23 Resource use and waste minimisation

This chapter describes the resources and materials, including potential sources and expected quantities that would be used to construct the M4-M5 Link (the project).

In addition, both construction and operation of the project would generate waste streams that would require management and disposal in accordance with relevant NSW policies and guidelines. This chapter also provides a description of each waste stream, expected quantities of waste materials where known and applicable waste management strategies.

Resource consumption and waste generated by the project would also contribute to the emission of greenhouse gases during construction and operation. The consideration of this impact and emission reduction opportunities are discussed further in **Chapter 22** (Greenhouse gas).

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued environmental assessment requirements for the project. These are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 23-1** sets outs these requirements and the associated desired performance outcomes that relate to waste management, and identifies where they have been addressed in this environmental impact statement (EIS).

Table 23-1 SEARs - waste

Desired performance outcome	SEARs	Where addressed in the EIS
16. Waste All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.	1. The Proponent must assess predicted waste generated from the project during construction and operation, including:	Construction resource consumption and waste is discussed in **section 23.3**. Operational resource consumption and waste is discussed in **section 23.4**.
	a) classification of the waste in accordance with the current guidelines;	The classification of waste is described in **section 23.3.2**
	b) 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;	The estimated quantities of waste to be generated are included in **section 23.3.2**.
	c) handling of waste including measures to facilitate segregation and prevent cross-contamination;	Construction waste management is discussed in **section 23.3.2**.
	d) management of waste including estimated location and volume of stockpiles;	Construction waste volumes and stockpile locations are provided in **section 23.3.2**.
	e) waste minimisation and reuse;	Efficient use of construction materials is discussed in **section 23.3.1**. Waste reuse is discussed in **section 23.3.2**.
	f) lawful disposal or recycling locations for each type of waste; and	Potential disposal or recycling locations are discussed in **section 23.3.2**.
	g) contingencies for the above, including managing unexpected waste volumes.	Contingencies for managing unexpected waste volumes are discussed in **section 23.3.2** and are summarised in **section 23.5**.

Desired performance outcome	SEARs	Where addressed in the EIS
	2. The Proponent must assess potential environmental impacts from the excavation, handling, storage on site and transport of the waste particularly with relation to sediment/leachate control, noise and dust.	Dust impacts and management are discussed in **Chapter 9** (Air quality). Noise impacts and management are discussed in **Chapter 10** (Noise and vibration). Sediment control and potential environmental impacts associated with the excavation of waste are described in **Chapter 15** (Soil and water quality) and **Chapter 16** (Contamination). Potential environmental impacts associated with the handling, storage and transport of waste are discussed throughout this chapter. Leachate control is discussed in **section 23.3.2**.

23.1 Assessment methodology

The *Protection of the Environment Operations Act 1997* (NSW) (POEO Act) establishes management and licensing requirements for waste. It also defines offences relating to waste and sets penalties. In accordance with the POEO Act and its regulations, the NSW Environment Protection Authority (NSW EPA) has established guidelines for the classification of waste. These have been considered in the assessment of waste generated by the project and subsequent development of mitigation and management measures.

Indicative quantities and types of waste that would be generated from the project have been estimated with consideration of earlier stages of WestConnex and form the basis for the preliminary classification in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW EPA 2014).

Resource use for the project was assessed by reviewing the indicative scale and extent of the project as outlined in **Chapter 5** (Project description) and the construction methodology described in **Chapter 6** (Construction work) and estimating the resources required for construction, including their likely source. Waste types, anticipated quantities of waste and resource use estimates would be revised during the detailed design of the project and would be finalised as part of the detailed construction planning and during construction.

23.2 Legislative and policy framework

There are three main legislative instruments to manage waste in NSW:

- *Waste Avoidance and Resource Recovery Act 2001* (NSW) (WARR Act)
- POEO Act
- Protection of the Environment Operations (Waste) Regulation 2014 (NSW) (POEO Regulation).

The WARR Act is the primary legislation for managing waste. It aims (among other things) to reduce waste generation and improve the conversion of waste into recoverable resources. Resource and waste management for the project would be prioritised according to the principles of the resource management hierarchy defined in the WARR Act, namely (in order of preference):

- Avoidance of unnecessary resource consumption
- Resource recovery (including reuse, reprocessing, recycling and energy recovery)
- Disposal.

The POEO Act defines 'waste' for regulatory purposes and establishes management and licensing requirements for its transport, storage, disposal and reuse. Under the POEO Regulation, the NSW EPA may grant exemptions from some of the requirements under the POEO Act in the form of either a 'resource recovery order' or a 'resource recovery exemption' (refer to clauses 91, 92 and 93 of the POEO Regulation). There are a number of resource recovery orders and resource recovery exemptions currently in force, which are relevant to a range of materials that are commonly used in road construction activities.

Potentially relevant resource recovery orders under Part 9, Clause 93 of the POEO Regulation would include:

- The excavated natural material order 2014
- The excavated public road material order 2014
- The reclaimed asphalt pavement order 2014
- The recovered aggregate order 2014
- The stormwater order 2014.

Potentially relevant resource recovery exemptions under clauses 91 and 92 of Part 9 of the POEO Regulation would include:

- The excavated natural material exemption 2014
- The excavated public road material exemption 2014
- The reclaimed asphalt pavement exemption 2014
- The recovered aggregate exemption 2014
- The stormwater exemption 2014.

Additional guidelines considered for the assessment include:

- *NSW Sustainable Design Guidelines* Version 3.0 (Transport for NSW 2013)
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and *Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries)* (NSW Department of Environment and Climate Change 2008).

23.3 Assessment of construction impacts

23.3.1 Construction resource consumption

Construction materials

Significant quantities of materials would be required for the construction of the project. Construction material would generally be sourced from off-site suppliers. Wherever practical, locally sourced construction materials would be used to minimise haulage distances and associated traffic impacts.

The project would adopt the following sustainability principles to optimise the efficient use of construction materials:

- Capitalise on opportunities to reduce material use and maximise the use of materials with low environmental impact

- Maximise the use of reused/recycled timber products and timber from sustainably managed forests that have obtained Forest Management Certification
- Optimise the amount of cement replacement material used in concrete
- Optimise the amount of recycled material used in road base and sub-base.

