Chapter 21
Resource use and waste management

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21.1 Assessment approach

The assessment of resource use and waste management for the upgrade of the Great Western Highway between Blackheath and Little Hartley (the project) comprised:

- review of the regulatory framework for waste management (including spoil reuse, recycling and disposal options)
- review of the likely resources required for the construction and operation of the project, including materials, water and power
- review of the likely waste streams, volumes and classifications
- estimating the quantities of bulk earthworks and spoil that would be generated during construction
- identification of opportunities for the avoidance, minimisation and reuse of waste, including targets for the beneficial reuse of solid wastes, water and other waste consistent with the project's sustainability framework (refer to Chapter 23 (Sustainability, climate change and greenhouse gas))
- identification of the environmental impacts associated with resource use and the generation, handling, storage and disposal of waste materials
- identification of management strategies for waste during construction and operation, including:
  - managing construction waste through the resource management hierarchy established under the *Waste Avoidance and Recovery Act 2001* (see Figure 21-1)
  - developing procedures for the assessment, handling, stockpiling and disposal of potentially contaminated materials and construction water, in accordance with the Waste Classification Guidelines (NSW Environment Protection Authority, 2014)
  - identifying resource replacement opportunities for achieving circular economy outcomes under the NSW Waste and Sustainable Materials Strategy 2041 (NSW Department of Planning, Industry and Environment, 2021b).

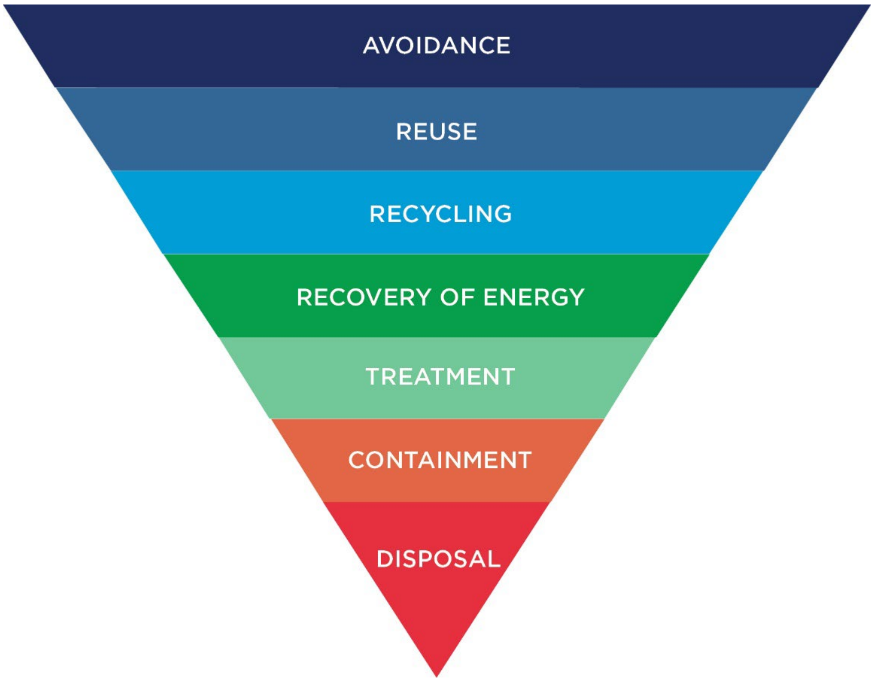

Figure 21-1 Resource management hierarchy considered for the project

21.2 Potential impacts – construction

Potential impacts during construction of the project relate to:

- construction resource use, including construction materials, water and power
- generation and management of wastes (non-spoil)
- generation and management of spoil.

21.2.1 Construction resource use

Construction materials

Indicative quantities of anticipated construction materials are provided in Table 21-1. Other items such as timber, electrical materials and landscaping materials would also be required. The portal emissions option would require less construction materials (such as for the ventilation building and outlet) compared to the ventilation outlet option (if identified as the preferred option).

