to the Nepean River at Wallacia Weir, for the release of advanced quality water.
- Infrastructure from the Centre to South Creek to release excess treated water and wet weather flows.
- A pipeline approximately five kilometres long from the main treated water pipeline at Wallacia to a location between the Warragamba Dam and Warragamba Weir, to release high-quality treated water to the Warragamba River as environmental flows.

2.1.3 Brine pipeline

- A pipeline approximately 24 km long that transfers brine from the Centre to Lansdowne, in south-west Sydney, where it connects to Sydney Water's existing Malabar wastewater network.

2.2 Study specific considerations

The following specific project components are directly related to the types and quantities of waste that can be expected to be generated by the project during construction and operation of Stage 1.

2.2.1 Advanced Water Recycling Centre

- Odour capture, extraction and treatment facilities are provided to mitigate against odour and minimise community odour complaints. Odorous air is extracted from the covered and ventilated areas and passed through the Biotrickling Filters and Activated Carbon Filters prior to discharge through a common stack. Disposal of these filters needs to be considered.
- Various water treatment chemicals are used for dosing in the plant. These chemicals are stored in various locations throughout the plant in storage tanks with dedicated concrete bunds. Such bunds, and associated loading bays, are provided with protective coatings to prevent concrete corrosion with any spillage of chemicals. While the majority of the spillages can be collected and reused in the plant, any contaminated residual spillages and waste chemicals needs to be considered.
- A single workshop has been identified next to the inlet works, similar in construction to the switchrooms, for the storage of equipment and the servicing of plant and machinery. Waste generated in the workshop need to be considered.
- An administration building to house the control room, laboratory, lunchroom, meeting rooms and amenities is located close to the main internal road corridor, adjacent to the main car park and in proximity to the entry of the AWRC site. The building facility requirements have generally been scaled to suit the estimated number of permanent site staff required for this facility of up to fifteen. Disposal of waste from this building needs to be considered.

2.2.2 Bulk earthworks

In order to construct the project and achieve finished surface levels, there will be significant cut/fill requirements.

This will generate a substantial amount of spoil. Approximately 20% of this spoil will be used on site. However, some will need to be disposed offsite to an appropriate location. Table 2 provides indicative volumes of spoil and other excavated material. It should be noted that these volumes are based on the current concept design and may change in the course of detailed design. Any changes would be captured in the future waste management planning.

Table 2: Indicative volumes of excavated material during construction

Activity	Topsoil volume that cannot be replaced (m^3)	Spoil and rock (m^3)	Total excess spoil to be taken off site and reused or disposed (m^3)
AWRC	26,145	67,669	93,814

Activity	Topsoil volume that cannot be replaced (m^3)	Spoil and rock (m^3)	Total excess spoil to be taken off site and reused or disposed (m^3)
Brine pipeline		40,380	40,380
Treated water pipeline		47,039	47,039
Environmental flows pipeline		4,587	4,587
Sub-Total	**26,145**	**159,675**	**185,820**
Spoil reused on the AWRC Site (m^3)			**4,991**
Total Excess spoil to be taken off site for reuse (m^3)			**180,829**

There is an estimated 10,222m^3 of existing asphalt and road material within the project footprint that would need to be disposed of to appropriate landfill or other disposal location. This material would be generated from the pipeline construction and so the management would be decentralised to the nearest compound and stored short term (likely up to several days) until it can be trucked to its disposal location. This excavated waste would be sorted and stored separately as asphalt and general solid waste before their appropriate management and disposal.

The amount of total excess spoil that will need to be disposed of is estimated at approximately 180,000m^3. It is likely this can be disposed as Excavated Natural Material (ENM). It is Sydney Water's intent to secure a commercial arrangement with a disposal location to take this material. This would be confirmed at the detailed design stage. For the purposes of this EIS, the design has incorporated capacity for temporary long-term storage for all of this material in the event that a disposal location is not immediately available. This includes:

- Allowance for a stockpile on the AWRC site to store all excess spoil generated from the site with an estimated size of up to 150m x 150m x 4m potentially being required.
- There is space at compounds C2 and C10 along the brine pipeline alignment and C12 along East Street for the remaining excess spoil that would be generated in connection with the pipeline construction. Spoil may also be stored at other compound locations.

2.2.3 Biosolids

The AWRC will produce digested sludge as part of the treatment processes. The digested sludge from the anaerobic digesters will be dewatered prior to being taken off-site for beneficial reuse as an agricultural biosolid. They will be handled in accordance with the Sydney Water *Bioresources Master Plan (Revision 3, August 2018)* and the NSW EPA's *Environmental Guidelines – Use and Disposal of Biosolids Products (1997).*

2.2.4 Treated water

For the purposes of this study, advanced quality water released as environmental flows is considered a resource and not a waste product, therefore all advanced quality water discharges have not been assessed as part of this study. This also applies for tertiary quality water flows discharged into the Nepean River, which have also not been assessed further.

During heavy rainfall wet weather overflows will be released to South Creek when inflows to the Centre exceed the capacity of the tertiary treatment systems, these discharges have also not been assessed any further.

2.2.5 Brine

The AWRC is likely to adopt reverse osmosis (RO) technology in order to produce very high-quality treated water. In addition to high-quality treated water, RO produces brine as a by-product which is a concentrated solution of salts and contaminants that are removed from the treated water. The brine from the AWRC will be transferred to the Malabar wastewater network and enter the Malabar wastewater treatment plant for treatment and discharge via the existing deep ocean outfall.

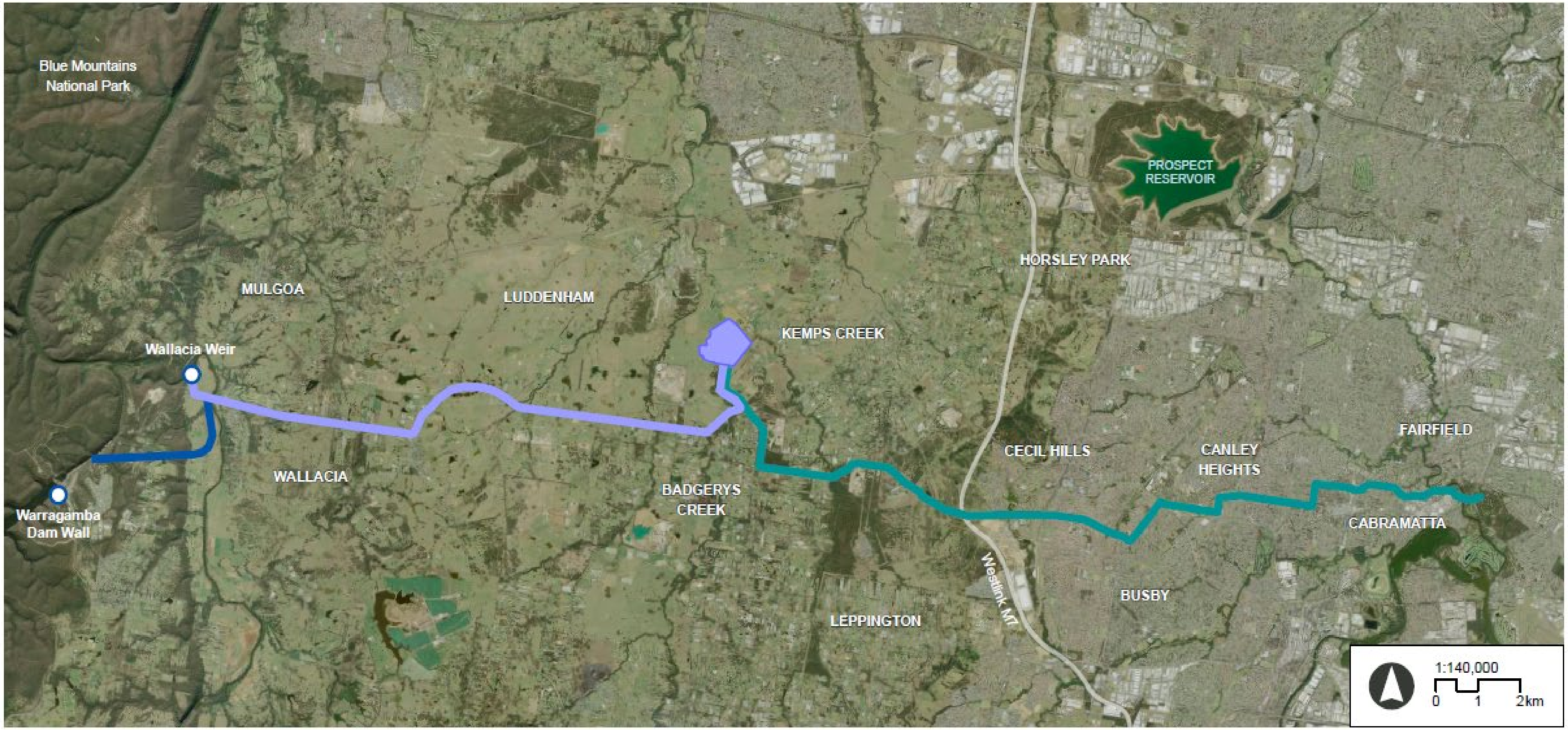
2.2.6 Solar farm

Due to the long period between the first stage and future stages, it is proposed that the area of the AWRC site allocated for future stages will be used to install ground mounted solar photovoltaic (PV) units. The opportunity may exist to further capitalise on the PV system as future stages are built by converting and utilising the units as rooftop PV.

The solar farm will be constructed on top of relatively undisturbed natural surface. Larger vegetation is to be cleared, while grass is to be maintained. The detailed solar farm design has not yet been developed. For the purposes of this report, it has been assumed solar panels would be installed on piles 2m deep and 1.5m above ground, with six panels per one pile. It has also been assumed a perimeter road would be constructed around the solar panels for maintenance and installation purposes.

2.2.7 Future stages

Waste derived from the construction and operation of future stages of the Centre have not been assessed in this study. These would be assessed in future environmental impact assessments for those stages and in line with legislation and policy at the time.

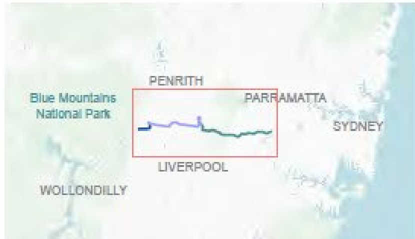


Upper South Creek Advanced Water Recycling Centre

Treated Water Pipeline

Brine Pipeline

Environmental Flows Pipeline



Projection: GDA 1994 MGA Zone 56
Project infrastructure locations are indicative and will be refined during design

Figure 1: Project Overview

3 Legislation and policy context

The NSW Environment Protection Authority (EPA) is the primary regulator of waste and pollution in NSW. The EPA regulates the transport and disposal of hazardous waste, and works with industry to find sustainable solutions to minimise the amount of waste going to landfill. The EPA provides leadership to ensure NSW has a fair, modern and well-regulated waste industry as well as reducing the impact of waste on the environment. In NSW, acts and regulations govern waste management. Anyone who handles, stores, transports, processes, recycles or disposes of waste must follow these rules to minimise harm to human health and the environment.

Table 2 summarises the key legislation and policies for waste management that are relevant to the project and specific Sydney Water policies that guide waste management.

Table 3: Legislation and policy relevant to technical study

Legislation/Policy	Brief description and intent	Relevance to the study
Protection of the Environment Operations Act 1997 (POEO Act)	The principal environmental protection legislation in NSW that addresses waste. It: • Defines 'waste' for regulatory purposes. • Establishes management and licensing requirements. • Defines offences relating to waste and sets penalties. • Provides for the issuing of environmental notices. • Allows for audits and investigations. • Establishes the ability to set various waste management requirements via the Protection of the Environment Operations (Waste) Regulation 2014 (Waste Regulation).	• Definition of waste used to identify waste materials: • Any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment. • Any discarded, rejected, unwanted, surplus or abandoned substance. • Any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance. • Any processed, recycled, reused or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations. • Any substance prescribed by the regulations to be waste. • Application of specific management and licensing conditions.

Legislation/Policy	Brief description and intent	Relevance to the study
		Section 48 of the POEO Act requires an Environment Protection Licence (EPL) for certain types of activities as outlined in Schedule 1 of the POEO Act. The project may generate excess volumes of spoil that will require temporary on-site storage prior to off-site disposal. If temporary storage is required, a premises based EPL will be needed for waste storage under section 42 of Schedule 1, unless the stockpile consists only of VENM in which case an EPL is not required. Sydney Water will establish the project's approach to spoil management and storage during construction planning, including whether it would trigger the need for an EPL. The project also requires an EPL under section 47 of the POEO Act as a scheduled development activity, and waste provisions would be captured in that licence, including any stockpiling of biosolids.
Protection of the Environment Operations (Waste) Regulation, 2014	Allows the EPA to protect human health and the environment and provides a platform for a modern and fair waste industry by setting out provisions related to the following: • The storage and transportation of waste. • Reporting and record-keeping requirements. • Special requirements for the management of certain special wastes including asbestos. • Thresholds for environment protection licences and outlines the payment of waste contributions. • Provides for exemptions to some of the requirements for certain activities under resource recovery orders and exemptions allowing specified reuse of waste streams. • Prohibits the transport of waste for disposal more than 150 kilometres from the place of generation.	Sets the project requirements for the following: • The storage and transportation of waste • Waste reporting and record-keeping • Management of asbestos • Resource Recovery Orders and Exemptions allowing specified reuse of waste streams that are relevant include: – Roadworks – Recovered aggregate – Reclaimed asphalt pavement – Other excavated road material – Excavated natural material – Treated drilling mud – Mulch

Legislation/Policy	Brief description and intent	Relevance to the study
		– Stormwater
Waste Avoidance and Resource Recovery Act, 2001	Promotes waste avoidance and resource recovery to achieve a continual reduction in waste generation by providing for the development of a state-wide Waste Strategy. Introduces a scheme to promote extended producer responsibility for the lifecycle of a product. It establishes the following waste management hierarchy: • Avoidance – minimise the potential for waste generation by avoiding unnecessary consumption of resources • Recovery – reuse, reprocess or recycle waste products to minimise the amount of waste requiring disposal • Disposal – as a last resort, dispose of resources that cannot be recovered. • The waste hierarchy is also shown visually in Figure 2.	The waste hierarchy is the governing philosophy that drives the management methodology for the project's waste.
NSW EPA – Waste Classification Guidelines, 2014 (Part 1 Classifying Waste)	Part 1 of the guidelines covers the classification of wastes into groups that pose similar risks to the environment and human health. These classifications are: • Special waste • Liquid waste • Hazardous waste • Restricted solid waste • General solid waste (putrescible) • General solid waste (non-putrescible)	These guidelines were used to classify all defined and identified wastes into the relevant environment and human health risk categories.