With the adoption of these principles, the project would minimise long-term impacts through the sustainable use of construction materials. Further detail of the overarching sustainability objectives for construction materials is provided in **Chapter 27** (Sustainability).

Indicative quantities and the major sources of materials required for construction are provided in **Table 23-2**.

Table 23-2 Indicative quantities of materials required for construction

Material	Estimated quantity required	Anticipated source/origin
Concrete	400,000 cubic metres	Sydney suppliers located close to the project
Precast concrete	32,250 cubic metres	Combination of NSW and overseas suppliers
Structural steel	450 tonnes	Manufactured in Australia and/or overseas
Reinforcing steel	15,000 tonnes	Manufactured in Australia
Asphalt	70,000 tonnes	Sydney suppliers located close to the project
Road base	20,000 tonnes	Quarries within the Sydney region
Water	2,000 megalitres	Recycled construction and mains water
Petrol	30,000 litres	Local Sydney supplier
Diesel	12 megalitres	Local Sydney supplier

Resource requirements may have an impact on resource availability within the local area over the construction period. However, with the adoption of the aforementioned sustainability principles, any impact would be reduced and limited to the construction period.

Sustainability would be considered when sourcing materials and equipment during construction of the project. A procedure for the procurement and management of subcontractors that factors in sustainability would be developed and implemented.

Water resources

Water would be required during construction for:

- Tunnelling activities, including for cooling water, dust suppression and concreting
- Surface works, including pavement construction, concrete works, washdown areas, dust suppression and landscaping activities
- Site offices and ablutions.

The total volume of water required for construction of the project would be around 6,000 kilolitres per day. Water would be sourced from sources where water quality and volume requirements are met, including:

- Stormwater harvesting (non-potable water)
- On-site construction water treatment and reuse (non-potable water)
- Mains supply (potable water).

Preference would be given to the use of non-potable water over potable water, in accordance with the *WestConnex Sustainability Strategy* (Sydney Motorway Corporation 2015). The extent to which non-potable water sources can be used would be governed by workplace health and safety considerations, economic feasibility, the functional specifications of the design, tunnelling equipment specifications, and non-potable water availability. Non-potable water could be used during

construction for dust suppression and end-of-project landscaping. It is anticipated that the local water supply network would have sufficient capacity to accommodate project construction water requirements.

Estimated volumes and potential supplies of water for each construction ancillary facility are summarised in **Table 23-3**. A water balance has been prepared for the project and is outlined in **Chapter 17** (Flooding and drainage).

Table 23-3 Estimated daily construction water requirements at construction ancillary facilities

Construction ancillary facility	Daily construction water usage (kilolitres per day)			
	Potable water supply from Sydney Water mains	Non-potable water supply		Total
		Collected rainwater	Treated groundwater	
C1a Wattle Street civil and tunnel site	420	2	250	672
C2a Haberfield civil and tunnel site	420	1	0	421
C3a Northcote Street civil site	10	0	0	10
C1b Parramatta Road West civil and tunnel site	420	2	250	672
C2b Haberfield civil site	40	1	0	41
C3b Parramatta Road East civil site	10	1	0	11
C4 Darley Road civil and tunnel site	630	1	50	681
C5 Rozelle civil and tunnel site	1,000	3	370	1,373
C6 The Crescent civil site	40	1	0	41
C7 Victoria Road civil site	40	1	0	41
C8 Iron Cove Link civil site	30	1	20	51
C9 Pyrmont Bridge Road tunnel site	840	1	25	866
C10 Campbell Road civil and tunnel site	840	1	100	941

Power

The total energy requirements to construct the project would be around 100,000 megawatt hours. At least 20 per cent of the electricity requirements would be met from renewable energy sources and/or accredited Green Power energy supplier as required by the *WestConnex Sustainability Strategy* (Sydney Motorway Corporation 2015). A target minimum of six per cent of construction electricity requirements would be offset, with any offset undertaken in accordance with the Australian Government National Carbon Offset. Greenhouse gas impacts related to project energy requirements are discussed in **Chapter 22** (Greenhouse gas).

Most of the project would be located underground, which would reduce surface amenity and property acquisition impacts during construction and operation. To deliver an underground motorway, a large tunnelling effort would be needed, requiring large amounts of energy during construction, including for the operation of the tunnelling machinery (known as roadheaders). The mainline tunnel alignment has

been optimised to minimise the length of the tunnel (refer to **Chapter 4** (Project development and alternatives)), helping to reduce construction power demands.

Construction ancillary facilities are required along the mainline tunnel alignment and for the Rozelle interchange and Iron Cove Link. Major construction power would be required at sites where tunnelling is to be carried out by roadheaders. Construction power supply requirements for major construction ancillary facilities are summarised in **Table 23-4**, including supply source and power requirements.

A Utilities Management Strategy (**Appendix F**) has been prepared for the project that identifies management options, including relocation or adjustment of utilities. This strategy includes a description of the process for confirming utility works within and outside the project footprint, an outline of the consultation that would be undertaken with utility providers and the local community regarding these works and an assessment of the range of potential environmental impacts associated with utility works. In addition, the strategy provides a process for how utility works not assessed as part of the EIS would be managed.

Table 23-4 Construction power supply for construction ancillary facilities

Construction ancillary facility	Maximum demand (MVA)[1]	Supply source connection point	Supply route length (metres)[2]
Wattle Street civil and tunnel site (C1a) and Haberfield civil and tunnel site (C2a)	10	Croydon Road at Croydon	850
Parramatta Road West civil and tunnel site (C1b)	10	Croydon Road at Croydon	850
Darley Road civil and tunnel site (C4)	8	Balmain Road at Leichhardt	850
Rozelle civil and tunnel site (C5)	13	Balmain Road at Leichhardt	1,500
Pyrmont Bridge Road tunnel site (C9)	10	Layton Street at Annandale	100
Campbell Road civil and tunnel site (C10)	10	Connection to be provided within site by New M5 contractor	N/A

Note:

1 Mega volt ampere

2 Supply route distance is measured as a straight line distance

Construction power demand for site offices, facilities, tools and small plant at the Northcote Street civil site (C3a), Haberfield civil site (C2b), Parramatta Road East civil site (C3b), Victoria Road civil site (C7) and the Iron Cove Link civil site (C8) would be within the capacity of the existing local distribution network.