Table 21-1 Indicative quantities of resources required for construction

Material	Indicative quantity required
Asphalt	26,800 m^3
Sprayed bitumen	226,100 L
Ready mixed concrete	478,900 m^3
Precast concrete	572,700 m^3
Aggregates – gravel/sand	20,600 m^3
Steel	42,600 t
Aluminium	22 t

Material	Indicative quantity required
Glass	1,300 m^2
PVC piping	63.5 t
Concrete piping	600 t
Plastic sheeting	35,000 m^2
Composites – compressed fibre cement	127,500 m^2
Coatings and finishes	38,900 m^2
Water treatment chemicals	1,259,000 L

Construction material requirements for the project are typical for a tunnel project of this scale. While the resource requirements of the project do have the potential to temporarily impact resource availability within the Blue Mountains region over the construction period, the period between the approval of the project and the start of major construction would be sufficient to allow the market to prepare for the needs of the project in conjunction with the resource needs of other infrastructure projects being constructed in NSW, including nearby projects listed in Chapter 24 (Cumulative impacts).

The design of the project has included careful consideration of the construction methodology and selection of materials and resources to ensure fitness for purpose and to minimise resource consumption. Consistent with the resource management hierarchy of the *Waste Avoidance and Resource Recovery Act 2001*, resource consumption would be further minimised during construction through reuse, where possible. For example, temporary work structures such as road plates and tunnel formwork would be reused.

Options for resource recycling would continue to be investigated during ongoing design development and would include consideration of alternatives for high impact resources such as concrete, aggregates and steel. Potential initiatives would include:

- minimising the embodied energy impacts of steel by maximising the use of recycled steel and steel produced using energy reducing processes
- identifying and implementing best practice low impact alternative materials in the construction supply chain including recycled materials and engineered timber
- undertaking lifecycle assessments and minimising the embodied energy impacts of materials, by selecting low carbon alternatives and considering durability and local sourcing
- prioritising products made from recycled content.

The following targets have been developed to support carbon and energy management during construction of the project:

- achieve at least a 10 per cent reduction from baseline greenhouse gas emissions during construction when compared to business as usual
- offset at least 25 per cent of the carbon emissions associated with consumption of fuel and electricity during construction through the purchase of approved offsets or renewable energy
- 10 per cent reduction of construction stage scope 1 emissions (greenhouse gas emissions generated by sources owned or controlled by the project) using Climate Active Standard eligible offsets
- reusing or recycling 100 per cent of uncontaminated spoil generated for beneficial purposes in accordance with the resource management hierarchy.

Water

Water would be required during construction activities including:

- tunnelling activities, cooling of tunnel boring machines (TBMs) and dust suppression
- surface works such as during compaction of pavement materials and for dust suppression
- concrete batching
- site offices and worker amenities.

Estimated indicative water use for the construction of the project is outlined in Table 21-2.

Table 21-2 Estimated indicative water use for the construction of the project

Activity	Indicative quantity (kilolitres per month)	Water source
Tunnelling	51,700	Potable and recycled
Earthworks	11,900	Potable and recycled
Site facilities	750	Potable
Dust suppression	5,000	Potable and recycled
Concreting	400	Potable and recycled (where properties meet relevant specifications)
Total	**69,750**	

Measures to avoid and minimise water consumption, particularly of potable water, have been included in the design and construction planning for the project. Examples of these measures include:

- use of dust extraction and ventilation systems to control dust in tunnels during construction to minimise the use of water as a dust suppressant
- capture, treatment and use of construction water and rainwater at construction sites to minimise the use of potable water during construction
- use of site-sourced water for dust suppression in civil works and landscaping.

Potential water sources for construction of the project would include:

- stormwater/ rainwater harvesting (non-potable water)
- water from nearby farm dams (non-potable water)
- treated construction water, including groundwater if encountered and collected during tunnel excavation (non-potable water)
- water from Lithgow City Council via a pipeline (potable water), delivered as part of the project (refer to Chapter 4 (Project description)).

Further investigation is being carried out for the use of groundwater to support construction activities at Little Hartley.

Where feasible and reasonable, and where water quality and volume requirements are met, non-potable water sources would be prioritised.

The following targets have been developed to support water resource efficiency during construction of the project:

- reduce water use by at least 10 per cent compared to business as usual

- source at least 33 per cent of the water used in construction from non-potable sources
- implement rainwater harvesting and reuse systems at construction sites.

The average total water demand during construction is estimated to be 69,750 kilolitres per month. Given this volume, and despite maximising the reuse of non-potable water (e.g. treated groundwater or harvested rainwater), it is likely that the majority of water would be sourced from Lithgow City Council (potable water) via a pipeline. Should construction of the project begin prior to construction of the pipeline being completed, water may be trucked in from Lithgow until the pipeline is operational.

A summary of the indicative construction water balance for the project is presented in Chapter 14 (Surface water and flooding).