Legislation/Policy	Brief description and intent	Relevance to the study
NSW EPA – Waste Avoidance and Resource Recovery Strategy, 2014 - 2021	Provides a framework and targets for waste management and recycling in NSW from 2014 to 2021/22. It supports investment in infrastructure, encourages innovation and improves recycling behaviour. It strives to help develop new markets for recycled materials and reduce litter and illegal dumping.	The relevant targets established under this strategy comprise: • Increasing recycling rates to 70% for industrial waste and 80% for construction and demolition waste • Increasing waste diverted from landfill to 75% These targets will be considered within the Waste Management Plan that forms part of the Construction Environmental Management Plan (CEMP).
NSW EPA – Asbestos Waste Strategy, 2019-2021	Proposes innovative measures to reduce illegal dumping and unsafe disposal and promotes lawful and appropriate disposal of asbestos waste. A key principle is the strive to making asbestos waste disposal cheaper by working with local government and industry to provide cheaper ways for householders and licensed contractors to lawfully dispose of asbestos waste under certain circumstances.	Used to determine the most environmentally and cost-efficient method of disposing of asbestos waste. See table 8.1 for management measures to manage asbestos waste.
NSW Circular Economy Policy Statement, 2019	Provides a framework for implementing initiatives throughout the product life cycle, from design, manufacturing, and retail to end-of-life-disposal. These initiatives promote long-lasting design, maintenance, repair, re-use, sharing, transforming products into services, remanufacturing, and recycling.	The principles were incorporated into the waste management methodology to minimise waste. See Table 8.1 for management measures to reduce and reuse waste.
20-Year Waste Strategy for NSW (still in development)	The NSW EPA is leading the development of a 20-year Waste Strategy in partnership with Infrastructure NSW, where an Issues Paper was circulated for public consultation. Its intent is to set a 20-year vision for reducing waste, driving sustainable recycling markets and identifying and improving the state and regional waste infrastructure network. It will provide industry with certainty and set goals and incentives, so the right infrastructure investments are made to meet community needs.	While this strategy is still in development, it is likely that it will be finalised within the project's duration, although, it is unclear whether it will be applicable to the project. Nevertheless, the long-term vision presented in the Issues Paper has been considered, particularly: • Generate less waste • Improve collection and sorting • Plan for future infrastructure • Create end markets for biosolids.

Legislation/Policy	Brief description and intent	Relevance to the study
Sydney Water - Environment Strategy (2018-2030)	Identifies four core environmental objectives, of which Objective #4 'Efficient & Sustainable Resource Use', guides the management of waste materials, specifically: • 4.3: Beneficially recover and reuse resources and reduce waste to landfill • 4.8: Explore innovative waste management to support the development of a circular economy	The objectives were incorporated into the waste management methodology.
Sydney Water - Environmental Plan (2019-2020)	Outlines specific actions that will be undertaken to meet the environmental objectives set out in the Environmental Strategy. It is updated on an annual basis to keep abreast of emerging environmental risks and ensure it meets Sydney Waters business focus. The specific waste management actions for 2019/2020 are: • 4.3: Beneficially recover and re-use resources and reduce waste to landfill. – Identify alternative uses for biosolids recovered from wastewater treatment to maintain 100% beneficial use of biosolids Furthermore, by 2030. Sydney Water aspire to: • 4.8: Explore innovative waste management to support the development of a circular economy.	The actions were implemented in the mitigation proposed, particularly: • Maintain 100% beneficial use of biosolids
Sydney Water - Bioresources Master Plan (Rev 3, August 2018)	Provides direction on the management of bioresource products (biosolids, grit, screenings, water sludge, stormwater material, and others) for the benefit of future generations in terms of environmental, social and financial outcomes.	Used as a framework for the management of biosolids.

4 Methodology

The methodology applied to predict the waste generated from Stage 1 of the project during construction and operation included consideration of relevant legislation, the types and quantities of waste that would be generated, the classification of wastes, potential impacts as a result of waste generation and appropriate management measures to avoid, reduce or minimise waste production.

4.1 Types and quantities of waste

The estimates and details of the quantity of each type of waste to be generated during the construction and operation of the project, including bulk earthworks and spoil balance, was informed through:

- Desktop reviews of the existing environment and previous land uses within the study area to determine the likelihood of encountering existing wastes in-situ.
- A site visit to confirm the findings of the desktop review and assess the area for any potential signs of existing wastes.
- A review of previous studies and resources, including similar Sydney Water wastewater treatment and water recycling plants (specifically Wollongong Water Recycling Plant) to determine typical wastes and quantities likely to be generated during operation. Other specialist studies carried out for the EIS were reviewed including:
  - Soils and Contamination Technical Study – To determine the types and volumes of contaminated soils
  - Traffic and Transport Study – To determine the number of truck movements
  - Greenhouse Gas Study – To align with the construction materials assessed
  - Preliminary Hazard Analysis Study – To align with the hazardous wastes identified
  - Surface Water Impact Assessment Report – To determine management measures for impacted water
- Examination of the reference design and drawings, models, geotechnical reports, earthworks and materials take offs, and general construction methodology of the project to determine the likely wastes and quantities
- Attendance at design meetings and workshops to develop an understanding of each facet of the design to estimate all actions that could generate waste

4.2 Classification of waste

The types and quantities of waste identified for the project were classified according to the NSW EPA *Waste Classification Guidelines* into the following classes (with a full descriptive list presented in Appendix 1):

- Special waste
- Liquid waste
- Hazardous waste
- General solid waste - putrescible (GSWp)

- General solid waste - non-putrescible (GSWnp)

This was a desktop classification and no sampling or laboratory testing was carried out.

4.3 Waste management

The waste management hierarchy in the NSW EPA's *Waste Avoidance and Resource Recovery Strategy 2014-2021*, was used to determine the waste management and disposal options for each waste classification identified for the project. Figure 2 shows this waste management hierarchy.

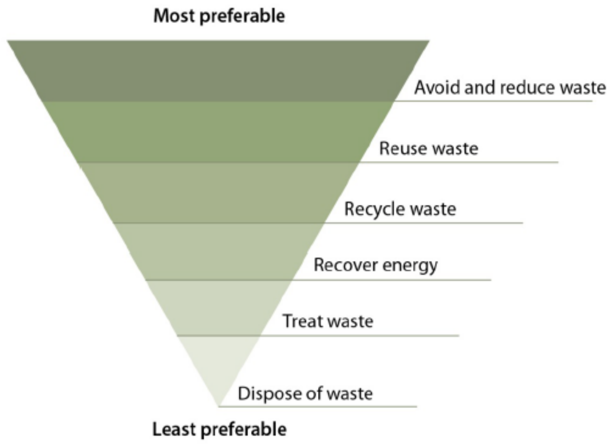


Figure 2 Waste hierarchy (source NSW EPA)

4.4 Assessment of environmental impacts

A risk assessment was carried out to identify the severity of environmental impacts as a result of excavation, handling, storage, and transportation of wastes during construction and operation.

For each predicated impact, a risk assessment has been undertaken, based on the likelihood and consequence of the impact occurring. These impacts have been assessed as negligible, low, moderate and major. Appendix 3 details the table of significance.

5 Existing environment

This section examines the existing environment that the project is located within, focusing on the aspects of the environment that could contribute to the types and quantities of waste generated by the project, as well as the waste management infrastructure facilities within the project area that handle and dispose of waste materials. A site visit was undertaken on 16 April 2020 to inform this section.

5.1 Land use

The AWRC is located within a rural area composed of large properties with fields and scattered trees. Denser vegetation is located in some areas near the centre and along creek lines. The surrounding localities are generally rural residential in nature containing a mix of agricultural, industrial and residential uses. The centre is hydraulically down gradient of the SUEZ Kemps Creek Resource Recovery Park the *Soils and Contaminated Land Impact Assessment (Aurecon Arup, 2021)* has indicated potential for contaminated groundwater at the site, further details can be found in that study.

The treated water and environmental flows pipelines traverse agricultural land, with scattered pockets of vegetation, becoming more urbanised moving east into Wallacia, Mulgoa and Luddenham, with less densely vegetated areas and more cleared land and development. Watercourses include South Creek at the AWRC site and the Warragamba and Nepean rivers at the release locations, There are several other waterway crossings along the brine and treated water alignment.

The brine pipeline passes through mixed land use areas, including residential, recreational and local businesses. Most of these areas are highly developed, becoming more densely developed moving east.

Considering the mixed nature of these land uses, the construction phase of the project is likely to require the removal of topsoil (of which most can reused), removal of vegetation (green waste) and removal of existing road infrastructure including road base and asphalt.

5.2 Soils

The *Soils and Contaminated Land Impact Assessment (Aurecon Arup 2021)* was reviewed to determine the likelihood of the type and quantities of soil wastes that could be generated, the findings are presented below.

5.2.1 Contaminated soils

The assessment of contamination risks for the project concluded that the risks of any EPA notified sites impacting the alignment areas are generally considered to be low. Laboratory analysis of the soil samples showed the following:

- Chromium and nickel exceeded the Guidelines contaminant threshold (CT) values for general solid waste (CT1) in several samples from the AWRC. Toxicity characteristic leaching procedure (TCLP) testing carried out on the samples indicated that all samples can be classified as General Solid Waste.
- Benzo(a)pyrene, chromium, lead and nickel exceeded the Guidelines contaminant threshold (CT) values for general solid waste (CT1) and restricted solid waste (CT2) in several samples along the pipelines. TCLP testing carried out on the samples indicated that all samples can be classified as General Solid Waste.

Based on the laboratory results, the *Contaminated Land Report* concluded and recommended the following:

- Soils excavated along the pipeline alignments and at the AWRC would be classified as General Solid Waste (Non-Putrescible), however, further testing may be required during construction to confirm specific waste classifications for soils and any stockpiles generated for off-site disposal (if required).

5.2.2 Acid Sulfate soils

There is potential for Acid Sulfate Soils (ASS) towards Georges River and Prospect Creek at the eastern end of the brine pipeline, however, the presence of Acid Sulphate Soils has not been indicated elsewhere on the project, . PFAS impacted soils

The Soils and Contaminated Land Impact Assessment (Aurecon Arup, 2021) has indicated no exceedances for PFAS within the desktop area. Therefore, it has been assumed that PFAS impacted soil is a waste stream that doesn't require assessment in this report.

5.2.3 Asbestos contaminated soils

While no friable asbestos was detected in any of the soil samples analysed, Asbestos Containing Materials (ACM) were detected in soils across the AWRC site. There is potential asbestos waste from the demolition of the existing infrastructure (some of the buildings on-site showed potential signs of asbestos). It has been assumed that the removal of the buildings forms part of the early works and will not be considered in this report.

ACM was found along the environmental flows pipeline, notably at Core Park Road, Megarritys Creek and Warragamba Dam viewing platform.

There were two asbestos fragments detected in two separate sample locations along the treated water pipeline route, however analysis results did not report any free or respirable fibres and there were no exceedances of the guideline investigation criteria. Therefore, a best case (emu picking on surface) and worse case (full excavation of the identified area) scenario has been assumed and an assessment of the likely volume range presented in Section 6.

The Soils and *Contaminated Land Impact Assessment (Aurecon Arup, 2021)* concluded and recommended the following:

- Any spoil or excavated materials that contain asbestos would be classified as 'special waste – asbestos waste'

5.2.4 Excavated Natural Material

While no specific tests were done for Excavated Natural Material (ENM) during the preliminary site investigations (as part of the contaminated land study), the *Contaminated Land Report* concluded and recommended the following:

- Some material may meet the requirements for Excavated Natural Material (ENM) or Virgin Excavated Natural Material (VENM) and could be beneficially re-used, however further testing is required to validate this.

5.3 Transport networks

The project is well serviced by main and ancillary roads which facilitate the easy movement of waste collection vehicles. The only area of concern is the high-quality treated water outlet structure at the Warragamba River where the grade of the road inhibits the easy access of vehicles.

5.4 Other waste generators within the study area

The study area traverses the Penrith, Wollondilly, Liverpool, Canterbury-Bankstown and Fairfield LGAs who all provide kerbside waste collection services to their residents. Furthermore, there are a number of large infrastructure projects currently underway that also contribute to the waste volumes (mainly waste soils) generated within the area, most notably:

- Western Sydney Airport
- Western Sydney Aerotropolis
- M12 motorway
- Sydney Metro – Western Sydney Airport
- The Northern Road upgrades

The cumulative impacts of these infrastructure projects are discussed further in Section 7.3.

5.5 Waste management facilities

To ensure the lawful recycling or disposal of the waste identified in Section 6, the locations of waste management facilities licensed to handle each type of waste within an economical haulage distance (assumed at 10km) from the project were investigated. These facilities are described in Section 5.3 and presented in Figure 2.

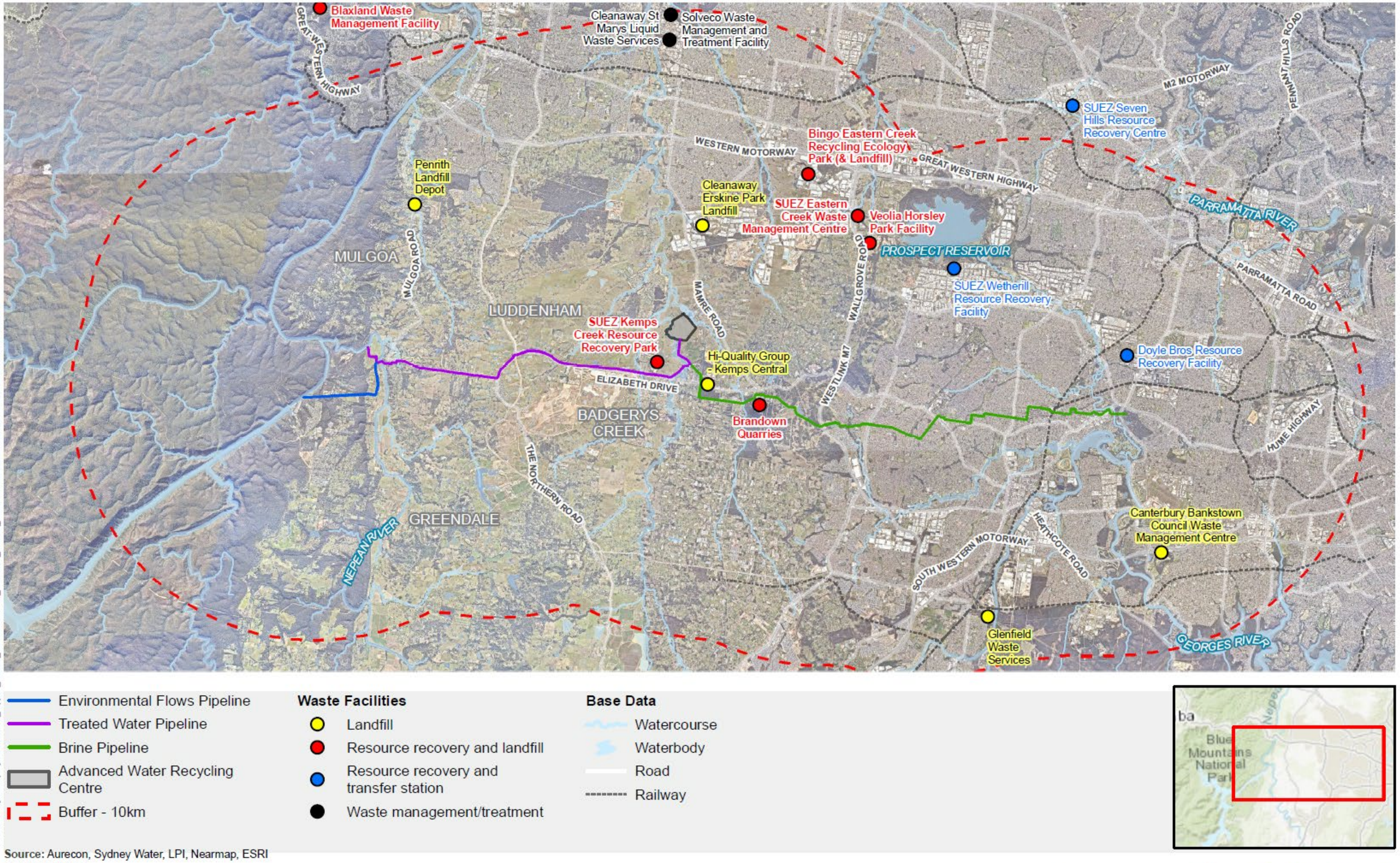
Due to its location immediately adjacent to the centre, the SUEZ Kemps Creek Resource Recovery Park has been identified as the preferred disposal facility. A desktop investigation identified a further 17 waste facilities across the study area as contingencies should the identified facility be unavailable for whatever reasons, or to manage unexpected waste volumes, or excessive stockpiling of materials. Details of the facilities, including the distance from the centre, are included in Table 5-1. A graphical representation of the proximity of the facilities to the study area is shown in Figure 4 where a 10km buffer zone around the study area gives an indication of distances.