Initial discussions with power supply authorities have confirmed that local substations have the required capacity to supply the construction ancillary facilities without affecting the local supply network. All power supply routes would be underground.

23.3.2 Construction waste management

Waste streams generated during construction of the project would include construction and demolition waste, vegetation waste, packaging materials and liquid wastes. All wastes would be managed using the hierarchy approach of waste avoidance and resource recovery before consideration of waste disposal.

Should the generation of wastes be unavoidable, or be unsuitable for reuse/recycling, disposal methods would be selected based on the classification of the waste material in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW EPA 2014). The Waste Classification Guidelines provide direction on the classification of waste, specifying requirements for management, transportation and disposal of each waste category.

All wastes would be managed in accordance with the waste provisions contained within the POEO Act and, where reused off-site, would comply with relevant NSW EPA resource recovery exemptions and requirements.

Solid and liquid wastes

Solid and liquid waste streams generated during construction of the project would include:

- Excavated wastes (spoil), such as soil and rock, primarily from tunnelling and cutting including virgin excavated natural material (VENM)
- Demolition wastes including concrete, bricks, tiles, timber (untreated and treated), metals, plasterboard, carpets, electrical and plumbing fittings and furnishings (doors, windows)
- Asbestos and hazardous waste (including contaminated spoil (refer to **Chapter 16** (Contamination))
- Vegetation waste from the removal of trees, shrubs and ground cover that are unable to be mulched and reused within the project
- General construction waste such as timber formwork, scrap metal, steel, concrete, plasterboards and packaging material (crates, pallets, cartons, plastics and wrapping materials)
- Waste from operation and maintenance of construction vehicles and machinery including adhesives, lubricants, waste fuels and oils, engine coolant, batteries, hoses and tyres
- General wastes from site offices such as putrescibles, paper, cardboard, plastics, glass and printer cartridges.

Potential impacts arising from construction waste management may include:

- Large volumes of spoil being directed to landfill due to inadequate recycling and reuse
- Dust impacts due to incorrect storage, handling, transport and disposal of spoil
- Large volumes of waste being directed to landfill due to inadequate collection, classification and disposal of waste
- Contamination of soil, surface and/or groundwater from the inappropriate excavation, storage, transport and disposal of liquid and solid waste
- Risks to human health from the handling, storage, transport and disposal of contaminated (including asbestos containing) material from demolition waste generated by the project.

Existing metropolitan waste management facilities would have capacity to receive the anticipated waste streams generated by the project. General wastes from site offices such as putrescible wastes, paper, cardboard, plastics, glass and printer cartridges would be collected for off-site recycling wherever practicable. Demolition and excavation waste generated by the project have the potential to contain hazardous materials, including acid sulfate soils, asbestos containing material (ACM) and other contaminated materials. The management of this waste is discussed in the 'Special wastes' section below.

Construction waste management activities would not pose a significant risk to the environment or human health, with the implementation of standard measures (provided in **section 23.5**) to adequately address waste generation, handling storage, transport, disposal and reuse. A Construction Waste Management Plan, as part of the Construction Environmental Management Plan (CEMP), would be prepared and implemented for the project. These plans would take into account construction staging and specific conditions of approval that may be applied to the project. More information regarding spoil management is provided in the sections below.

Spoil management

Excavated soil and rock (spoil), mainly from tunnelling and bulk excavation works, would make up most of the solid waste generated by the project during construction. Up to about 4,000,000 cubic metres of spoil would be generated during construction of the project.

Spoil generation and management

Most spoil would be received and managed at tunnel construction sites. Smaller quantities of spoil would be generated during site preparation activities, excavation of dive structures, and cut-and-cover activities for the surface components of the project.

Anticipated spoil volumes generated from each construction ancillary facilities site for tunnelling and surface works are outlined in **Table 23-5**. Up to about 4,000,000 cubic metres of spoil would be generated during construction of the project. This large volume of spoil is a result of constructing tunnels to accommodate up to four lanes of traffic in each direction and large underground interchanges (the Inner West subsurface interchange and the Rozelle interchange).

Table 23-5 Anticipated spoil volumes

Site	Estimated spoil volume (cubic metres)		
	Tunnel	Surface	Total
Wattle Street civil and tunnel site (C1a)	276,500	35,000	311,500
Haberfield civil and tunnel site (C2a)[1]	276,500	-	276,500
Parramatta Road West civil and tunnel site (C1b)	500,000	20,000	520,000
Darley Road civil and tunnel site (C4)	549,500	10,500	560,000
Rozelle civil and tunnel site (C5)	1,008,000	35,000	1,043,000
The Crescent civil site (C6)	-	43,800	43,800
Victoria Road civil site (C7)	-	25,000	25,000
Iron Cove Link civil site (C8)	-	44,100	44,100
Pyrmont Bridge Road tunnel site (C9)	849,500	5,000	854,500
Campbell Road civil and tunnel site (C10)	715,000	40,000	755,000
Total (with Option A ancillary facilities)	**3,675,000**	**238,400**	**3,913,400**
Total (with Option B ancillary facilities)	**3,622,000**	**223,400**	**3,845,400**

Note:

[1] The Haberfield civil and tunnel site would be used as a support site for the construction of the M4-M5 Link/M4 East connection. This construction ancillary facility would be used to transport small plant, workers and materials. Tunnel spoil would not be transported to the surface from these tunnelling works. All spoil transport from these tunnelling works would occur via the M4 East tunnels and the M4 East Motorway.

The majority of excavated spoil material would be uncontaminated crushed sandstone and shale, classified as VENM. This would consist of mixed size crushed rock ranging from shale and sand to lumps of rock.