Power

Electricity supply would be required at all construction sites, including a high voltage supply at the Little Hartley construction site for TBM tunnelling support. Table 21-3 summarises the indicative electricity demand at construction sites for TBMs, roadheaders and other construction equipment.

Power supply would be established prior to construction commencing. The power supply for the Little Hartley construction site would be provided by a new substation and switching station which would connect to the existing power supply network near the Little Hartley portal. Power supply to Blackheath and Soldiers Pinch construction sites would be accommodated by local Endeavour Energy powerlines. If required, generators would be used for a short period of time until power supply is established.

Measures to avoid and minimise electricity consumption have been included in the design and construction planning for the project. Examples of these measures include:

- use of a single source for both construction and operational power supply at Little Hartley
- use of TBM guidance systems for tunnel excavation which would allow TBMs to continuously track the position and direction of tunnelling to minimise excessive electricity consumption
- use of energy efficient site buildings at construction sites that meet the Responsible Construction Leadership Group Sustainable Site Facilities requirements (Responsible Construction Leadership Group, 2018), including LED lighting, effective air-conditioning control and sub-metering of electricity
- use of energy efficient equipment at construction sites, including use of solar powered lights and signage where feasible and reasonable
- efficient design of electricity transmission systems to supply power as efficiently as possible.

Opportunities to include sustainable electricity supply would continue to be investigated during ongoing design development. Further information on the incorporation of sustainable construction methods is provided in Chapter 23 (Sustainability, climate change and greenhouse gas).

Table 21-3 Indicative construction power supply requirements

Construction site and works requiring power	Indicative construction power requirements (Mega Volt Ampere (MVA))
Blackheath: • site establishment • road header support • construction support infrastructure	3.2
Soldiers Pinch: • site establishment • road header support • construction support infrastructure	3.2

Construction site and works requiring power	Indicative construction power requirements (Mega Volt Ampere (MVA))
Little Hartley: • site establishment • TBM support • construction support infrastructure	22

21.2.2 Construction waste generation and management (non-spoil)

General waste

Table 21-4 summarises indicative solid and liquid waste streams that would be generated during construction, including examples of these waste streams, indicative waste stream quantities and anticipated waste classifications. The types of non-spoil construction waste generated by the project are likely to have limited disposal and/or recycling opportunities.

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:

- preference for precast 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 construction site where possible.

The identified solid waste construction streams can be adequately managed with the implementation of standard waste management practices (addressing waste generation, storage, disposal and reuse) and the mitigation measures outlined in Table 21-11.

Measures would be implemented to manage unexpected waste volumes and types of waste materials generated from construction. Construction sites would have suitable space to accommodate short-term management of unexpected waste volumes. These areas would be hardstand or lined areas that are appropriately stabilised and bunded. The environmental mitigation measures outlined in Section 21.4.2 would be consistently implemented in the event of unexpected waste volumes and materials generated during construction, along with adherence to all waste principles and relevant legislation and regulations.

Table 21-4 Indicative solid and liquid waste streams generated during construction

Waste stream	Examples of waste	Indicative quantity	Likely waste classification	Likely management method
Demolition wastes	Concrete, bricks, tiles, timber, metals, plasterboard, carpets, electrical and plumbing fittings, furnishings	210 t	General solid waste (non-putrescible)	Sent to licensed facility for recycling and/or disposal.
Aggregates – crushed rock/concrete	Concrete	80,420 t	General solid waste (non-putrescible)	Incorporated into fill through a crushing plant or sent to licensed facility for recycling and/or disposal.

Waste stream	Examples of waste	Indicative quantity	Likely waste classification	Likely management method
Hazardous wastes	Asbestos, heavy metals	2 t	Hazardous waste and/or special waste	Sent to licensed facility with ability to accept material for disposal.
Vegetation wastes	Trees, shrubs, ground cover	13,370 m^3	General solid waste (putrescible)	Mulched and re-used on site.
General construction wastes	Timber formwork, scrap metal, steel, concrete, plasterboards, packaging materials	2,030 t	General solid waste (non-putrescible)	Sent to licensed facility for recycling.
Waste from operation and maintenance of construction vehicles and equipment	Oils	90,400 L	Hazardous waste and/or special waste	Sent to licensed facility for recycling, treatment and/or disposal.
	Tyres	640 (no.)		
	Batteries	160 (no.)		
	Hydraulic hoses	810 (no.)		
General wastes from site offices	Putrescibles (food waste), paper, cardboard, plastics, glass, printer cartridges	220 t	General solid waste (putrescible and non-putrescible)	Sent to licensed facility for recycling and/or disposal.