Table 5-1 Waste facilities across the study area

Facility Name	Address	Distance from centre (km via road)	Facility Type	Description
SUEZ Kemps Creek Resource Recovery Park	1725 Elizabeth Drive, Kemps Creek	1.3	Resource recovery and landfill	Accepts biosolids, contaminated waste, mixed putrescibles and non-putrescibles
Hi-Quality Group - Kemps Central	1503 – 1509 Elizabeth Drive, Kemps Creek	3.8	Landfill	Accepts asphalt and VENM

Facility Name	Address	Distance from centre (km via road)	Facility Type	Description
Wanless Sydney Recycling Park	16-23 Clifton Avenue, Kemps Creek	4.2	Resource recovery and landfill	Accepts commercial/industrial waste, ENM/VENM and C&D waste.
Brandown Quarries	Lot 90, Elizabeth Drive, Kemps Creek	7.5	Resource recovery and landfill	Private resource recovery, GSW landfill and quarry facility
Cleanaway Erskine Park Landfill	85-87 Quarry Road, Erskine Park	14.3	Landfill	Accepts commercial/industrial waste, GSW, ENM/VENM and C&D waste.
Veolia Horsley Park Facility	752/716 Wallgrove Rd, Horsley Park	16.9	Resource recovery and landfill	Accepts GSW (non-putrescible) wastes.
SUEZ Eastern Creek Waste Management Centre	Wallgrove Road, Eastern Creek	16.9	Resource recovery and landfill	Accepts GSW, ENM/VENM, organic wastes.
Penrith Landfill Depot	842 Mulgoa Rd, Mulgoa	17.0	Landfill	Accepts domestic and commercial wastes.
SUEZ Wetherill Resource Recovery Facility	20 Davis Rd, Wetherill Park	19.9	Resource recovery and transfer station	Accepts special, hazardous and commercial/industrial waste, GSW, ENM/VENM and C&D waste.
Bingo Eastern Creek Recycling Ecology Park (& Landfill)	1 Kangaroo Ave, Eastern Creek	20.0	Resource recovery and landfill	Accepts GSW, ENM/VENM, organic wastes.
Cleanaway St Marys Liquid Waste Services	40 Christie St, St Marys	23.2	Waste management/treatment	Accepts hazardous liquid wastes.
Solveco Waste Management and Treatment Facility	38 Links Rd, St Marys	24.0	Waste management/treatment	Accepts hazardous, liquid, chemical and industrial wastes in liquid, sludge and solid states.
Doyle Bros Resource Recovery Facility	87/91 Lisbon St, Fairfield East	24.1	Resource recovery and transfer station	Accepts recyclable domestic and commercial wastes.

Facility Name	Address	Distance from centre (km via road)	Facility Type	Description
Glenfield Waste Services	2 Cambridge Ave, Glenfield	25.1	Landfill	Accepts commercial/industrial waste, GSW, ENM/VENM and C&D waste.
Blacktown Waste Services	25 Harris Ave, Marsden Park	29.9	Landfill	Accepts domestic and commercial wastes.
SUEZ Seven Hills Resource Recovery Centre	29 Powers Rd, Seven Hills	31.8	Resource recovery and transfer station	Accepts GSW, ENM/VENM, organic wastes.
Canterbury Bankstown Council Waste Management Centre	Panania NSW 2213	33.2	Landfill	Accepts domestic and commercial wastes.
Blaxland Waste Management Facility	28-30 Attunga Rd, Blaxland	33.4	Resource recovery and landfill	Accepts domestic and commercial wastes.



Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Date: 4/11/2020

1:217,000
0 2.5 5km

Projection: GDA2020 MGA Zone 56

Upper South Creek Advanced Water Recycling Centre **Waste Technical Study**

Figure 2.1: Waste Facilities

6 Waste generation and management

The waste types, classifications and quantities estimated to be generated during the construction and operation of Stage 1 of the project were developed in accordance with the methodology presented in Section 4. A summary of the results is presented in Section 6.1 for the Centre and the Pipelines during construction; Section 6.2 for the Centre during operations; and Section 6.2.1 for the Centre during decommissioning. A brief list of assumptions used to develop the estimates is also presented, while a detailed breakdown of the calculations and assumptions is presented in Appendix 1.

These waste streams are typical of construction and operational activities and can be adequately managed with the implementation of common waste management strategies. Consistent with the resource management hierarchy under the *Waste Avoidance and Resource Recovery Act 2001*, solid wastes would be reused and recycled where feasible and reasonable in accordance with the *NSW Waste Avoidance and Resource Recovery Strategy 2014-2021*. Construction and operational waste would be disposed of at appropriate licenced facilities.

6.1 Construction waste

The Centre and the Pipelines are two distinct elements of the project with separate construction methodologies and have been assessed separately. Measures to minimise the generation of waste and to maximise resource recovery have been included in the design and construction planning for the project. Examples of these measures include:

- Prioritisation of pre-cast concrete structural elements to improve efficiency and minimise waste
- On-site sorting of materials like timber, steel and concrete to maximise resource reuse on-site or nearby to the site where possible.

6.1.1 The Centre

The main construction activities that are likely to generate wastes during the construction of the Centre are listed below:

- Site establishment (grubbing and removal of surface vegetation, demolish existing buildings, ancillary construction works such as roads and fencing)
- Earthworks (cut and fill to prepare site, excavate for detention basins and underground infrastructure)
- Civil works (construction of roads and stormwater infrastructure, landscaping)
- Structure Construction (construction of buildings, treatment infrastructure, storage tanks and other treatment process units)
- Mechanical and electrical installation (utility connections, operations equipment installation and testing)
- Construction compounds (general workshop and office waste, plant maintenance waste)
- Commissioning

The estimated types, quantities, classification, and examples of wastes generated during construction of the Centre is presented in Table 6-1 and is based on the following, non-exhaustive list of assumptions (the full list of assumptions and calculations are presented in Appendix 1):

- The overall number of construction staff engaged will depend on how the delivery contractor schedules the works. It has been assumed that during peak construction periods, there will be 150 staff on site. This figure has been used to calculated the daily waste generated by the site staff.
- Vehicle wastes have been based on the following truck movement data: Heavy Vehicles = Kenworth T409 truck and dog; Light Vehicle = Toyota Hilux Ute
- Some ACM was detected in the soil samples analysed and assumed at 5% of the total spoil volume. There is also potential asbestos waste from the demolition of the existing infrastructure, it has been assumed that the removal of the buildings forms part of the early works and will not be considered in this study
- Contaminated soils were observed throughout the site with the soil classified as General Solid Waste – non-putrescible (GSWnp) with an assumed volume of 15% of the total spoil volume. The remainder of the soil is classified as either VENM or General Excavated Materials (GSWnp) with an assumed volume of 80% of the total spoil volume presented in Table 2.
- A construction period of 36 months and a standard 5.5 day working week

Table 6-1 Construction waste – the Centre

Waste classification	Waste stream	Waste description	Estimated quantity (36-month period)
Special	Asbestos waste	Excavated soils contaminated with asbestos (loose or bonded)	4,690 m^3
	Tyres	Used construction plant tyres	6 tonnes
Liquid	Waste oils	Used oil from construction plant	1,050 litres
	Wastewater	Sewerage from ablution facilities and amenities. Greywater from construction activities such as equipment washdown. Stormwater runoff collected in retention/detention basins and erosion and sediment control systems	18,000 m^3
Hazardous	Unwashed containers that previously held Class 1, 3, 4, 5 or 8	Unwashed containers that previously contained fuels, paint, and chemicals	360 m^3
	Used batteries	Lead-acid batteries from construction plant, rechargeable Nickel-Cadmium batteries from portable handheld power tools	65 kg
GSWnp	General excavated materials	Earthworks spoil, topsoil, rock, road base, asphalt	79,742 m^3
	Contaminated soils	Contaminated earthworks spoil, topsoil, rock, road base, asphalt	14,072 m^3
	Green waste	From land clearing activities, tree felling	14,400 m^3
	Wood waste	Timber offcuts, crates, pallets, packaging	78 tonnes
	Electrical infrastructure waste	Cables, conduits, ducts, sleeves, switches, etc	720 kg

Waste classification	Waste stream	Waste description	Estimated quantity (36-month period)
	Piping materials	Offcuts (PE, steel, SCL, reinforced concrete), grindings, welding rods, gaskets	480 tonnes
	Metal wastes	Cladding/sheeting (Colorbond® etc), catwalks, handrails, gratings, beams, bars, tubes, nuts, bolts, chains, plates, frames, structural steel)	1,850 tonnes
	Demolition waste	Demolition of existing buildings (not containing asbestos)	1,000 m³
	Other construction waste	Packaging, rebar, concrete, glass, plastic, rubber, plasterboard, ceramics, bricks, grout, kerbs, conduits, asphalt	6,530 m³
	Site office waste	Paper, cardboard	20 tonnes
	Construction plant waste	Plant maintenance/ workshop waste (drained oil filters and containers, rags, grease, lubricants, etc)	90 m³
	Synthetic fibres and membranes	Geotextile offcuts (Bidim®, etc), geomembrane liners, straps/slings	5 tonnes
	Dewatered grit, sediment, litter and gross pollutants	Collected in, and removed from, stormwater treatment devices and/or stormwater management systems	180 m³
GSWp	Food waste	Generated from worker's lunches	40 tonnes

6.1.2 The pipelines (treated water and brine)

The estimated types, quantities, classification, and example of wastes generated during construction are shown in Table 6-2 and are based on the following, non-exhaustive list of assumptions (the full list of assumptions and calculations are presented in Appendix 1):

- While the majority of the bulk wastes (soils) are expected to be generated along the entire pipeline, there will be a number of construction compounds situated along the pipeline route. It is expected that these compounds will serve as waste depots for non-bulk (i.e. all loose, transportable wastes) waste items, where they will be stockpiled before removal. They will also act as administrative centres, fabrication yards and workshops for construction plant and will therefore contribute a relatively significant proportion of the total waste load. As such, they will serve as the main transportation nodes for the consolidation and removal of waste.
- The overall number of construction staff engaged will depend on how the delivery contractor schedules the works. It has been assumed that during peak construction periods, there will be 200 staff on site. This figure has been used to calculated the daily waste generated by the site staff.
- The main construction technique for the pipeline will be trenching, with a fill blanket of sand or cement stabilised sand, depending on the trench depth. In cases where the trench is excessively deep or requires additional protection, the pipe will be encased in reinforced concrete. An allowance has been made for wastage of these backfill materials.

- In certain scenarios, trenchless piping by micro-tunnelling or horizontal directional drilling techniques will be used, producing treated and untreated drilling mud wastes.
- The pipeline materials consist of a range of polyethylene; SCL (steel cement lined); and Steel pipes. An allowance has been made for wastage of these piping materials.
- No friable asbestos was detected in any of the soil samples analysed, although, some minor fragments were detected on the surface at two points along the alignment. A best case (emu picking on surface) and worse case (full excavation of the identified area) scenario has been assumed and a range presented.
- Contaminated soils were observed throughout the site with the soil classified as General Solid Waste – non-putrescible (GSWnp) with an assumed volume of 15% of the total spoil volume. The remainder of the soil is classified as either VENM or General Excavated Materials (GSWnp) with an assumed volume of 85% of the total spoil volume presented in Table 2.
- A construction period of 32 months and a standard 5.5 day working week

Table 6-2 Construction waste – the Pipelines

Waste classification	Waste stream	Waste description	Estimated quantity (32-month period)
Special	Asbestos waste	Excavated soils contaminated with asbestos (loose or bonded)	20 - 75 m^3
	Tyres	Used construction plant tyres	55 tonnes
Liquid	Untreated drilling muds	Untreated slurry that consists of drilling mud (mixture of rock and soil) and drilling fluid (mixture of water, bentonite, soda ash and other additives)	860 m^3
	Waste oils	Used oil from construction plant	9,690 litres
	Partially treated water	Partially treated water from the brine pipeline discharged during commissioning	8.3ML
	Wastewater	Sewerage from ablution facilities and amenities. Greywater from construction activities such as equipment washdown. Stormwater runoff collected in retention/detention basins and erosion and sediment control systems. Hydrostatic test water	16,000 m^3
Hazardous	Unwashed containers that previously held Class 1, 3, 4, 5 or 8	Unwashed containers that previously contained fuels, paint, and chemicals	320 m^3
	Used batteries	Lead-acid batteries from construction plant, rechargeable Nickel-Cadmium batteries from portable handheld power tools	380 kg
GSWnp	General excavated materials	Earthworks spoil, topsoil, rock, road base, asphalt	86,894 m^3

Waste classification	Waste stream	Waste description	Estimated quantity (32-month period)
	Contaminated soils	Contaminated earthworks spoil, topsoil, rock, road base, asphalt	15,334 m³
	Treated drilling muds	Dewatered (drilling fluid has been removed) to create a solid	1,540 m³
	Green waste	From land clearing activities, tree felling	30,500 m³
	Pipe blanket backfill material	Excess sand/stabilised sand used as backfill material, rock	4,450 m³
	Wood waste	Timber offcuts, crates, pallets, packaging	41 tonnes
	Piping materials	Offcuts (PE, steel, SCL, reinforced concrete), grindings, welding rods	850 tonnes
	Other construction waste	Treated timber, packaging, metal, rebar, concrete, glass, plastic, rubber, plasterboard, ceramics, bricks, grout, kerbs, conduits	2,560 m³
	Site office waste	Paper, cardboard	23 tonnes
	Construction plant waste	Plant maintenance/ workshop waste (drained oil filters and containers, rags, grease, lubricants, etc)	80 m³
	Dewatered grit, sediment, litter and gross pollutants	Collected in, and removed from, stormwater treatment devices and/or stormwater management systems	160 m³
	Synthetic fibres	Geotextile offcuts (Bidim®, etc)	5 tonnes
GSWp	Food waste	Generated from worker's lunches	47 tonnes

6.1.3 Commissioning

Waste generated during the commissioning phase has been considered as construction waste. During the commissioning phase, partially treated water may be discharged from the AWRC through the brine pipeline to the Malabar wastewater network for treatment at the Malabar wastewater treatment plant.

6.1.4 Waste management

These waste streams are typical of construction activities and can be adequately managed with the implementation of common waste management strategies. Consistent with the resource management hierarchy under the *Waste Avoidance and Resource Recovery Act 2001*. Standard waste management practices that would be implemented on a construction site include:

- Construction waste not able to be reused or recycled would be disposed of at appropriate licenced facilities as detailed in Section 5.5.

6.1.5 Wastewater

Wastewater volumes generated during construction would vary depending on the rainfall received on the site, the types of construction activities being carried out, and the stage of construction. The wastewater would be classified as Liquid waste, anticipated to be generated from the following sources:

- Sewerage – from ablution facilities and amenities.
- Greywater – from construction activities such as equipment washdown.
- Stormwater – stormwater runoff collected in retention/detention basins and erosion and sediment control systems.