A contamination assessment has been carried out as part of this EIS (further details are provided in **Chapter 16** (Contamination)). The assessment identified that it is likely that contaminated materials, including asbestos, are present at sites where previous land uses included the use of asbestos materials (such as at the Rozelle Rail Yards) and where older buildings and structures would be demolished.

Spoil management hierarchy

The project design has taken into account the principles of the resource management hierarchy as defined in the WARR Act, including minimising excess spoil generation, as far as practical. Where possible and fit for purpose, spoil would be beneficially reused as part of the project before alternative spoil disposal options are pursued. Excess spoil which cannot be reused or recycled would be disposed of at a suitably licensed landfill or waste management facility.

The project would seek to reuse or recycle around 95 per cent of uncontaminated spoil, either within the project or at other locations. Spoil reuse would be prioritised in accordance with the spoil management hierarchy outlined below.

Where feasible and reasonable, spoil would be managed according to the following hierarchy:

- Minimisation of spoil generation through design and management
- Reuse of spoil within the project
- Beneficial reuse of spoil outside the project
- Where reuse is not possible, disposal of spoil would be the last resort.

The following spoil reuse opportunities have been identified within the project:

- The use of tunnel spoil for the backfill of cut-and-cover tunnels and the infill of temporary access shafts and declines
- The use of tunnel and civil surface works spoil for fill, landscaping and site rehabilitation purposes
- The use of tunnel spoil for local road upgrades, namely the replacement of existing unsuitable pavement subgrade material
- The use of tunnel spoil for remediation activities at the Rozelle Rail Yards.

Spoil reuse would include the opportunities above, and further opportunities would be investigated during the construction of the project.

The construction traffic and transport assessment has taken into account heavy vehicle movements associated with spoil management during the peak construction period. **Chapter 8** (Traffic and transport) provides a summary of heavy vehicle movements at each construction ancillary facility, including spoil related haulage.

Stockpile management

Stockpiles would be located at the following construction ancillary facilities:

- Wattle Street civil and tunnel site (C1a)
- Parramatta Road West civil and tunnel site (C1b)
- Darley Road civil and tunnel site (C4)
- Rozelle civil and tunnel site (C5)
- The Crescent civil site (C6)
- Victoria Road civil site (C7)
- Pyrmont Bridge Road tunnel site (C9)
- Campbell Road civil and tunnel site (C10).

The estimated stockpile volumes at these construction ancillary facilities are provided in **Table 23-6**. Stockpile material at the tunnelling sites listed above (C1a, C1b, C4, C5, C9 and C10) would consist primarily of spoil while stockpile material at the civil sites listed above (C6 and C7) would consist primarily of excavated infrastructure. At the Iron Cove Link civil site (C8), spoil from the construction of the dive and cut-and-cover structures would be loaded directly onto spoil trucks from excavation areas.

Table 23-6 Stockpile volumes

Stockpile location	Estimated stockpile volume (cubic metres)
Wattle Street tunnel and civil site (C1a)	20,000
Parramatta Road West civil and tunnel site (C1b)	1,600
Darley Road civil and tunnel site (C4)	20,000
Rozelle civil and tunnel site (C5)	40,000
The Crescent civil site (C6)	20
Victoria Road civil site (C7)	5,000
Pyrmont Bridge Road tunnel site (C9)	20,000
Campbell Road civil and tunnel site (C10)	20,000

Spoil stockpiles would be contained within acoustic sheds or separated by roller doors between cut-and-cover ramps and tunnel sections. Where excavations are carried out prior to the construction of cut-and-cover ramps, spoil would be stored on the surface within the Rozelle Rail Yards or loaded into spoil trucks directly from excavation areas.

The roller doors and acoustic sheds would minimise the potential for spoil sediments to be transported by wind or rain. They would also minimise the potential for impacts from runoff (including from contaminated materials) and sedimentation associated with stockpiling. Stockpiles would also be covered and bunded where appropriate to avoid potential impacts associated with runoff, sedimentation and leachate. Potential impacts from runoff and sedimentation would be further minimised through the implementation of the environmental management measures described in **Chapter 15** (Soil and water quality).

Potential impacts related to leachate (ie 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, except at the Campbell Road civil and tunnel site (C10), where intrusive works would be undertaken within the former Alexandria Landfill Environment Protection Licence (EPL) boundary. Construction activities in this area would be required to comply with the existing Golder (2016) RAP, Landfill Closure Plan, EPL and New M5 conditions of approval. Stockpiles would be covered and bunded where appropriate to avoid potential impacts associated with runoff, sedimentation and leachate.

Contaminated material would be segregated from uncontaminated material on site to prevent cross-contamination during the storage and handling of spoil. The Construction Waste Management Plan would describe methodologies and strategies to prevent cross-contamination. Suitable areas would be identified to allow for contingency management of unexpected waste materials, including contaminated spoil. Suitable hardstand or lined areas would be required that are appropriately stabilised and bunded, with sufficient area for stockpile storage and segregation.

Potential impacts related to dust and noise and vibration associated with the management of stockpiles are discussed in **Chapter 9** (Air quality) and **Chapter 10** (Noise and vibration) respectively.

Spoil reuse sites and disposal sites

Excess spoil that cannot be reused within the project would require off-site reuse/disposal. Around 95 per cent of uncontaminated spoil would be beneficially reused in accordance with the project spoil management hierarchy.

Five potential sites have been identified for receiving excess spoil from the project, as summarised in **Table 23-7**. Negotiations for the final destination(s) for excess spoil would be carried out during detailed design, and may include one or more of the sites listed in **Table 23-7** or other alternative sites identified during detailed design.

Table 23-7 Potential spoil management sites

Spoil management site	Location	Distance from the project (kilometres)	Capacity for site to accept spoil (cubic metres)
Horsley Park (manufacturing facility)	Wall Grove Road at Horsley Park	About 40	Capacity for entirety of project spoil generation[1]
Blacktown Waste Services (landfill)	920 Richmond Road at Marsden Park	About 45	250,000
Sakkara Development (industrial estate)	Riverstone Parade at Riverstone	About 45	3,500,000
Kurnell Landfill	330 Captain Cook Drive at Kurnell	About 20	7,000,000
Moorebank Intermodal Terminal Precinct	Moorebank Avenue, Moorebank	About 30	2,500,000
Western Sydney Airport	Lot 1 DP 838361, Badgerys Creek	About 50	Capacity not known at this stage

Note:

[1] The Horsley Park spoil management site is a manufacturing facility and currently does not have a definitive limit for the amount of spoil it can receive.