During the construction phase, disturbed soil and stockpiles exposed to rainfall and runoff will contribute elevated levels of suspended solids in runoff. Construction of the AWRC represents the largest risk of sediment pollution to neighbouring waterways. To ensure suspended solids concentrations are reduced to acceptable levels it is expected that stormwater management basins will be utilised as sedimentation basins to capture and contain runoff and facilitate sediment removal. The proposed on-site detention basins provide a suitable area away from waterways and flooding. Their capacity to function as sediment basins was confirmed in accordance with the *Soils and Construction Guide Volume 1, 4th Edition* for managing urban stormwater by the NSW government (Landcom, 2004). Calculations undertaken indicate the required storage volumes are significantly less than the current proposed sediment basin volumes and thus the initial use of these areas for sedimentation purposes is expected to be adequate.

Construction of the photovoltaic cells, site compounds and landscaping work present a lesser risk of sediment pollution given the smaller extent of ground disturbance. Sediment controls will be installed as necessary and in accordance with the Soils and Construction Guide.

Water for bulk earthworks will be provided from a combination of harvested stormwater runoff and potable water. It is planned that within the construction impact zone, temporary basins would be constructed, and existing on-site dams would be repurposed, to catch any runoff for reuse in the bulk earthworks. Mains water supply will be connected to the AWRC site before construction to top up harvested stormwater. The re-use of local runoff is expected to reduce the external demand significantly.

Wastewater services will likely be provided via portable ablutions block as sewer won't be connected.

Opportunities for wastewater reuse would be investigated and pursued where feasible and reasonable, and subject to meeting water reuse quality requirements. Options for wastewater reuse may include on-site reuse for construction purposes, such as dust suppression.

Surface water management activities have been incorporated into the Project reference design of the AWRC site through an iterative design process to ensure functional, integrated stormwater assets can facilitate the site function, while operating within the context of the various site constraints. Other elements of the Project reference design, including pipelines and pipeline construction depot sites did not require significant consideration of surface water management beyond flood preparedness and sediment and erosion control. Further details on surface water management can be found in the Surface Water Impact Assessment Report.

6.1.6 Bulk earthworks and spoil balance

Initial geotechnical assessments of the site have determined an area of approximately 115,000m^2 will need to be stripped of topsoil to a depth of 300mm, to allow bulk earthworks to be undertaken. Therefore approximately 34,500m^3 of topsoil will be removed. Topsoil would be stockpiled on site for later reuse. Additionally, the Geotech investigation identified the underlying 200mm of material below the topsoil is unsuitable for construction and is to be removed and disposed of offsite. The concept design earthworks quantities for Stage 1 of the centre are listed in Table 2.

As areas are stripped, they would be progressively filled with imported engineering fill material from offsite. Due to poor existing ground conditions cut material will be required to be disposed of offsite. This will require the use of on road licensed vehicles, likely truck and dogs, to shift the material. Preferably the engineering fill source and disposal site will be close to the AWRC to assist in maintaining low transport costs and offsite activity. Considering the cut volumes of the AWRC as well as the general spoil from the AWRC and pipeline trenches, there is an overall volume of about 180,829m^3 of spoil which would be produced during construction of the project. It is likely this can be disposed as Excavated Natural Material (ENM). It is Sydney Water's intent to secure a commercial arrangement with a disposal location to take this material. This would be confirmed at the detailed design stage. For the purposes of this EIS, the design has incorporated capacity for temporary long-term storage for all of this material in the event that a disposal location is not immediately available. This includes:

- An allowance for a stockpile on the AWRC site to store all excess spoil generated from the site with an estimated stockpile size of up to 150m x 150m x 4m.
- There is space at compounds C2 and C10 along the brine pipeline alignment and C12 along East Street for the rest of the excess spoil that would be generated in connection with the pipeline construction. Spoil may also be stored at other compound locations.

The management of spoil during construction of the project would depend on its composition, the location from which it was removed, and whether it is considered to be suitable or unsuitable for reuse. The approach to management of spoil materials is shown in Figure 5.

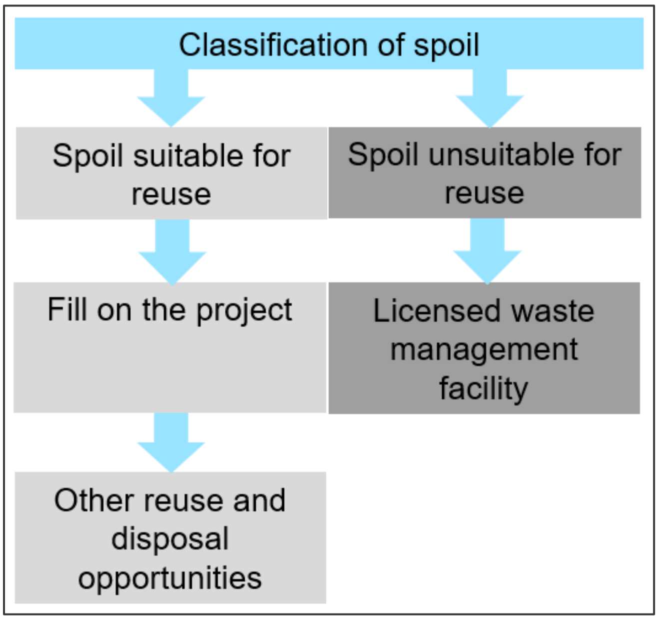


Figure 5 Spoil management approach

The trenching and under boring along the pipeline route would be the main generator of spoil during construction. Additional quantities of spoil would be generated at the AWRC. These spoil volumes will be located and managed at each of the construction compounds closest to the source of spoil. The spoil will be stored in temporary stockpiles, constructed with appropriate measures, including bunding, to avoid the potential for impacts associated with runoff and sedimentation and leachate. Potential impacts from runoff and sedimentation would be further minimised through the implementation of the environmental management measures described the Surface Water Impact Assessment Report. Potential impacts related to leachate (i.e. contaminated liquid that drains from a landfill or stockpile) are considered to be unlikely during construction as the project does not involve the excavation or disturbance of landfill areas.

The volume of the spoil stockpiles will be determined during construction to suit the construction sequencing and methodology. Spoil would be classified prior to leaving the site in accordance with NSW and Australian standards and guidelines. Spoil and soils sourced from pipeline trenching and under bore construction activity can be reused under an NSW EPA approved construction Environment Protection License (EPL) where the materials are sourced from within the project boundary / construction boundary. These materials can be reused under specific management measures within the AWRC site for landscaping, noise mounds, engineering fill and similar uses. The materials, if contamination is present within the spoil, must be non-leachable to ensure that leaching of contaminants (such as heavy metals) does not occur long term where reused. Specifically, reuse within the project boundary should aim to reuse suitable spoil from both a contamination and geotechnical perspective to minimise offsite waste disposal in accordance with the NSW EPA waste avoidance hierarchy.

There is potential to discover contaminated material during excavation works for the project. A Stage 1 contamination assessment has been carried out to determine the potential for encountering contaminated material during construction (refer to Soils and Contamination Technical Study). Management of contaminated spoil would be in accordance with the mitigation measures outlined in the study. Any contaminated material disturbed during construction would be separated from uncontaminated material on site to prevent cross contamination. This spoil would be loaded into sealed and covered trucks for disposal at a suitably licenced landfill.

The design of the project has taken into consideration the waste hierarchy by aiming to reduce the volume of excess spoil generated, as far as practical. Where possible, the project would maximise reuse of spoil generated during construction before alternative off-site spoil disposal options are pursued. The geochemistry of the spoil material as well as its consistency and quality would determine the reuse options. Where spoil cannot be reused for the project, opportunities to reuse this material on other projects (preferably within the Sydney region to reduce transport distances) would be identified.

6.2 Operational waste

The estimated waste types and descriptions, classifications and quantities of wastes generated during an average year of operation of the Centre is presented in Table 6-3 and is based on the following, non-exhaustive list of assumptions (the full list of assumptions and calculations are presented in Appendix 1).

- All infrastructure will be routinely inspected, maintained and repaired according to Sydney Water’s standard operating protocols for treatment centres.
- Based on similar treatment centres, it’s expected that about 10-15 staff will operate the centre, but for some night-time periods the centre may be unstaffed, although it will operate 24/7.

- Vehicle movements during operations will be related to staff journeys, biosolids removal (one truck approximately every 2-3 days) and other deliveries (e.g. between 3 and 7 vehicles/day for chemical deliveries) and scheduled/unscheduled maintenance requirements as well as regular grounds maintenance.
- The types and estimated quantities of wastes does not included wastes generated outside of normal operations e.g. emergencies.
- The pipeline will not generate any operational waste, it has been assumed that any maintenance activities will be undertaken by the relevant Sydney Water depot and any resultant waste will be reported as part of the depot's operations. Therefore, only the operational waste of the Centre has been considered in this assessment.
- As mentioned in Section 2.2, treated water is not considered a waste and has therefore not been considered in this assessment.

Table 6-3 Stage 1 operational waste – the Centre

Waste classification	Waste Stream	Waste description	Estimated quantity per year
Special	Tyres	Used maintenance plant tyres	30 kg
Liquid	Waste oils	Used oil from maintenance plant, workshops	5 litres
	Electrical transformer oils	Used oils from electrical transformers	100 litres
	Workshop liquid wastes	Degreasers, oily water, solvents, general cleaning and washdown chemicals	440 litres
	Brine	Concentrated solution of salts and contaminants that are removed from the water during advanced treatment	8.3ML
	Wastewater	Sewerage from ablution facilities and amenities. Greywater from maintenance activities (intentional pipe scouring, hydrostatic testing, pipe leaks/bursts, equipment washdown retention/detention basins and erosion and sediment control systems. Stormwater runoff collected in site stormwater infrastructure.	>200 m³
Hazardous	Unwashed containers that previously held Class 1, 3, 4, 5 or 8	Unwashed containers that previously contained fuels, paint, and chemicals	5 m³
	Lightbulbs	Used lightbulbs	20 kg
	Water treatment chemicals	Unused or spilt chemicals: Sodium Bisulphate, Sodium Hypochlorite, Ferric Chloride, Sodium Hydroxide, Methanol, Sulphuric acid, Anti-scaleant (Phosphonic acid)	8,760 litres

Waste classification	Waste Stream	Waste description	Estimated quantity per year
	Batteries	Lead-acid batteries from maintenance plant, rechargeable Nickel-Cadmium batteries from portable handheld power tools, backup batteries	1 kg
GSWnp	Green waste	Landscaping	10 tonnes
	Office waste	Paper, cardboard, plastic	1 tonnes
	Maintenance waste	Drained oil filters and motor oil containers, workshop waste (containers, rags, grease and lubricants), sealants, gaskets, packaging	30 m^3
	Wood waste	Crates, pallets	120 kg
	E-waste	Computers, electric monitoring components, solar panels, instrumentation and control, etc	20 kg
	Water treatment chemicals	Unused or spilt chemicals: Sodium hydroxide, Alum, Ammonia Sulphate	3,510 litres
	Odour control chemicals	Used or spilt odour control chemicals (nutrient dosing, similar to fertiliser)	30 kg
	Scrap metals	Pipes, valves, gratings, beams, bars, tubes, nuts, bolts, chains, etc	2 tonnes
	Spent filters	Spent carbon and dust filters from odour control system, air filters for blowers, RO membranes	10 m^3
	Biosolids	Dewatered and digested sludge from the anaerobic digesters (transported off-site for beneficial reuse as an agricultural biosolid)	16.3 tonnes
GSWp	Food waste	Generated from worker's lunches	2 tonnes
	Dewatered screenings	Collected in and removed from wastewater treatment devices (waste purposely flushed down the toilet)	210 tonnes
	Dewatered grits	Collected in and removed from wastewater treatment devices (sand, rock and gravel that has infiltrated the wastewater network)	110 tonnes

6.2.1 Waste management

The volumes and types of waste would be typical of similar water treatment operations and could be accommodated by existing metropolitan waste management facilities. With the implementation of Sydney Water standard waste management practices, the overall impact of operational waste streams would be minimal. Common management practice would be:

6.2.2 Wastewater

Wastewater volumes generated during operations would vary depending on the rainfall received on the site as well as the types of activities being carried out. They are mainly associated with site stormwater management practices and maintenance activities. The wastewater would be classified as Liquid waste, anticipated to be generated from the following sources:

- Sewerage – from ablution facilities and amenities.
- Greywater – from maintenance activities (intentional pipe scouring, hydrostatic testing, pipe leaks/bursts, equipment washdown).
- Stormwater – stormwater runoff collected in site stormwater infrastructure.

The sewerage volume generated is expected to be around 480 L/d (based on a return efficiency of 80%) and could be directed straight to the headworks. Supply for washdown water will be prioritised from the local rainwater harvesting tanks. Surface water management elements will be in place to achieve the draft WQOs (flow and health) for Wianamatta-South Creek established by DPIEEES in October 2020. These measures include:

- First flush capture.
- Passively irrigated street trees.
- Gross pollutant traps (GPT).
- Bioretention basins.
- Pond / wetland.
- Rainwater tank and stormwater harvesting.
- Grassed swales.

Surface water management activities have been incorporated into the Project reference design of the AWRC site through an iterative design process to ensure functional, integrated stormwater assets can facilitate the site function, while operating within the context of the various site constraints. Further details on surface water management can be found in the Surface Water Impact Assessment Report.

6.3 Decommissioning waste

As is standard Sydney Water practice for these types of assets, it is highly unlikely that the centre will be decommissioned. It is more probable that the centre will be repaired and upgraded throughout its design life to maintain its operation.

However, with the development of future stages the solar farm will have to be decommissioned in its current form to vacate the land. The opportunity may exist to further capitalise on the PV system in future stages by converting and using the units as rooftop PV.

7 Impact assessment

The environmental impact assessment identified the potential impacts from the excavation, handling, storage and transport of the waste generated by the project during construction and operation of Stage 1. The impacts are discussed below, as well as the mitigation and management measures for each identified impact which are presented in Section 8.

The key environmental values that have the potential to be impacted by the inappropriate management of waste are:

- Life, health and wellbeing of people.
- Diversity of ecological processes and associated ecosystems.
- Soils and land use capability.
- Management of finite natural resources.
- Consumption of landfill airspace.

7.1 Construction

The determination of the significance of the potential impacts associated with the waste generated during construction of the project were calculated according to the methodology described in Section 4 and are listed below and further detailed in Table 7-1. The full impact assessment is presented in Appendix 3.

- Generation and management of construction and demolition waste.
  - This includes all wastes identified in Table 6-1 and Table 6-2 but excludes all soil wastes.
  - A full description of the impact assessment can be found in Appendix 3 Table A3.1.
- Generation and management of soil wastes.
  - This includes all soil wastes identified in Table 6-1 and Table 6-2 and excludes all other types of waste materials. These wastes have been grouped together as they have similar impacts and mitigation measures
  - A full description of the impact assessment can be found in Appendix 3 Table A3.4.
- The contamination of ocean water from the discharge of partially treated water from the brine pipeline to the Malabar wastewater system during commissioning.
  - This includes all partially treated water identified in Table 6-2.

The impacts in Table 7-1 describe the potential impacts associated with the generation of waste. A summary of potential impacts to the environment and their significance are summarised below but are discussed in detail in the Surface Water Impact Assessment (Aurecon Arup, 2021), the Groundwater Impact Assessment (Aurecon Arup, 2021), the Soils and Contaminated Land Assessment (Aurecon Arup, 2021), the Air Quality Impact Assessment (Aurecon Arup, 2021).

Table 7-1 Construction impact assessment outcomes and significance

Potential impact	Description	Impact significance
Generation and management of soil wastes (excluding construction and demolition waste) from the AWRC and pipeline construction	This impact is the excessive generation of spoil material (identified in Table 2, Table 6-1 and Table 6-2) from excavations that can't be reused on site or is poorly managed leading to: • Waste of raw materials and resources due to poor handling of materials, overspecification, poor stock management etc. • Loss of opportunities for resource reuse and recycling if the waste material is disposed • Increased transport movements and fuel use for cartage of spoil to stockpiles or to disposal • Consumption of landfill airspace from disposal of spoil to landfill • Risks to human health and safety from exposure to contaminated spoil materials due to lack of training, or spills to the environment • Pollution of soil, groundwater and surface water due erosion from stockpiles, particularly those containing saline or sodic soils • Dust impacts associated with poor spoil stockpile management and transportation routes may impact nearby residents for example those in close proximity to the AWRC site.	**Moderate** The pipeline portion of the project would generate up to 181,000 m^3 of excess spoil material. Without mitigation, this spoil material would not be beneficially reused elsewhere on site, or could be poorly handled and disposed of, which would have a *moderate* impact on the site environment. Poorly maintained stockpiles can result in erosion and sediment runoff to waterways along the pipeline alignment, South Creek close to the AWRC site (Compound C8) and the Warragamba and Nepean rivers (compounds C1 and C3)

Potential impact	Description	Impact significance
Generation and management of Special Waste from the AWRC and pipeline construction	Disturbance of special waste (volumes indicated at Tables 6.1 and 6.2) including asbestos containing soils, can lead to: • Risks to human health and safety from exposure to contaminated spoil materials due to lack of training or spills to the environment • Pollution of soil, groundwater and surface water due to inappropriate management of spoil stockpiles, handling and transportation or allowing asbestos containing material to enter waterways	**Low** Contaminated land testing, outlined in the Contaminated Land Study (Aurecon Arup, 2021) and Tables 6-1 and 6-2, has indicated the volumes of potentially asbestos containing material are very low and they are not likely to be a friable material. Other special wastes, such as used construction tyres, are of low volumes and are can be easily transported to an appropriate disposal location
Generation and management of Liquid waste (excluding brine) from the AWRC and pipeline construction	Liquid waste (can impact the environment through: • Untreated drill muds entering nearby waterways, particularly along the pipeline route • Waste oils from construction plant being incorrectly stored, and contaminating soil • Sewerage from ablution facilities at compounds (e.g C1-C15) and greywater from construction activities, leading to pollution of soil, groundwater and surface water due to inappropriate handling and transportation	**Low** Volumes of drill muds and waste oils, as outlined in Table 6-1 and 6-2, are expected to be relatively low and will be contained in clearly defined areas. Due to the large workforce likely to be present at any one time, the volume of sewerage being produced is likely to be moderate. If this is left untreated and uncontained there would be a potentially high consequence to the environment.
The contamination of ocean water from the discharge of partially treated water from the brine pipeline to the Malabar wastewater system during commissioning	Contamination of ocean water by discharges of partially treated water from the brine pipeline, identified in Table 6-3, that leads to: Exceedances of environmental limits at the ocean discharge	**Low** The project would discharge partially treated water through the brine pipeline during commissioning. Because partially treated commissioning water will be treated at Malabar WWTP it discharges will be consistent Environment Protection Licence, this impact is considered to be low.

Potential impact	Description	Impact significance
Generation and management of Hazardous waste from the AWRC and pipeline construction	Hazardous waste (Tables 6.1 and 6.2) in the form of unwashed containers and used batteries can impact the environment by: • Loss of opportunities for resource reuse and recycling if the waste material is disposed • Risks to human health and safety from exposure to hazardous materials • Pollution of soil, groundwater and surface water due to inappropriate management of hazardous materials, particularly around compounds and drill sites	**Low** Very minimal volumes of hazardous materials will be produced during the construction phase. The majority of which are generated within workshops or compound areas.
Generation and management of GSWnp (excluding soil waste) waste from the AWRC and pipeline construction	A range of general waste items will be produced during construction and indicated at Tables 6.1 and 6.2. These include green waste from land clearing, wood waste, piping offcuts, packaging materials, metals, concrete, glass, plastics, and plasterboard. These can have environmental impacts through: • Waste of raw materials and resources due to poor handling of materials, overspecification, poor stock management etc. • Loss of opportunities for resource reuse and recycling if the waste material is disposed • Increased transport movements and fuel use for cartage of waste to stockpiles (at construction compounds) or to disposal • Consumption of landfill airspace and the resultant generation of methane and leachate at the landfill from disposal of waste to landfill • Risks to human health and safety from exposure to waste materials from spills to the environment • Pollution of soil, groundwater and surface water due to inappropriate waste storage, handling and	**Moderate** The largest volume of general waste is likely to be green waste from land clearing activities with approximately 45,000 m³ may be generated during the construction phase. Inappropriate storage can cause impacts to waterways, including South Creek, waterways along the pipeline alignment, Warragamba and Nepean Rivers. All other general waste materials are likely to be of low volumes and can be reduced through ordering and handling practices.

Potential impact	Description	Impact significance
	transportation, particularly at construction compounds and green waste stockpiles near waterways along the pipeline alignment, tunnelled or trenched water way crossings or stockpiles at compounds.	
Generation and management of GSWp waste from the AWRC and pipeline construction	Putrescible general waste (indicated at Tables 6.1 and 6.2) will be generated in the form of food waste from construction workers meals. This can have an environmental impact through: • Loss of opportunities for resource reuse and recycling if the waste material is disposed • Consumption of landfill airspace and the resultant generation of methane and leachate at the landfill from disposal of waste to landfill • Litter and impacts to public amenity (vermin, visual and odour impacts)	**Moderate** There are potentially up to 150 workers on site each day, therefore without mitigation measures there is the potential for large volumes of food waste to enter the environment.

7.2 Operation

As mentioned in Section 6.1.3, it has been assumed that the pipeline will not generate any operational waste and that high-quality treated water and treated water are not considered wastes and have therefore not been considered in this assessment.

Potential impacts associated with the waste generated during operation of the project are listed below and further detailed in Table 7-2 and the full risk assessment is presented in Appendix 3.

- Generation and management of operational waste identified in Table 6-3 but excluding brine discharges. .
- The contamination of ocean water from the discharge of brine identified in Table 6-3 to the Malabar wastewater system.

Table 7-2 Operational impact assessment outcomes and significance

Potential impact	Description	Impact significance
The contamination of ocean water from the discharge of brine to the Malabar wastewater system	Contamination of ocean water by discharges of brine, identified in Table 6-3, that leads to: • Exceedances of environmental limits at the ocean discharge	**Low** The brine waste stream will be managed through Sydney Water's standard operations and processes so the impact of brine on the water quality (exceeding discharge limits) within the ocean is expected to be low.
Generation and management of Special Waste during operations	The generation of special waste during the operational phase could lead to: • Risks to human health and safety from exposure to waste materials due to lack of training • Pollution of soil, groundwater and surface water due to inappropriate waste storage, handling and transportation.	**Low** During operation, negligible special waste will be generated and is likely to be limited to used tyres from maintenance vehicles. Sydney water will manage operational wastes in accordance with existing management systems. Therefore, the impact will be minor.
Generation and management of Liquid waste (excluding brine) during operations	The generation of liquid waste during the operational phase could impact the immediate environment surrounding the ARWC through: • Loss of opportunities for resource reuse and recycling if the waste material is disposed • Increased transport movements and fuel use for cartage of waste to disposal • Risks to human health and safety from exposure to waste materials due to lack of training or spills to the environment • Pollution of soil, groundwater and surface water due to inappropriate waste storage, handling and transportation.	**Low** Minimal liquid waste is likely to be generated from workshop activities such as waste oils and general cleaning. Sydney water will manage operational wastes in accordance with existing management systems. Therefore, the impact will be minor.
Generation and management of Hazardous waste during operations	The generation of hazardous waste during the operational phase could impact the environment through: • Waste of raw materials and resources due to poor stock management etc.	**Moderate** During operations there is potential for moderate amounts of hazardous materials to be generated from water treatment chemicals. This could include unused chemicals or be due to spills. If mitigation

Potential impact	Description	Impact significance
	• Loss of opportunities for resource reuse and recycling if the waste material is disposed • Increased transport movements and fuel use for cartage of waste to disposal • Risks to human health and safety from exposure to waste materials due to lack of training or spills to the environment • Pollution of soil, groundwater and surface water due to inappropriate waste storage, handling and transportation.	measures are not applied to the storage and disposal of these hazardous wastes there could be an minor impact to the environment. Impacts from other hazardous materials such as lightbulbs and batteries are expected to be negligible. Sydney water will manage operational wastes in accordance with existing management systems. Therefore, the impact will reduced to minor.
Generation and management of GSWnp waste during operations	The generation of GSWnp waste during the operational phase could impact the environment through: • Waste of raw materials and resources due to poor stock management etc. • Loss of opportunities for resource reuse and recycling if the waste material is disposed • Increased transport movements and fuel use for cartage of waste to disposal • Consumption of landfill airspace and the resultant generation of methane and leachate at the landfill from disposal of waste to landfill • Risks to human health and safety from exposure to waste materials due to lack of training or spills to the environment • Pollution of soil, groundwater and surface water due to inappropriate waste storage, handling and transportation.	**Low** Most general waste generated during the operational phase, is likely to be similar to a general office and workshop and therefore the impact is likely to be minimal. There will be ongoing general waste such as spent filters (including RO membranes and carbon filters) and non hazardous water treatment chemicals There may be some larger 'one off' items of general waste such as used solar panels and E-waste. Due to the specialist nature of some of these waste streams, without mitigation measures there is a potential for environmental impacts to occur in the vicinity of the AWRC. Sydney water will manage operational wastes in accordance with existing management systems. Therefore, the impact will be minor.

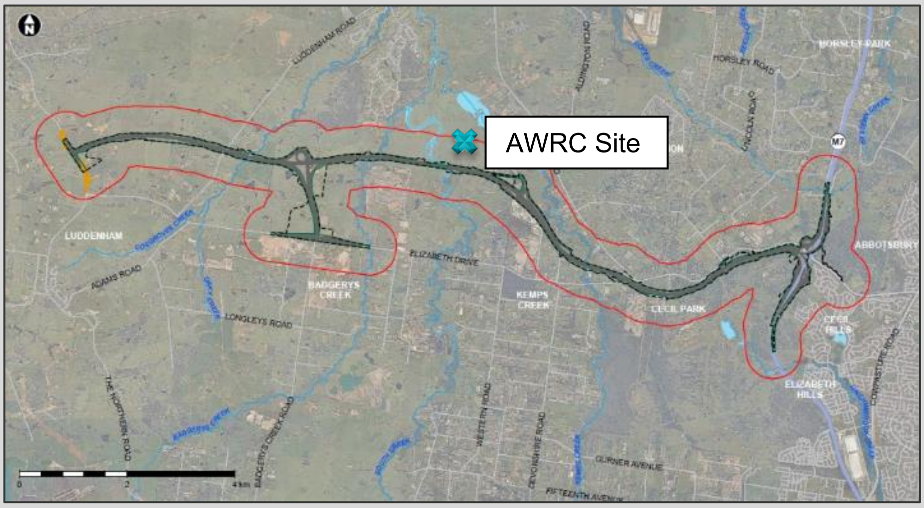
Potential impact	Description	Impact significance
Generation and management of GSWp waste during operations	The generation of GSWp waste during the operational phase could impact the environment through: • Loss of opportunities for resource reuse and recycling if the waste material is disposed • Increased transport movements and fuel use for cartage of waste to disposal • Consumption of landfill airspace and the resultant generation of methane and leachate at the landfill from disposal of waste to landfill • Risks to human health and safety from exposure to waste materials due to lack of training or spills to the environment • Pollution of soil, groundwater and surface water due to inappropriate waste storage, handling and transportation.	**Low** The majority of the putrescible waste will be generated from the dewatering of screenings and grit. There is likely to be minimal food waste from workers during the operational phase. Sydney Water will manage operational wastes in accordance with Sydney Waters existing management systems. Therefore, the impact will be minor.

7.3 Cumulative impacts

Western Sydney has been earmarked for major growth and urbanisation within the near future. This growth is the primary driver for the development of the AWRC project. The rapid change in topography, surface coverage and general land use will result in major impacts to the natural environment.

When considered in isolation, any identified project impacts may be considered minor. These minor impacts may however be compounded when the cumulative impacts of multiple projects on the same receivers are considered. As such, the potential impacts identified in Table 7-1 and Table 7-2 need to be considered alongside recently completed, ongoing and proposed projects. The major projects currently being proposed within close proximity to the desktop assessment area are indicated in Table 7-3.

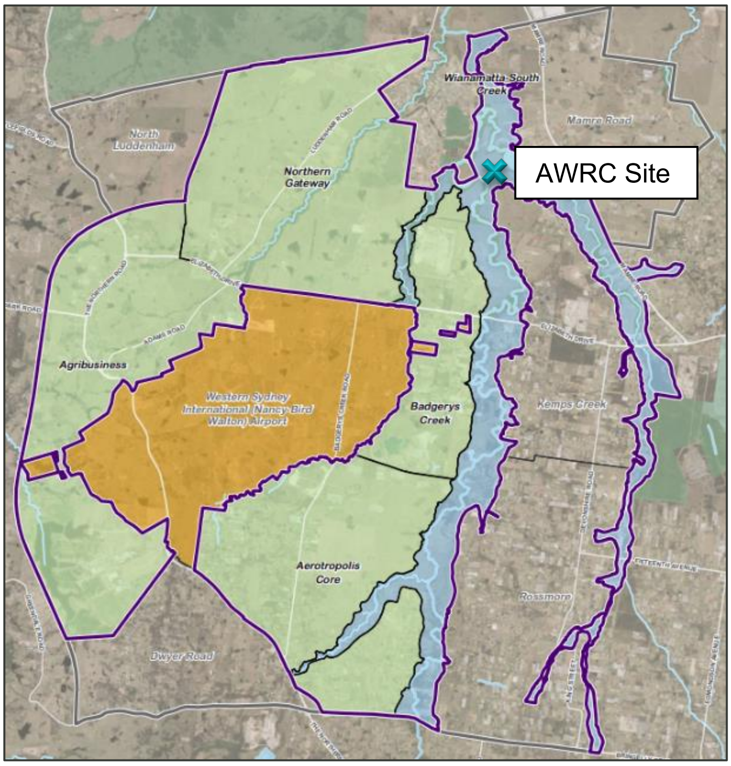
Table 7-3 Proposed major projects in close proximity to the project

Project	Project description, relation to current proposed AWRC project and expected cumulative impacts
Western Sydney Airport	**Description:** The proposed Western Sydney Airport site will be located approximately 3.2 km south-west of the AWRC site, south of Elizabeth Drive. The site is primarily drained by Badgerys Creek and Cosgroves Creek. Construction at the Western Sydney Airport site has already commenced. **Interaction:** The interaction between the Western Sydney Airport and AWRC site is expected to be minimal due to physical distance. The interaction between the Western Sydney Airport and the treated water pipeline will occur principally along the Elizabeth Drive northern boundary of the airport during construction.
M12 Motorway	**Description:** The proposed M12 Motorway will run between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham for a distance of about 16 km and would be opened to traffic prior to opening of the Western Sydney Airport.  **Interaction:** The AWRC site itself is located within the extents of the M12 impact area. The pipelines will follow a similar alignment to the M12 along portions of their routes. The interaction between the M12 Motorway and the treated water pipeline will occur principally along the Elizabeth Drive northern boundary of the airport during construction along with work immediately south of the AWRC site.

<table>
<tr><th>Project</th><th>Project description, relation to current proposed AWRC project and expected cumulative impacts</th></tr>
<tr><td>Aerotropolis priority precincts</td><td>

Description:

The Western Sydney Planning Partner (WSPP) has identified several initial precincts which will targeted for early land release and development. These precincts all directly border the Western Sydney Airport site, they include: the Aerotropolis Core, Badgerys Creek, Northern Gateway, Agribusiness and adjoining areas of Wianamatta-South Creek as indicated below. These precincts are primarily located within the South Creek catchment as the discharge pipelines will transect several of them.