Spoil would be delivered to the spoil management sites in accordance with the conditions of approval and environment protection licences governing those sites. The spoil reuse and disposal sites identified above are based on the current existing availability of spoil receiving locations (including projects with a fill deficit) across the Sydney area. Construction of the project would occur over a five-year period, with spoil generation peaking in 2019–2021 when both the mainline tunnels and Rozelle interchange are under construction concurrently. It is therefore anticipated that alternative locations may emerge during construction that could represent an improved outcome.

The following criteria would be applied to determine the priority given to the identified spoil reuse and disposal sites, including how much spoil would be sent to each site, and to evaluate any additional spoil reuse or disposal options that emerge during construction:

- Environmental benefit – in terms of a preference for the material to be reused for such purposes as:
  - Environmental works (eg coastal protection works, flood mitigation or restoration)
  - Clean fill on other projects (eg landscaping, barrier mounds, land reclamation, capping)
  - Land restoration (eg filling of disused mines and quarries)
- Traffic impacts – with a preference for haulage routes that keep to major arterial roads and minimise total haulage requirements as far as possible
- Approvals – any receiving location would need to be approved to receive the applicable type and volume of spoil
- Economic – feasibility of transporting the spoil compared to the options already identified, including consideration of the distances to be travelled.

Spoil would be hauled using heavy vehicles to spoil reuse and disposal sites. The anticipated spoil haulage routes are outlined in **Chapter 6** (Construction work). Other disposal/reuse sites may be used depending on need at the time spoil is generated. In addition, there is the potential that spoil could be removed by barge, subject to further investigations. Further details regarding spoil generation and management are provided in **Chapter 6** (Construction work) and in **Chapter 8** (Traffic and transport).

Cumulative spoil management

Construction of the project would occur:

- At the same time as other tunnelling projects in Sydney, including:

  - New M5 project
  - M4 East project (for Option B construction ancillary facilities)
  - Sydney Metro City and Southwest
- Within one year of the completion of other tunnelling projects in Sydney, including:
  - M4 East project (for Option A construction ancillary features)
  - NorthConnex.

The tunnelling projects listed above would also require the management and disposal of large volumes of spoil and there is the potential for cumulative impacts related to spoil disposal for the project. Cumulative impacts would arise if the spoil management sites identified for the project reach capacity as a result of receiving spoil from other tunnelling projects. Cumulative impacts may also arise where multiple tunnelling projects use the same spoil management sites and/or haulage routes (refer to **Chapter 26** (Cumulative impacts) for more detail regarding cumulative impacts).

Estimated spoil volumes and potential spoil management sites for the project and for other tunnelling projects (as identified in their respective environmental assessments) are outlined in **Table 23-8**.

Table 23-8 Estimated spoil volumes and spoil management site capacities for Sydney tunnelling projects

Project	Estimated spoil volume (cubic metres)	Spoil management sites	Capacity (cubic metres)[1]
M4-M5 Link (the project)	4,000,000	Horsley Park	Capacity for entirety of project spoil generation
		Blacktown Waste Services	250,000
		Sakkara Development, Riverstone	3,500,000
		Kurnell Landfill	7,000,000
		Moorebank Intermodal Terminal Precinct	2,500,000
		Western Sydney Airport	Capacity not known at this stage
M4 East	2,400,000	Sakkara Development, Riverstone	3,500,000
		Quakers Hill	600,000
		Marsden Park	360,000
		Horsley Park	Capacity for entirety of M4 East spoil generation
New M5	3,200,000	Boral-CSR Brick Pit, Schofields	550,000
		Quakers Hill	500,000
		Horsley Park	3,000,000
		Sakkara Development, Riverstone	3,500,000
		Kurnell Landfill	7,000,000
NorthConnex	2,600,000	Former Australian Defence Industries site, St Marys	2,500,000
		Gosford Quarry	2,500,000
		Hornsby Quarry	3,300,000
		CSR Quarry	1,160,000
		Quakers Hill	500,000
		Sandy Point Quarry	5,000,000

Project	Estimated spoil volume (cubic metres)	Spoil management sites	Capacity (cubic metres)[1]
Sydney Metro	2,400,000	CSR Quarry, Schofields	1,100,000
		Horsley Park (No. 2 and No. 3 Plants only)	600,000
		CSR Quarry, Schofields	1,100,000
		CSR Quarry, Horsley Park	2,000,000
		Hornsby Quarry	1,800,000
		Gosford Quarry	2,500,000

Note:
[1] Capacity data has been taken from relevant project environmental assessments and therefore represents the capacity of the spoil management sites at the time of the release of the assessments.

Considering the combined capacity of the Sakkara Development (3,500,000 cubic metres), Kurnell Landfill (7,000,000 cubic metres) and Horsley Park (capacity for entirety of project spoil generation), it is unlikely that any one spoil management site would reach capacity and it is highly unlikely that all the sites would reach capacity at the same time.

Spoil management site options, including the Western Sydney Airport, would continue to be investigated during detailed design. Internal coordination with the proponents of the tunnelling projects identified in **Table 23-8** would be undertaken to encourage cooperative approaches to spoil management.

Contaminated spoil

A contamination assessment has been carried out as part of this EIS. The assessment identified:

- Soil and groundwater contamination at some test locations within or adjacent to the project footprint including the Rozelle Rail Yards, Rozelle civil and tunnel site (C5), Victoria Road civil site (C7) and Campbell Road civil and tunnel site (C10)
- The potential for contamination at other locations within the project footprint based on existing or past land uses.

Further details are provided in **Chapter 16** (Contamination).

If previously unidentified contaminated material is discovered, all relevant work would cease in the vicinity of the discovery and the unidentified contaminated material would be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the *Guideline for the Management of Contamination* (NSW Roads and Maritime Services (Roads and Maritime) 2013). Relevant works would not recommence until the scope of remedial action(s), if required, was identified in accordance with the requirements of the *Contaminated Land Management Act 1997* (NSW).