Interaction:

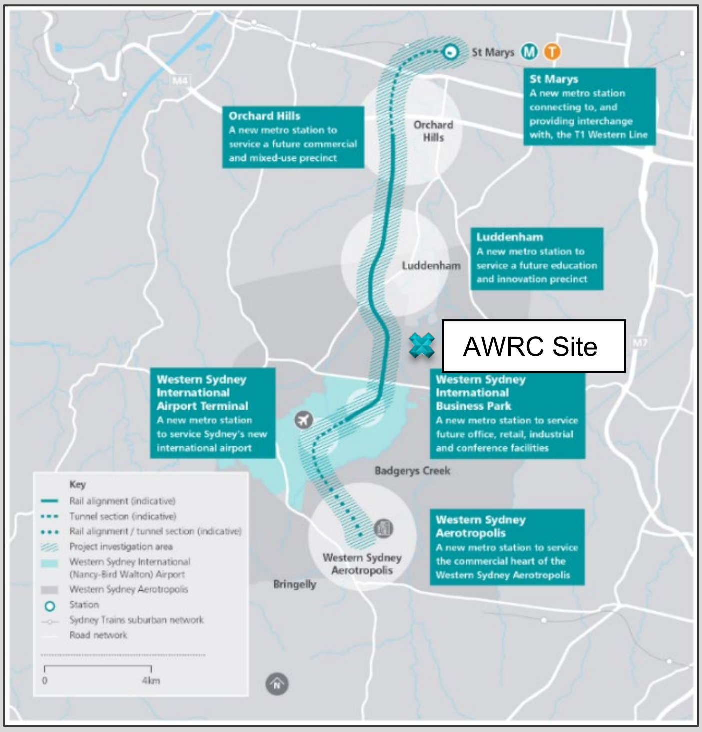
Interaction will occur within the impact area for pipelines and the AWRC site which is within the initial precincts. An integrated water management plan and land capability assessment targeting these precincts has been developed. This includes the Phase 1 DCP for initial precincts with associated objectives and benchmarks for soil and contamination management during future development. The purpose of the plan is to identify measures and control mechanisms to ensure sustainable soil and contamination management practices are established and consequently mitigate the cumulative impacts that the rapid urbanisation may lead to.

</td></tr>
</table>

<table>
<tr><th>Project</th><th>Project description, relation to current proposed AWRC project and expected cumulative impacts</th></tr>
<tr><td>Sydney Metro – Western Sydney Airport</td><td>

Description:

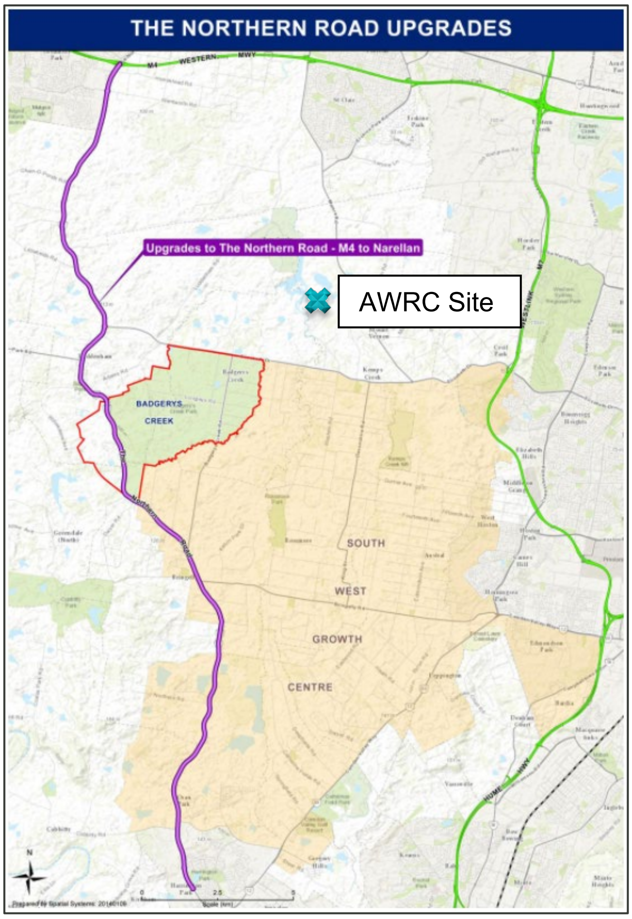
The proposed new railway will link St Marys to the new airport and the Western Sydney Aerotropolis, alignment indicated below (Sydney Metro, 2020).



Interaction:

The project footprint is primarily located within the South Creek catchment (or its tributaries). The expected interaction between the projects is minimal, however, the EIS is currently being developed so interaction assessment is limited (to be updated via coordination of studies).

</td></tr>
</table>

Project	Project description, relation to current proposed AWRC project and expected cumulative impacts
The Northern Road Upgrade	**Description:** The Northern Road between Mersey Road and Glenmore Parkway is being upgraded and includes upgrades at the intersection of Elizabeth Drive along the treated water pipeline.  **Interaction:** The interaction between the Northern Road Upgrade and AWRC site is expected to be minimal due to physical distance. The interaction between the Northern Road Upgrade and the treated water pipeline will occur principally along the Northern Road at Luddenham, Elizabeth Drive and Park Road during construction.
Warragamba Dam Raising	**Description:** Warragamba Dam Raising is a project to provide temporary storage capacity for large inflow events into Lake Burragorang to facilitate downstream flood mitigation and includes infrastructure to enable environmental flows. **Interaction:** The EIS for this project is still being developed and thus potential impacts have not been assessed and published as yet.

These proposed major projects along with the general expected future urban development in the area have the potential to contribute to the faster than anticipated/planned consumption of available landfill airspace capacity caused by an overutilization of waste management facilities within the immediate area of the site (identified in Table 5-1). This overutilisation could exacerbate any impacts arising from the construction and operation of the AWRC and pipelines.

Generally major projects are designed and delivered in accordance with current environmental legislation and incorporate sufficient control measures to mitigate associated impacts and primarily targeting a neutral or beneficial impacts outcome. Given the widespread expected urbanisation of the local environment, which would include numerous small-scale developments, the cumulative impacts from these smaller developments could become a more likely source of compounded impacts.

Sydney Water's approach to waste management takes this potential for overutilization of waste management facilities into account by providing capacity at the construction work areas for the temporary long-term storage of excess spoil, thereby reducing the immediate burden on waste management facilities.

In addition, Sydney Water has consulted with the local councils affected by the project with the specific intent to source information and concerns about additional pressure on waste infrastructure. During consultation with the Councils, no issues or concerns were raised with respect to waste with the exception of Liverpool Council. Their concern related to potential impacts to their ability to access the SUEZ Kemps Creek Resource Recovery Park where the Council's waste is disposed. If there are impacts from road works or from increased traffic, there is a possibility that trucks will be inhibited from accessing the landfill and be forced to sit idle, thus forming a backlog that further inhibits access to their key disposal location.

Most impacts associated with the AWRC project are expected to be minor and short-term (during construction). The AWRC project is not expected to generate significant impacts during operation. If the proposed mitigation measures are incorporated, the project would have a minor contribution to any foreseen cumulative impacts from other identified projects in the vicinity.

8 Mitigation and management measures

8.1 Approach to mitigation and management

Mitigation and management measures have been proposed in accordance with legislative requirements and the relevant Sydney Water waste management guidelines that address the identification, segregation, storage, transportation and disposal methodologies of these wastes to achieve the identified report objectives. The waste management strategy for the project would continue to be developed and refined throughout each stage. In addition, waste auditing and monitoring would be undertaken to ensure that the mitigation measures are scaled with actual waste volumes.

Contingency measures would be implemented to manage unexpected waste volumes and types of waste materials generated from the construction and operation of the project. Suitable areas would be identified, where feasible, to allow for contingency management of unexpected waste materials. These areas would be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage and segregation.

The project design has considered the principles of the waste management hierarchy as described in Section 4.3. Where feasible and reasonable, resources would be managed according to the following hierarchy:

- Avoidance of unnecessary resource consumption through design, efficient construction methodologies and management
- Resource recovery, including reuse, reprocessing, recycling and energy recovery within the project
- Resource recovery, including reuse, reprocessing, recycling and energy recovery outside the project
- Where resource recovery is not feasible or reasonable, disposal would be the last resort

Measures to avoid, minimise or manage resource consumption and waste generation as a result of the project are detailed in Table 8-1 below.

It is expected that a Waste Management Sub-plan will be developed as part of the Construction Environmental Management Plan. This Sub-plan is to outline the mitigation measures and procedures to be undertaken during construction. Waste management is to be undertaken by appropriately licensed operators who are obligated to adhere to the identified policies and legislation.

In order to assess the performance of the waste management activities against the determined targets, the generated waste streams and quantities would be monitored regularly (e.g. monthly) and audited at least once a year from the source of generation to the point of destination which could be either the waste disposal facility or the recycling facility. The disposal receipts for the waste types and quantities will be kept within a construction site register and will be available for review to demonstrate compliance with the agreed targets during routine construction auditing.

The Waste Management Sub-plan will also be included in monitoring and auditing procedures.

During the operational phase wastes will be managed in accordance with relevant legislative and policy requirements, and in accordance with Sydney Waters operational management protocols.

This will occur via operational controls in Sydney Water's existing management systems, including Enterprise Quality Management System and Environmental Management System, as well as the specific waste management measures listed in Sections 6.2.1 and wastewater management measures listed in Section 6.2.2.

Sydney Water operates under an ISO14001 certified environmental management system (EMS), which includes processes for managing Environmental and Sustainability Requirements in Procurement, as well as training, awareness and operational controls for the environmental aspects of the business.\

The mitigation measures in Table 8-1 describe the mitigation measures required to manage the generation of waste which will then minimise impacts to the environment. A full description of management measures to manage impacts to the environment are discussed in detail in the Surface Water Impact Assessment (Aurecon Arup, 2021), the Groundwater Impact Assessment (Aurecon Arup, 2021), the Soils and Contaminated Land Assessment (Aurecon Arup, 2021), the Air Quality Impact Assessment (Aurecon Arup, 2021).

Table 8-1 Mitigation and effectiveness

Potential impact	Mitigation measure
Generation and management of all waste streams from AWRC and pipeline construction	• Develop and implement a procedure for Waste Management that considers as a minimum: • All wastes generated by the project should be classified in accordance with the EPA waste classification guidelines and specifies targets for waste streams with a view to disposal being the least preferred approach in accordance with the waste hierarchy. • Wastes identified in Table 6-1 and 6-2 would be stored and handled according to their waste classification. This should include site specific measures (in accordance with the compound locations) for waste segregation, storage and handling according to their waste classification and in a manner that prevents pollution of the surrounding environment. • Sufficient infrastructure would be provided to ensure that wastes are able to be segregated into separate bins or stored in demarcated areas to prevent cross contamination. The infrastructure would be provided to store a volume of waste aligned with the waste collection schedule. Furthermore, as a contingency, additional storage would be provided to accommodate any unexpected waste volumes. • The design of the waste infrastructure at the AWRC would consider the health and safety requirements of users and include sufficient environmental controls to prevent pollution of the surrounding environment (water, acoustics, visual, odour, etc). • A waste collection schedule would be determined to prevent the excessive stockpiling of wastes at the AWRC prior to final treatment or disposal. • Maps of designated locations of waste storage and stockpiles of materials within each of the construction compounds, including sufficient storage to align with the waste collection schedule, would be developed. • The waste storage areas will be located in areas easily accessible by vehicles collecting waste. Wastes will be appropriately transported by licensed waste transporters. • Clear, visible and legible signage would be provided on compound and storage areas to encourage correct recycling and reduce contamination. Waste signage will be selected based on types of waste generated and aligned with the relevant LGA's existing signage.

Potential impact	Mitigation measure
	• Measures to ensure safe transport of waste materials and avoid or minimise any risk of waste or contaminated materials creating dust or other impacts to the community or surrounding sensitive environments are included. • A record keeping system is implemented on site so that waste tracking systems can be maintained. This should include the use of the NSW EPA's online waste tracking system where required. Keep records of receipts to prove that waste diversion and recycling targets have been met. • includes training and awareness for all construction personnel
The contamination of ocean water from the discharge of partially treated water from the brine pipeline to the Malabar wastewater system during commissioning	• Managing wastes in accordance with relevant legislative and policy requirements, as outlined in Section 4, including Sydney Water's Discharge Protocol. • The partially treated water is to be discharged into a network of pipes that take it to the Malabar Waste Water Treatment Plant (MWWTP) where it will be treated to acceptable environmental levels before being discharged into the ocean in accordance with the EPL requirements. •
The contamination of ocean water from the discharge of brine to the Malabar wastewater system	• Sydney Water will manage the brine waste stream in accordance with Sydney Waters standard operational protocols. • The brine is to be discharged into a network of pipes that take it to the Malabar Waste Water Treatment Plant (MWWTP) where it will be treated to acceptable environmental levels before being discharged into the ocean consistent with the Malabar WWTP EPL requirements. •
Generation and management of soil wastes from the AWRC and pipeline construction	Prepare and implement a Construction Spoil Management Plan as part of the CEMP in accordance with standard Sydney Water management systems, including the specific bulk earthworks and spoil balance management measures listed in Sections 6.1.6 as well as, but not limited to, the following key elements: • **Focus on spoil reduction**: develop measures to avoid the generation of spoil. This should be done by balancing the cut/fill during the design process. It is noted that the site contains both saline and sodic soils, which cannot be reused, these will need to be removed from site. • **Spoil production and material types**: Confirm spoil types including estimated volumes (e.g confirm if excavated material can be classified as ENM). Determine the most environmentally and cost-efficient method of disposing of these spoils including asbestos contaminated soil that have been identified across the project area. • **Resource recovery exemptions**: determine if any 'resource recovery exemptions' which allow for the beneficial reuse of wastes *via* land application are applicable. • **Environmental Protection License**: determine if the temporary storage of excess spoil on site triggers the need for an EPL under section 42 of Schedule 1 of the POEO Act. • **Spoil reuse and disposal**: track and keep records of spoil using the NSW EPAs online waste tracking system. Dispose of spoil at facilities licensed for the type of waste, including those listed in Table 5-1. Keep records of receipts to prove that waste diversion and recycling targets have been met.

Potential impact	Mitigation measure
	• **On-site spoil management**: prepare a site plan that shows the location of all stockpiles, their quantities, and the management of runoff. The site plan should consider the indicative volumes identified in Section 6.1.6. The stockpiles are to be located in a position that is convenient with reasonable proximity to the vehicle entrance. Once the classification of spoil is confirmed, the hierarchy for managing spoil should be: • Reuse within the Project • Reuse for environmental works • Reuse on other development Projects • Reuse for land restoration • Reuse for landfill management • Dispose offsite as waste • **Clearly assign and communicate responsibilities**: nomination of a person responsible for spoil management of the site and for keeping records to ensure waste diversion and recycling targets are met. Ensure that those involved in the management of spoil are aware of their responsibilities in relation to the spoil management plan. Provision of clear signage on how to use the spoil management system and what materials are acceptable to be posted at all stockpiles areas. • **Monitor**: ongoing monitoring and annual reviews of the plan to be undertaken using Sydney Water Environmental Management System waste reporting templates..
Generation and management of Special Waste from the AWRC and pipeline construction	• A procedure for managing Special Waste identified in Table 6-1 and Table 6-2 will be implemented in accordance with relevant legislative and policy requirements. It should include as a minimum: – review contaminated spoil volumes identified in the Waste Impact Assessment (Aurecon Arup 2021). Confirm volumes of soils contaminated with ACM as detailed design develops. – identify lawful offsite storage and disposal options including those indicated at Table 5.1 – if asbestos waste is transported off site, ensure appropriate containment methods are in place including, as a minimum, wrapping asbestos sheets and wetting down soil contaminated with ACM. – ensure transportation of asbestos waste by appropriately qualified personnel. • Asbestos Containing Material is known to occur in small quantities across the construction site and is further outlined in the Contaminated Land Impact Assessment (Aurecon Arup, 2021). The Contaminated Land Impact Assessment recommends developing and implementing a remedial action plan for AECs, • Prior to the demolition of any existing buildings a contaminated and hazardous material survey will be undertaken. In the event that asbestos or other hazardous materials are identified in these structures, management measures for hazardous materials within existing structures are identified within the Contaminated Land Impact Assessment (

Potential impact	Mitigation measure
	• Other special waste, such as used tyres from construction activities, is to be disposed of to a licenced facility.
Generation and management of Liquid waste (excluding brine) from the AWRC and pipeline construction	• Drilling mud, is to be contained at the drill site and removed from site as soon as possible to a lawful disposal facility • Effluent and greywater from the ablutions at each compound are to be stored in a securely sealed system and transported offsite for disposal by an appropriately licensed contractor. • Construction runoff is to be stored in sediment basins at the AWRC site or managed by sediment and erosion control measures detailed in the surface water Impact Assessment (Aurecon Arup, 2021). • Saline ground water is to bestored and trucked offsite. Management measures for saline groundwater are detailed at the Groundwater Impact Assessment (Aurecon Arup, 2021) • Waste oil is to be contained in a fully sealed container and stored on a bunded pallet, prior to removal from site to a licenced facility
Generation and management of Hazardous waste from the AWRC and pipeline construction	• Hazardous waste to be stored and transported in accordance with legislative requirements. All hazardous waste transport to be undertaken by appropriately licensed contractors. Disposal must be at a lawful facility including those identified at Table 5.1. • Hazardous waste to be removed from site immediately and not stockpiled. • Where possible, construction compounds to be located away from waterways, including all creeks along the alignment, and the Nepean and Warragamba Rivers • Where this cannot be done, for compounds such as C1, C2, C3, C4, C8, C9 and C14 which are currently located directly near waterways, stormwater drains found in roadways and likely close to all compounds and works are also protected under sediment erosion control measures identified in the Surface Water Impact Assessment (Aurecon Arup, 2021). • Workshops in compounds to be located away from nearby waterways.waterways. Workshops to be temporary in nature and should not be used for storage of large volumes of materials.
Generation and management of GSWnp (excluding soil waste) waste from the AWRC and pipeline construction	• Manage General Waste identified in Table 6-1 and Table 6-2 in accordance with relevant legislative and policy requirements. This should include targets that consider: • Recycling rates of 80% for construction and demolition waste • Diversion of 75% of all other general waste from landfill
Generation and management of GSWp waste from the AWRC and pipeline construction	Food waste generated from workers lunches is to be source separated at each compound site. Opportunities to divert food waste from landfill should be investigated for example, commercial composting services to undertake food waste composting offsite or the provision of site waste facilities such as bins to separate food waste at source
Generation and management of Special Waste during operations	• Special Waste generation during operation is likely to be limited to used tyres from workshops. Used tyres are to be taken to an appropriately licensed tyre recycling facility. Used tyres are not be disposed of with general waste or taken to landfill.

Potential impact	Mitigation measure
Generation and management of Liquid waste (excluding brine) during operations	
Generation and management of brine waste during operations	The brine waste stream will be managed through Sydney Water's standard operations and processes. • Sydney Water has processes and procedures in place to respond to the unlikely event of system failures, including leaks, of pressurised wastewater systems such as the treated water and brine systems. This includes isolating damaged areas for repair and rehabilitating any impacted areas. • As detailed design progresses we will undertake a more detailed risk assessment of pipeline failures. If any further mitigation measures are identified, these will be incorporated into the design and the standard operating procedure for the brine pipeline.
Generation and management of Hazardous waste during operations	• Hazardous waste including oil, solvents and water treatment chemicals will be classified and disposed in accordance with relevant legislative requirements and Sydney Waters existing management systems
Generation and management of GSWnp waste during operations	• General waste will be managed in accordance with Sydney Water's existing management systems.
Generation and management of GSWp waste during operations	• General putrescible waste will be managed in accordance with Sydney Waters existing management systems • Where possible opportunities to divert food waste from landfill which may include the provision of site waste facilities such as bins to separate food waste at source will be investigated. • Maintaining 100% beneficial reuse of biosolids

9 Monitoring requirements

Monitoring is important in ensuring construction and operational phase mitigation measures are effective, and waste impacts across the project do not exceed acceptable limits. Monitoring is proposed to:

- Comply with legislative requirements.
- Assess consistency with the project's waste management plans.
- Assess the adequacy of proposed mitigation measures and identify where mitigation measures need revision or additional measures.
- Monitor potential environmental impacts that will enable positive action to be implemented in case of incidents or accidents related to waste activities.

Monitoring during construction would include:

- Regular inspection and auditing against waste management plan requirements and mitigation measures. The inspection and auditing approach would be captured in the project's waste management plan.

10 Conclusion

This report provides a summary of the types and quantities of waste that can be expected to be generated by Stage 1 of the project during its construction and operation. It assesses the impacts these wastes could have on environmental values and proposes mitigation and management measures to avoid adverse impacts on the life, health and wellbeing of people and the diversity of ecological processes and associated ecosystems surrounding the project site.

As a first step, a sustainable approach to the design and construction of the project elements will minimise the overall amount of waste generated; followed by the appropriate management and storage of wastes that will prevent on-site and off-site pollution and enhance opportunities for reuse and/or recycling and diversion from landfill. Waste that is not regulated or able to be reused or recycled should be transported by a licensed transporter to a licensed disposal facility.

To ensure appropriate waste management, onsite waste monitoring and auditing procedures should be developed in accordance with the recommendations of this report as well as relevant legislation, license and permit conditions, construction procedures and industry best practice standards, during both construction and operational phases; this should be captured in the form of a series of construction site environmental management documentation, most notably a Construction and Operational Waste Management Plan and a Construction Spoil Management Plan.

Appendix 1

Waste quantity calculations

Waste	Quantity	Unit	Source	Assumption	Calculation
Construction Waste					
The Centre					
Asbestos waste	0	m³	Contaminated land report	No asbestos was detected in any of the samples analysed There is potential asbestos waste through the demolition of the existing infrastructure (some of the buildings on-site showed potential signs of asbestos) but this is outside the scope of this study.	
Tyres	6	ton	Traffic and Transport Report Kenworth T409 operating manual Toyota Hilux operating manual Bridgestone spec sheet	Change HV tyres every 80,000km, 26 tyres per truck and dog @ 50kg each Change LV tyres every 40,000km, 4 tyres per vehicle @ 15kg each Construction period = 36 months = 7,056 hrs (6 days a week) Truck movements are based on reported figures in Traffic and Transport Report figures and are peak daily volumes.	HV: 90 movements/day @ 4km/movement = 360km/9.5 (hrs in a day) = 37km/hr 37 x 7056 (total hrs) = 267,385km/80,000 = 3.3 tyre changes x 26 tyres x 50kg = 4.34 tons LV: 350 movements/day @ 4km/movement = 1,400km/9.5 = 147km/hr 147 x 7056 = 1,039,831km/40,000 = 25.9 tyre changes x 4 tyres x 15kg = 1.56 tons
Waste oils	1,050	litres	Traffic and Transport Report Kenworth T409 operating manual Toyota Hilux operating manual	Heavy vehicle: Based on a Kenworth T409 with a 50 litre oil change every 20,000km Light vehicle: Based on a Toyota Hilux with a 5 litre oil change every 15,000km Construction period = 36 months = 7,056 hrs (6 days a week) Truck movements are based on reported figures in Traffic and Transport Report figures and are peak daily volumes.	HV: 90 movements pd @ 4km/movement = 360km/day 360/9.5 (hrs in a day) = 37km/hr 37 x 7056 (total hrs) = 267,385 km 267,385/20,000 = 14 oil changes 14 oil changes @ 50l = 700l LV: 350 movements @ 4km/movement = 1,400km/day 1,400/9.5 = 147km/hr 147 x 7056 = 1,039,831 km 1,039,831/15,00 = 70 oil changes 70 oil changes @ 5l = 350l
Unwashed containers that previously held Class 1, 3, 4, 5 or 8	360	m³		$5m^3$ bin every fortnight over 36 months	
Used batteries	65	kg	Traffic and Transport Report Marshall Battery guide	Kenworth works 20km/hr = 2 trucks required Hilux works 30km/hr = 5 vehicles required Battery life of 5 yrs, 1/3 of batteries need to be replaced over construction period Kenworth T409 battery weighs 26kg Toyota Hilux battery weighs 22kg Other batteries (not vehicles) account for an additional 20%	HV: 90 movements pd @ 4km/movement = 360km/9.5 (hrs in a day) = 37km/hr 37km/hr/20 = 2 trucks x 0.33 = 0.66 batteries x 26kg = 17.2 kg LV: 350 movements @ 4km/movement = 1,400km/9.5 = 147km/hr 147km/hr/30 = 5 trucks x 0.33 = 1.65 batteries x 22kg = 36.3kg Total = 53.4 x 120% = 65kg
Excavated Natural Material (ENM)	0	m³	Contaminated land report	There were no tests done for this material	
Acid Sulfate Soils (ASS)	0	m³	Contaminated land report	There were no tests done for this material	
Potential Acid Sulfate Soils (PASS)	0	m³	Contaminated land report	There were no tests done for this material	
Virgin Excavated Natural Soils (VENM)	0	m³	Contaminated land report Reference design	Assume all re-used on site. The excavated material will predominately consist of VENM and general solid waste (non-putrescible). Assume half the material is VENM	Half of 5,013 = 2,507
Contaminated soils	0	m³	Contaminated land report	There was no contaminated soil observed throughout the site works. No exceedances of BTEXN, PAHs, TRH, Heavy Metals, OCPs, OPPS, PCBs and PFAS	

Waste	Quantity	Unit	Source	Assumption	Calculation
Construction Waste					
The Centre					
General excavated materials	2,507	m^3	Contaminated land report Reference design	Assume no re-use on site. The excavated material will predominately consist of VENM and general solid waste (non-putrescible). Assume half the material is VENM	Half of 5,013 = 2,507
Green waste	14,400	m^3	Reference design	Assume clearing 80Ha, 150mm deep, 20% bulking factor	
Wood waste	78	ton	Reference design	Majority of the wood waste is plywood formwork. Other wood materials are reused i.e. pallets are returned to supplier	278 tons of plywood, figure from SW Assume a high wastage factory of 15% Other general wood waste = 1 ton / mth
Electrical infrastructure waste	720	kg	Reference design	There is a significant amount of electrical infrastructure being installed. Due to the cost of these materials, wastage is low at 5%. Assume 20kg a month for 36 months	
Piping materials	479	ton	Reference design	The majority of these materials will be fabricated off site with low wastage on site at 2%. 1.596 ton/m	Total pipes length installed = approximately 15km
Metal wastes	1,850	ton	Reference design	While the majority of these materials will be fabricated off site, there is a lot of assembly on site with possible wastage of 5%.	37,000 tons of various metals used on site (rebar, steel tanks, structural steel), figure from SW. Due to the high value of this material, assume a low wastage factor of 5%
Demolition waste	1,000	m^3		The majority of the demolition will have been done during the Early Works stage Assume 1,000m^3 to account for any small remaining works	
Other construction waste	6,526	m^3	Reference design	Assume wastage factor of 10%	59,500 m^3 of concrete and brickwork, figure provided by SW Other construction waste assumed to be 4 x 5m^3 bin every week for 36 months
Site office waste	20	ton	National waste report	Assume 0.5 kg waste generated pppd, 5,5 working days per week, 36 months period, 150 staff, 1/3 of this waste is office waste	
Construction plant waste	90	m^3	Traffic and Transport Report Kenworth T409 operating manual Toyota Hilux operating manual Bridgestone spec sheet	Assumed that 2 oil changes per month will generate 5m^3 bin every second month for 36 months	HV: total of 14 oil changes LV: total of 70 oil changes Total oil changes per month (over 36 months) = 2.3
Synthetic fibres and membranes	5	ton		Very light material, assume 150 kg a month for 36 months	
Dewatered grit, sediment, litter and gross pollutants	180	m^3		Assume 1x5m^3 bin a month for 36 months	
Food waste	40	ton	National waste report	Assume 0.5 kg waste generated pppd, 5,5 working days per week, 36 months period, 150 staff, 2/3 of this waste is food waste	

Waste	Quantity	Unit	Source	Assumption	Calculation
Construction Waste					
The Pipelines					
Asbestos waste	20 - 75	m³	Contaminated land report	No asbestos was detected in any of the soil samples analysed There were two asbestos fragments detected in two separate locations	Best case - Removal of soil within a 3m radius of the fragment to a depth of 1m 2 location x 3 x 3 x 1 =18m^3 Worst case - Removal of soil within a 5m radius of the fragment to a depth of 1,5m 2 location x 5 x 5 x 1,5 = 75m^3
Tyres	55.0	ton	Traffic and Transport Report Kenworth T409 operating manual Toyota Hilux operating manual Bridgestone spec sheet	Change HV tyres every 80,000km, 26 tyres per truck and dog @ 50kg each Change LV tyres every 40,000km, 4 tyres per vehicle @ 15kg each Construction period = 32 months = 6,272 hrs (6 days a week) Truck movements are based on reported figures in Traffic and Transport Report figures and are peak daily volumes.	HV: Section 1: 33 movements @ 22km/move = 726km/9.5hrs = 76km/hr 76 x 6,272 = 479,312/80,000 = 6 changes x 26 tyres x 50kg = 7.8 tons Section 2: 92 moves @ 22km/move = 2,024km/9.5hrs = 213km/hr 213km/hr x 6,272hr = 1,336,266km/80,000 = 16.7 tyre changes x 26 tyres x 50kg = 21.71 tons Section 3: 1 move @ 16km/move = 1km/hr 1km/hr x 6,272hr = 10,563hrs/80,000 = 0.13 tyre changes x 26 tyres x 50kg = 0.17 tons Section 4: 26 moves @ 16km/move = 416km/9.5hrs = 43km/hr 43km/hr x 6,272hr = 274,647km/80,000 = 3.43 tyre changes x 26 tyres x 50kg = 4.46 tons Section 5: 27 moves @ 16km/move = 432km/9.5hrs = 45km/hr 45km/hr x 6,272hrs = 285,210km/80,000 = 3.56 tyre changes x 26 tyres x 50kg = 4.63 tons LV: Based on the same methodology as above except different movements, number of tyres is 4 @ 15kg each and servicing interval is 40,000kkm. Section 1: 180 movements; Section 2: 400 moves; Section 3: 40 moves; Section 4: 90 moves; Section 5: 100 moves
Untreated drilling muds	859	m³	Reference design	Assume 795m @ 0.6m diameter + 2608m @ 0.75m diameter of drilling, 30% untreated, 60% bulking factor, 30% added water	
Waste oils	9,685	litres	Traffic and Transport Report Kenworth T409 operating manual Toyota Hilux operating manual	Heavy vehicle: Based on a Kenworth T409 with a 50 litre oil change every 20,000km Light vehicle: Based on a Toyota Hilux with a 5 litre oil change every 15,000km Construction period = 32 months = 6,272 hrs (6 days a week) Truck movements are based on reported figures in Traffic and Transport Report figures and are peak daily volumes.	HV: Section 1: 33 movements @ 22km/move = 726km/9.5hrs = 76km/hr 76 x 6,272 = 479,312/20,000 = 24 oil changes @ 50l = 1,200l Section 2: 92 moves @ 22km/move = 2,024km/9.5hrs = 213km/hr 213km/hr x 6,272hr = 1,336,266km/20,000 = 67 oil changes @ 50l = 3,350l Section 3: 1 move @ 16km/move = 1km/hr 1km/hr x 6,272hr = 10,563hrs/20,000 = 1 oil change @ 50l = 50l Section 4: 26 moves @ 16km/move = 416km/9.5hrs = 43km/hr 43km/hr x 6,272hr = 274,647km/20,000 = 14 oil changes @ 50l = 700l Section 5: 27