Spoil, including contaminated spoil, would be classified in accordance with the *Waste Classification Guidelines: Part 1 Classifying Waste* (NSW EPA 2014). Depending on the extent of contamination, spoil would be considered for reuse on the project site or, where reuse is not possible, disposed of lawfully at an appropriately licensed facility.

Suitable areas would be identified to allow for contingency management of unexpected waste materials, including contaminated materials. Suitable hardstand or lined areas would be required that are appropriately stabilised and bunded, with sufficient area for stockpile storage and segregation.

Material that is identified as contaminated would be segregated from uncontaminated material on site to prevent cross-contamination. A detailed sub-plan to the CEMP for the project would describe methodologies and strategies to prevent cross-contamination.

Special wastes

Acid sulfate soils

There is the potential for acid sulfate soils to be present within the project footprint (refer to **Chapter 16** (Contamination)). Procedures to manage acid sulfate soils would be included in a Construction Soil and Water Management Plan that would be prepared as part of the CEMP.

Identified acid sulfate soil material would be stored temporarily in a bunded area, transported, treated and disposed of off-site at a licensed facility. Management of acid sulfate soils would be in accordance with the *Guideline for the Management of Acid Sulfate Materials* (NSW Roads and Traffic Authority 2005c).

Asbestos

ACM are likely to be present within the project footprint. The excavation, handling, storage, movement and disposal of ACM would be undertaken in accordance with procedures detailed in an Asbestos Management Plan prepared as part of the Work Health and Safety Plan for the project, which would be prepared in accordance with:

- *Work Health and Safety Act 2011* (NSW)
- *Code of Practice for the Safe Removal of Asbestos 2nd Edition* (National Occupational Health and Safety Commission (NOHSC) 2005a)
- *Code of Practice for the Management and Control of Asbestos in Workplaces* (NOHSC 2005b)
- Protection of the Environment Operations (Waste) Regulation 2014 (NSW) – clause 42 special requirements relating to asbestos waste
- National Environment Protection (Assessment of Site Contamination) Measure 1999
- AS2601:2001 Demolition of Structures.

An asbestos survey would be undertaken of buildings to be demolished prior to demolition. Removal of ACM would be undertaken by suitably qualified experts in accordance with an Asbestos Management Plan which would include notification requirements. For further details on known and potentially contaminated sites within the project footprint, refer to **Chapter 16** (Contamination).

Heavy metals

There is the potential for heavy metals such as cadmium, arsenic, copper, lead, mercury, magnesium, aluminium and iron to exist at the Rozelle civil and tunnel site (C5), given the various historical land uses that have occurred at the Rozelle Rail Yards.

The excavation, handling, storage, movement and disposal of waste material that is identified as being contaminated with heavy metals would be undertaken in strict accordance with the procedures detailed in the CEMP and the Work Health and Safety Regulation 2011 (NSW). For further details on known and potentially contaminated sites within the project footprint, refer to **Chapter 16** (Contamination).

Wastewater

Tunnel construction would result in significant volumes of groundwater inflow that would require collection, treatment and disposal. Wastewater volumes generated during tunnel construction would vary depending on construction activity, tunnel groundwater infiltration rate and excavated tunnel length. In addition, wastewater would be generated from other construction activities including dust suppression, washdown areas and stormwater runoff from construction ancillary facilities (grey water). Indicative total wastewater volumes generated over the duration of the construction period are identified in **Table 23-9**.

Construction water would either be reused on site wherever feasible, or discharged into the local stormwater system in accordance with the requirements of the POEO Act, including an environment protection licence (if required).

Opportunities for the reuse of treated water would be considered in preference to discharge to the stormwater system or receiving waterbodies. This could include irrigation of landscaped areas within the project footprint, such as the new open space at the Rozelle Rail Yards. Preference would be given to reusing as much water as practicable before discharging.

Table 23-9 Indicative wastewater volumes

Construction ancillary facility	Estimated daily treatment (kilolitres)	Estimated daily discharge (kilolitres)	Available for reuse on site (kilolitres)	Discharge point
Haberfield civil and tunnel site (C2a)	2,000	1,200	800	Dobroyd Canal (Iron Cove Creek) via a stormwater piper under Parramatta Road.
Parramatta Road West civil and tunnel site (C1b)	2,000	1,200	800	Dobroyd Canal (Iron Cove Creek) via a stormwater piper under Parramatta Road.
Darley Road civil and tunnel site (C4)	1,500	700	800	Hawthorne Canal via the existing channel between Blackmore Park and Canal Road at Leichhardt.
Rozelle civil and tunnel site (C5)	4,000	2,400	1,600	Rozelle Bay near the intersection of City West Link and The Crescent.
The Crescent civil site (C6)	1	10	0.2	Whites Creek/Rozelle Bay via a sedimentation basin within the C6 site.
Victoria Road civil site (C7)	1	200	0.6	Existing drainage system at Victoria Road draining to White Bay.
Iron Cove Link civil site (C8)	10	300	2	Iron Cove via the existing outfall within King George Park.
Pyrmont Bridge Road tunnel site (C9)	2,000	1,200	800	Stormwater drainage system under Parramatta Road.
Campbell Road civil and tunnel site (C10)	2,000	1,200	800	Alexandra Canal.

Around six water treatment plants would be used during construction of the project. These would be located at the Haberfield civil and tunnel site (C2a) or the Parramatta Road West civil and tunnel site (C1b), the Darley Road civil and tunnel site (C4), the Rozelle civil and tunnel site (C5), the Iron Cove Link civil site (C8), the Pyrmont Bridge Road tunnel site (C9) and the Campbell Road civil and tunnel site (C10).

Details of water treatment methods and discharge water quality are provided in **Chapter 15** (Soil and water quality). For further information on water treatment plants proposed to collect and treat construction water, surface water runoff and groundwater inflows, as well as the expected groundwater discharge volumes during both construction and operation, refer to **Chapter 6** (Construction work) and **Chapter 15** (Soil and water quality).

An updated water balance would be prepared during detailed design. The outcomes of this study would be used to further improve water efficiency during construction and operation.

23.4 Assessment of operational impacts

23.4.1 Operational resource consumption

Water resources

During the operation of the project, water would be required for:

- Tunnel deluge system (testing and operation)
- Tunnel wall washing
- Motorway operations complex ablutions
- Landscape irrigation.

The anticipated volume, source, management and treatment of operational water are detailed in **Chapter 5** (Project description).

The local water supply network would have sufficient capacity to accommodate project operational water requirements. Opportunities for reuse of treated water would be considered in preference to discharge to the stormwater system or receiving waterbodies. This could include irrigation of landscaped areas within the project such as the new open space at the Rozelle interchange. In order to reduce demand on local water supplies, options would be investigated to provide water for the deluge system from wastewater produced through the tunnel drainage system, where it meets appropriate quality parameters.

Other than during regular maintenance testing, which would require relatively minor water volumes, the deluge system would only operate during emergencies. Water for the deluge system would be sourced from the mains supply.

Power

Operational electricity supply would be required for the mainline tunnels and associated mechanical and electrical equipment. As described in **Chapter 5** (Project description), the project would include the provision of five above ground substations, located at Darley Road motorway operations complex (MOC1), Rozelle West motorway operations complex (MOC2), Rozelle East motorway operations complex (MOC3), Iron Cove Link motorway operations complex (MOC4) and Campbell Road motorway operations complex (MOC5). The project would also include a series of underground substations at a spacing not exceeding 1,200 metres within the tunnel.

The anticipated energy consumption of each operational component of the tunnel is summarised in **Table 23-10**. A minimum of six per cent of operational electricity requirements for the project would be sourced from renewable sources and/or an accredited GreenPower energy supplier. Opportunities for operational energy offset, in accordance with the Australian Government National Carbon Offset Standard, would be considered during detailed design.

The project has been designed to minimise energy consumption and maximise energy efficiency. Measures to improve energy efficiency are detailed in **Chapter 22** (Greenhouse gas). Initial discussions with power supply authorities indicate that there is sufficient capacity to supply the project's power requirements without negative impacts on the local power supply.

Table 23-10 Anticipated operational power supply requirements

Location	Power requirement (MVA)
Mainline tunnels	35
Rozelle interchange and Iron Cove Link	30

Peak oil

Peak oil refers to the fact that oil production may peak, or may have already peaked, and that oil production would decline after this peak. The impact could increase the cost and reduce the availability of transport fuels. Peak oil issues in relation to transport generally include the use of fossil fuels, the energy efficiency of vehicles and construction products derived from fossil fuels. Although consideration of peak oil is not included in the SEARs, Roads and Maritime acknowledges that it is prudent to consider peak oil in terms of the project's resource needs.

Despite efforts to limit demand for road transport, it is expected that the need for road transport would continue to grow, as described in **Chapter 3** (Strategic context and project need). The WestConnex program of works is intended to increase travel speeds, reduce travel distances and improve travel efficiency across the city, including on parallel arterial roads. This may result in an overall reduction in the quantity of fuel consumed.

Further, by alleviating road congestion on key arterial and local roads and providing new and upgraded active transport links, the project would:

- Directly and indirectly improve opportunities for short and local journeys to be taken on foot or bicycle
- Indirectly facilitate the use and reliability of road based public transport (refer to **Chapter 3** (Strategic context and project need)).

The project would also be able to be utilised by vehicles not powered by fossil fuels (eg electric vehicles).

Government and industry initiatives relevant to peak oil but outside the scope of this project include the NSW Government's *Resource Efficiency Policy* (NSW Office of Environment and Heritage 2014a) and the participation of Roads and Maritime, Austroads and industry in research, with the goal of developing more sustainable road construction materials and practices, thereby reducing reliance on products derived from oil.

23.4.2 Operational waste management

Solid waste

Wastes would be generated during routine maintenance and repair activities required over time, as well as from the operation of the motorway operations complexes. The type and volume of wastes generated would depend on the nature of the activity, but would predominantly consist of minor volumes of general office waste (paper, plastics, food waste), green waste, oil and road materials, as well as contaminated waste resulting from potential fuel spills and leaks. Recycling bins would be provided at site offices to encourage local recycling.

The volumes and types of waste would be typical of motorway operations facilities and could be accommodated by existing metropolitan waste management facilities. Maintenance and repair activities would be subject to separate assessment processes, which would include the assessment of waste impacts associated with these activities.

With the implementation of standard work practices during routine maintenance and repair activities (which would be assessed separately from the project), the overall impact of operational waste streams would be minimal.

Wastewater

The mainline tunnels would include drainage infrastructure to capture groundwater and stormwater ingress, spills, maintenance wastewater, fire suppressant deluge and other potential water sources. The two tunnel drainage streams are expected to produce flows containing a variety of pollutants that require slightly different treatment before discharge to manage adverse impacts on the receiving environment. The pre-treatment water quality of each wastewater stream is expected to vary considerably, and consequently it is likely that the two wastewater streams would need to be collected and treated separately.

Tunnel wastewater from the mainline tunnels would be pumped to an operational water treatment facility at the Darley Road motorway operations complex (MOC1) at Leichhardt, with one option for treated flows being discharged into Hawthorne Canal. Hawthorne Canal discharge point has been considered as an indicative location. Other appropriate locations would be considered during detailed design.

Tunnel wastewater from the Rozelle interchange tunnels and Iron Cove Link would be pumped to an operational water treatment facility at the Rozelle East motorway operations complex (MOC3), with flows being treated at the constructed wetland at Rozelle civil and tunnel site (C5) and then discharged into Rozelle Bay. A small portion (around 1.6 kilometres) of tunnel, to and from the St Peters interchange, would also drain to the New M5 operational water treatment facility at Arncliffe, draining to the Cooks River.

The combined mainline tunnel and Rozelle interchange tunnel would generate around 1,418 megalitres per year of treated groundwater.