Waste	Quantity	Unit	Source	Assumption	Calculation
Construction Waste					
The Pipelines					
					moves @ 16km/move = 432km/9.5hrs = 45km/hr 45km/hr x 6,272hrs = 285,210km/20,000 = 15 oil changes @ 50l = 750L LV: Based on the same methodology as above except different movements, volume of oil is 5l and servicing interval is 15,000kkm. Section 1: 180 movements; Section 2: 400 moves; Section 3: 40 moves; Section 4: 90 moves;
Unwashed containers that previously held Class 1, 3, 4, 5 or 8	320	m³		5m³ bin every fortnight over 32 months	
Used batteries	378	kg	Traffic and Transport Report Marshall Battery guide	Kenworth works 40km/hr = 11 trucks required Hilux works 60km/hr = 30 vehicles required Battery life of 5 yrs, 1/3 of batteries need to be replaced over construction period Kenworth T409 battery weighs 26kg Toyota Hilux battery weighs 22kg Other batteries (not vehicles) account for an additional 20%	HV: Section 1: 33 movements @ 22km/move = 726km/9.5hrs = 76km/hr/40 = 2 trucks Section 2: 92 moves @ 22km/move = 2,024km/9.5hrs = 213km/hr/40 = 6 trucks Section 3: 1 move @ 16km/move = 1km/hr/40 = 0 trucks Section 4: 26 moves @ 16km/move = 416km/9.5hrs = 43km/hr/40 = 2 trucks Section 5: 27 moves @ 16km/move = 432km/9.5hrs = 45km/hr/40 = 1 truck Total = 11 trucks x 0.33 = 3.67 batteries x 26kg = 95.4 kg LV: Based on the same methodology as above except different movements, operating speed of 60km/hr and battery weight of 22kg. Section 1: 180 movements; Section 2: 400 moves; Section 3: 40 moves; Section 4: 90 moves; Section 5: 100 moves Total = 30 vehicles x 0.33 = 10 batteries x 22kg = 220 kg
Excavated Natural Material (ENM)	0	m³	Contaminated land report	Assuming 1/3 of excavated material can be used as back fill	
Acid Sulfate Soils (ASS)	0	m³	Contaminated land report	There were no tests done for this material	
Potential Acid Sulfate Soils (PASS)	0	m³	Contaminated land report	There were no tests done for this material	HV: 90 movements pd @ 4km/movement = 360km/9.5 (hrs in a day) = 37km/hr 37km/hr/20 = 2 trucks x 0.33 = 0.66 batteries x 26kg = 17.2 kg LV: 350 movements @ 4km/movement = 1,400km/9.5 = 147km/hr 147km/hr/30 = 5 trucks x 0.33 = 1.65 batteries x 22kg = 36.3kg Total = 53.4 x 120% = 65kg
Virgin Excavated Natural Soils (VENM)	125,000	m³	Contaminated land report Project description	Assuming 1/3 of excavated material can be used as back fill = 125,000 The excavated material will predominately consist of VENM and general solid waste (non-putrescible)	Total volume is 375,000, 1/3 can be reused = 125,000

Waste	Quantity	Unit	Source	Assumption	Calculation
Construction Waste					
The Pipelines					
Contaminated soils	0	m³	Contaminated land report	There was no contaminated soil observed throughout the site works No exceedances of BTEXN, PAHs, TRH, Heavy Metals, OCPs, OPPS, PCBs and PFAS	
General excavated materials	250,000	m³	Contaminated land report	Assuming 2/3 of excavated material is waste = 250,000 The excavated material will predominately consist of VENM and general solid waste (non-putrescible)	Total volume is 375,000, 2/3 is waste = 250,000
Treated drilling muds	1,542	m³	Reference design	Assume 795m @ 0.6m diameter + 2608m @ 0.75m diameter of drilling, 70% untreated, 60% bulking factor	
Roadbed materials	0	m³	Reference design	Forms part of the general excavated materials	
Asphalt	0	m³	Reference design	Forms part of the general excavated materials	
Green waste	30,528	m³	Reference design	Assume (24 + 2.1 + 16.3km) long and 20m wide, 150mm deep, 20% needed clearing, 20% bulking factor	
Pipe blanket backfill material	4,452	m³	Reference design	Assume (24 + 2.1 + 16.3km) long, 1.9m wide, 1,6m deep, 1.2m diameter, 5% wastage, 10% bulking factor	
Wood waste	41	ton	Reference design	Majority of the wood waste is plywood formwork. Other wood materials are reused i.e. pallets are returned to supplier	60 tons of plywood, figure from SW Assume a high wastage factor of 15% Other general wood waste = 1 ton / mth
Piping materials	850	ton	Reference design		17,700 tons of mixed piping material, figure from SW Assume 5% wastage
Other construction waste	2,560	m³		4x 5m³ bin every week, 32 months	
Site office waste	23	ton	National waste report	Assume 0.5kg waste generated pppd, 5,5 working days per week, 32 months period, 200 staff, 1/3 of this waste is office waste	
Construction plant waste	80	m³		Assumed that 2 oil changes per month will generate 5m³ bin every second month for 32 months	
Dewatered grit, sediment, litter and gross pollutants	160	m³		Assume 1x5m³ bin a month for 32 months	
Synthetic fibres	5	ton		Very light material, assume 150kg a month for 32 months	
Food waste	47	ton	National waste report	Assume 0.5kg waste generated pppd, 5,5 working days per week, 32 months period, 200 staff, 2/3 of this waste is food waste	

Waste	Quantity	Unit	Source	Assumption	Calculation
Operational Waste					
The Centre					
Tyres	30	kg	Traffic and Transport Report Toyota Hilux operating manual Bridgestone spec sheet	Change LV tyres every 40,000km, 4 tyres per vehicle @ 15kg each 24/7 for a year = 12 months = 30.5 days = 24 hrs = total of 8,784 hrs per year Truck movements are based on reported figures in Traffic and Transport Report figures and are peak daily volumes.	LV: 10 movements/day @ 4km/movement = 40/24 = 1.7km/hr 1.7 x 8784 = 14,640/40,000 = 0.37 tyre changes x 4 tyres x 15kg = 21.96 kg
Waste oils	5	litres	Traffic and Transport Report Kenworth T409 operating manual Toyota Hilux operating manual	Light vehicle: Based on a Toyota Hilux with a 5 litre oil change every 15,000km 24/7 for a Year = 12 months = 30.5 days = 24 hrs = total of 8,784 hrs per year Truck movements are based on reported figures in Traffic and Transport Report figures and are peak daily volumes.	LV: 10 movements/day @ 4km/movement = 40/24 = 1.7km/hr 1.7 x 8784 = 14,640/15,000 = 0.98 @ 5l = 4.8l
Electrical transformer oils	100	litres		1 oil change every 10 years, 1m^3 of oil	Quantities from similar WWTW
Workshop liquid wastes	440	litres		2x 220litre drums	Quantities from similar WWTW
Brine	up to 20	ML/day		Reference design maximum pump capacity	
Unwashed containers that previously held Class 1, 3, 4, 5 or 8	5	m^3		1x 5m^3 bin	Quantities from similar WWTW
Lightbulbs	20	kg		Assume LED lighting, so very little bulb waste, bulk is taken up by large warehouse lights and spot lights	Quantities from similar WWTW
Water treatment chemicals (hazardous)	8,760	litres	Process designers	Assume 16,000 litres per day used, 0.15% wastage	
Batteries	1	kg		1 vehicle battery change per year plus others Battery life of 5 yrs, 1 battery change every 5 years Toyota Hilux battery weighs 22kg Other batteries (not vehicles) account for an additional 20%	Hilux works 30km/hr = 5 vehicles required Battery life of 5 yrs, 1/3 of batteries need to be replaced over construction period Kenworth T409 battery weighs 26kg Toyota Hilux battery weighs 22kg Other batteries (not vehicles) account for an additional 20%
Green waste	9.8	ton	The Lawn Institute	10Ha, 97.6512kg pa from 100m2	
Office waste	0.9	ton	National waste report	Assume 0.5kg waste generated pppd, 7 working days per week, 12 month period, 15 staff, 1/3 of this waste is office waste	
Maintenance waste	30	m^3		5m^3 bin every 2 months	Quantities from similar WWTW
Wood waste	120	kg		20kg every 2 months, mainly unreturned pallets	Quantities from similar WWTW
E-waste	20	kg		Assume 20kg pa	Quantities from similar WWTW
Water treatment chemicals (non-hazardous)	3,504	litres	Process designers	Assume 6,400 litres per day used, 0.15% wastage	
Odour control chemicals	30	kg	Process designers	10x 25kg bags used a month, 1% wastage	
Scrap metals	2	ton		Assume 2-ton pa, mainly chains and lifting gear	Quantities from similar WWTW
Spent filters	10	m^3	Process designers	Assume 2x 5m^3 bin pa	
Food waste	1.8	ton	National waste report	Assume 0.5kg waste generated pppd, 7 working days per week, 12 month period, 15 staff, 2/3 of this waste is food waste	
Dewatered screenings	208	m^3	Process designers	Quantities from similar WWTW	
Dewatered grits	104	m^3	Process designers	Quantities from similar WWTW	

Appendix 2

Waste classes

NSW EPA Waste Classification Guidelines classifies waste into the following classes:

Special waste

'Special waste' is a class of waste that has unique regulatory requirements. The potential environmental impacts of special waste need to be managed to minimise the risk of harm to the environment and human health. Special waste means any of the following:

- clinical and related waste.
- asbestos waste.
- waste tyres.
- anything classified as special waste under an EPA gazettal notice.

Liquid waste

Liquid waste means any waste (other than special waste) that:

- has an angle of repose of less than 5 degrees above horizontal.
- becomes free flowing at or below 60ºC or when it is transported.
- is generally not capable of being picked up by a spade or shovel.
- is classified as liquid waste under an EPA gazettal notice.

Hazardous waste

The following waste types (other than special waste or liquid waste) have been pre-classified by the EPA as 'hazardous waste':

- containers, having previously contained a substance of Class 1, 3, 4, 5 or 8 within the meaning of the Transport of Dangerous Goods Code, or a substance to which Division 6.1 of the Transport of Dangerous Goods Code applies, from which residues have not been removed by washing or vacuuming.
- coal tar or coal tar pitch waste (being the tarry residue from the heating, processing or burning of coal or coke) comprising of more than 1% (by weight) of coal tar or coal tar pitch waste.
- lead-acid or nickel-cadmium batteries (being waste generated or separately collected by activities carried out for business, commercial or community services purposes).
- lead paint waste arising otherwise than from residential premises or educational or childcare institutions.
- any mixture of the wastes referred to above.

A waste must be classified as 'hazardous waste' if it is a dangerous good under any of the following classes or divisions of the *Transport of Dangerous Goods Code*:

- Class 1: Explosives.
- Class 2: Gases (compressed, liquefied or dissolved under pressure).

- Class 3: Flammable Liquids.
- Class 4: Flammable Solids.
- Class 5: Oxidising agents and organic peroxides.
- Class 6: Toxic substances.
- Class 7: Radioactive substances.
- Class 8: Corrosive substances.

Waste generators must chemically assess their waste to determine the waste's classification. If the waste generator does not undertake chemical assessment of the waste, the waste must be classified as hazardous waste. The chemical assessment process is based on the waste's potential to release chemical contaminants into the environment through contact with liquids, which leads to the production of leachates.

General solid waste - putrescible (GSWp)

The following wastes (other than special waste, liquid waste, hazardous waste or restricted solid waste) have been pre-classified by the EPA as 'general solid waste (putrescible) (GSWp)':

- household waste that contains putrescible organics.
- waste from litter bins collected by or on behalf of local councils.
- manure and night soil.
- disposable nappies, incontinence pads or sanitary napkins.
- food waste.
- animal waste.
- grit or screenings from sewage treatment systems that have been dewatered so that the grit or screenings do not contain free liquids.
- any mixture of the wastes referred to above.

General solid waste - non-putrescible (GSWnp)

The following wastes (other than special waste, liquid waste, hazardous waste, restricted solid waste or GSWp) are pre-classified as 'general solid waste (non-putrescible) (GSWnp)':

- glass, plastic, rubber, plasterboard, ceramics, bricks, concrete or metal.
- paper or cardboard.
- household waste from municipal clean-up that does not contain food waste
- waste collected by, or on behalf of, local councils from street sweepings.
- grit, sediment, litter and gross pollutants collected in, and removed from, stormwater treatment devices and/or stormwater management systems, that has been dewatered so that they do not contain free liquids.
- grit and screenings from potable water and water reticulation plants that has been dewatered so that it does not contain free liquids.
- garden waste.
- wood waste.

- waste contaminated with lead (including lead paint waste) from residential premises or educational or childcare institutions.
- containers, previously containing dangerous goods, from which residues have been removed by washing or vacuuming.
- drained oil filters (mechanically crushed), rags and oil-absorbent materials that only contain non-volatile petroleum hydrocarbons and do not contain free liquids.
- drained motor oil containers that do not contain free liquids.
- non-putrescible vegetative waste from agriculture, silviculture or horticulture.
- building cavity dust waste removed from residential premises or educational or child care institutions, being waste that is packaged securely to prevent dust emissions and direct contact synthetic fibre waste (from materials such as fibreglass, polyesters and other plastics) being waste that is packaged securely to prevent dust emissions, but excluding asbestos waste.
- virgin excavated natural material
- building and demolition waste.
- asphalt waste (including asphalt resulting from road construction and waterproofing works).
- biosolids categorised as unrestricted use, or restricted use 1, 2 or 3, in accordance with the criteria set out in the Biosolids Guidelines (EPA 2000).
- cured concrete waste from a batch plant.
- fully cured and set thermosetting polymers and fibre-reinforcing resins.
- fully cured and dried residues of resins, glues, paints, coatings and inks
- any mixture of the wastes referred to above.

Appendix 3

Impact risk assessment

Table 10.1 Impact significance table

Magnitude of Impact	Impact significance		
		Moderate	Low
High	Major	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Negligible

The significance of any potential project impact on the environment, impacts associated with the generation of waste has been determined by considering the sensitivity of the environment related to the assessed criteria as well as the magnitude of the expected change.

The *Sensitivity of Environmental Values* evaluation is influenced by the following criteria:

- Condition of the environmental value, i.e. how far is it understood to have already been changed from its original natural form or state?
- How unique or rare is the condition or value or it's dependant ecological receptors?
- How sensitive are the dependant receptors to changes?
- Does the project exacerbate risks from the volumes of generated waste?

The *Magnitude of Impact* evaluation is influence by the following criteria:

- For quantitative assessments where the volume of waste has been estimated the following is considered
  - Expected duration of impact: Temporary vs. long-lasting/permanent
  - Expected extent of impact: Local vs. regional/widespread
  - Estimated degree of change from pre-development conditions
- If a qualitative assessment has been conducted, the relative magnitude of the likely waste volumes was considered, in comparison to the other known waste volumes.