Collected groundwater would be pumped to water treatment facilities. Other sources of water captured by the tunnel drainage system (ie washdown or a spill) would be collected in one of the tunnel sumps, assessed to determine the source, tested, and either pumped to and discharged at the surface or removed directly from the sump by tanker for treatment, and disposal elsewhere.

Further information is provided in **Chapter 15** (Soil and water quality) including potential impacts associated with operational stormwater runoff.

23.5 Environmental management measures

Resource use and waste management can be managed and mitigated through the development of construction management plans and implementation of standard approaches.

Measures to avoid, minimise or manage resource consumption and waste streams generated as a result of the project are detailed in **Table 23-11** and would ensure that all wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects human health and environmental values. Specific contingency measures for waste management are outlined in the section below and are detailed in **Table 23-11**.

Contingency management of waste

Specific contingency measures to manage waste generated from the construction and operation of the project will be implemented to manage unexpected volumes of waste or otherwise exceptional circumstances. Suitable areas will be identified to allow for contingency management of unexpected waste materials, including contaminated materials. These areas will be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage and segregation.

The spoil management sites identified in **section 23.3.2** will have adequate capacity to accept spoil from the project at the time of disposal and there is additional capacity at these sites in the event of additional unexpected spoil volumes.

In the event of discovery of previously unidentified contaminated material, all relevant work will cease in the vicinity of the discovery and the unidentified contaminated material would be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime 2013).

The environmental management measures outlined in **Table 23-11** and throughout this assessment will be consistently implemented in the event of encountering unexpected volumes of waste or otherwise exceptional circumstances, along with adherence to all project resource use and waste principles and relevant legislation and regulations.

Table 23-11 Environmental management measures – waste

Impact	No.	Environmental management measure	Timing
Construction			
Resource consumption	RW1	Construction material will be sourced in accordance with the relevant aims of the *WestConnex Sustainability Strategy* (Sydney Motorway Corporation 2015) and a Sustainability Strategy (that will be developed during detailed design), including to optimise resource efficiency and waste management, and the selection of locally sourced materials and prefabricated assets where possible, to reduce greenhouse gas emissions. Unnecessary resource consumption will be avoided through the detailed design of the project and by making realistic predictions about the required quantities of resources, such as construction materials.	Construction
Waste generation and disposal	RW2	Wastes will be managed and disposed of in accordance with relevant NSW legislation and government policies.	Construction
	RW3	A Construction Waste Management Plan will be prepared as part of the CEMP and regularly updated during detailed design and construction, detailing appropriate procedures for waste management. The plan will include the waste management measures described in this EIS.	Construction
	RW4	Wastes will be managed using the waste hierarchy principles of: • Avoidance of unnecessary resource consumption to reduce the quantity of waste being generated • Recovery of resources for reuse on-site or off-site for the same or similar use, without reprocessing • Recovery of resources through recycling and reprocessing so that waste can be processed into a similar non-waste product and reused • Disposal of residual waste.	Construction
	RW5	Resource recovery will be applied to the management of construction waste and will include: • Recovery of resources for reuse – reusable materials generated by the project will be segregated for reuse on site, or off site where possible, including the reuse of the major waste streams (VENM) • Recovery of resources for recycling – recyclable resources (such as metals, plastics and other recyclable materials) generated during construction and demolition • Resources will be segregated for recycling and sent to an appropriate recycling facility for processing • Recovery of resources for reprocessing – cleared vegetation will be mulched or chipped on-site and used for landscaping, in the absence of a higher beneficial use being identified.	Construction
	RW6	Options identified for the off-site reuse of waste will comply with relevant NSW EPA resource recovery exemptions and requirements.	Construction

Impact	No.	Environmental management measure	Timing
	RW7	The Construction Waste Management Plan will document anticipated volumes of spoil that will be generated by the project, spoil storage locations within project sites and likely spoil disposal sites. The Construction Waste Management Plan and spoil reuse opportunities will be regularly reviewed and updated during detailed design and project construction.	Construction
	RW8	The project will reuse or recycle around 95 per cent of uncontaminated spoil generated for beneficial purposes, either within the project or at other locations in accordance with the project spoil management hierarchy.	Construction
	RW9	Suitable areas will be identified to allow for contingency management of unexpected waste materials, including contaminated materials. Suitable areas would be required to be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage.	Construction
Exposure to unexpected contaminated land	RW10	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the *Guideline for the Management of Contamination* (Roads and Maritime 2013) and detailed in the CEMP.	Construction
Dust generation, erosion and sedimentation of stockpiles	RW11	Spoil stockpiles will be provided with appropriate environmental controls and managed to reduce potential impacts associated with dust generation, erosion and sedimentation.	Construction
Generation of general waste	RW12	General wastes from site offices such as putrescibles, paper, cardboard, plastics, glass and printer cartridges will be separated and collected for recycling off-site wherever practicable.	Construction
Exposure to asbestos	RW13	An asbestos survey will be undertaken of buildings to be demolished as part of the project in accordance with an Asbestos Management Plan as part of the Work Health and Safety Plan. The survey will be conducted by a suitably qualified person.	Construction
	RW14	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan as part of the Work Health and Safety Plan and relevant NSW legislation, government policies and Australian Standards. The plan will include prior notification to adjacent communities about potential hazards.	Construction

Operation			
Waste generation and disposal	ORW1	The project will be operated in accordance with the relevant aims of the *WestConnex Sustainability Strategy* (Sydney Motorway Corporation 2015) and a Sustainability Strategy will be developed during detailed design to outline ways to optimise resource efficiency and waste management.	Operation
	ORW2	Waste will be managed and disposed of in accordance with relevant NSW legislation and government policies and the mitigation measures described in this EIS.	Operation
Wastewater use and discharge	ORW3	Opportunities to reuse treated groundwater during project operation will be considered in preference to discharge to the stormwater system or receiving waterbodies. This could include irrigation of landscaped areas within the project footprint such as new open spaces at the Rozelle interchange.	Operation
	ORW4	In order to reduce demand on local water supplies, options will be investigated to provide water for the deluge system from wastewater produced through the tunnel drainage system, where it meets appropriate quality parameters.	Operation