Water

Water volumes generated during construction would vary depending on the types of construction activities being carried out and the stage of construction. The majority of water generated during construction would be through tunnelling followed by earthworks. A description of how construction water would be managed is provided in Chapter 5 (Construction).

The tunnels would be constructed by TBMs and would be progressively lined with segment lining. The maximum predicted tunnel groundwater inflow level would peak at around 750 to 1,850 cubic metres per day (8.7 to 21.4 litres per second) associated with construction of the cross passages. Non-peak groundwater inflows are predicted to be much lower at other periods during construction. Total inflows would be expected to decrease around 2029 once construction of these elements is complete. Further information on groundwater infiltration and groundwater effects is provided in Chapter 13 (Groundwater and geology).

Smaller volumes of water would be generated by other construction activities, such as dust suppression, concreting and equipment washdown. Indicative construction water treatment plant discharge volumes at the construction sites are summarised in Table 21-5. These volumes conservatively assume that all water would be treated and discharged, and do not take into account the opportunities for water reuse identified above. Further information on water treatment and discharge water quality, as well as the complete water balance for the project, is provided in Chapter 14 (Surface water and flooding).

Stormwater would drain to water quality basins where it would be treated for reuse or discharge from site as appropriate. Groundwater from tunnel inflows would be pumped to the construction water treatment plants where it would be treated and reused where possible or discharged from site as appropriate.

Site amenity water (sewage) would be discharged to a local sewer system where possible or trucked off-site to an appropriate disposal facility.

Table 21-5 Indicative average construction water treatment plant discharge volumes

Construction sites	Estimated discharge (kilolitres per day)	Site amenity water for treatment and discharge or disposal (kilolitres per day)	Potential water available for treatment and reuse (kilolitres per day)
Blackheath	57	12	45
Soldiers Pinch	42	20	22
Little Hartley	915	155	760

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

The anticipated generation of water from tunnel construction would be greater than the potential for reuse. Therefore, treatment of surplus construction water and off-site discharge would be required. Chapter 6 (Statutory context) outlines the requirement for an environment protection licence for road construction under Chapter 3 of the *Protection of the Environment Operations Act 1997*.

The water collected from tunnelling activities would be tested and treated at construction water treatment plants prior to reuse or discharge. Site-specific trigger values would be used during construction planning when setting the water treatment plant discharge criteria to ensure water meets the requirements for discharge to the Sydney drinking water catchment, including the need to have a neutral or beneficial effect (NorBE) on water quality. Further information on potential water quality impacts is provided in Chapter 14 (Surface water and flooding).

Waste storage and disposal

Appropriate waste storage facilities, such as bins, would be provided for general waste storage during construction. Waste would be classified in accordance with the Waste Classification Guidelines Part 1: Classifying waste and segregated appropriately. Waste collection would be carried out by an authorised contractor for off-site recycling or disposal at a licensed waste facility.

The Lithgow Solid Waste Facility has been identified as a potential waste disposal site which accepts general putrescible and non-putrescible solid waste, asbestos and tyres. The Oberon Waste Facility has been identified as a potential disposal site for other wastes including hazardous materials and liquid wastes such as oils or wastewater not suitable for treatment or discharge. Suitable waste disposal sites that recycle and dispose of construction waste would be further investigated and confirmed during design development by the construction contractor(s) and documented in the Construction Environmental Management Plan. As far as possible, waste disposal locations located to the west of the project would be considered to minimise the transport of waste through Blackheath and Mount Victoria.

Waste would be transported off-site for disposal, which would generally occur during standard construction hours. There is potential for environmental impacts as a result of the transport of waste including dust, mud-tracking and accidental spills. Mitigation measures would be outlined in the Construction Environmental Management Plan (CEMP) including adequate covering of truck loads and washing of heavy vehicle tires to minimise tracking mud onto the road network.

21.2.3 Spoil management

Spoil generation and management

The largest waste stream associated with the project would be spoil generated from the excavation of the tunnels in excess of what can be reused for the project. Smaller quantities of spoil would be generated by excavation required for surface components of the project. Around 7.8 million tonnes of spoil would be generated during construction of the project. Indicative cut and fill volumes for the project are provided in Table 21-6.

Table 21-6 Indicative cut and fill volumes for the project

Location	Cut volume (m^3)	Fill volume (m^3)
Blackheath area earthworks	456,290	231,750
Little Hartley area earthworks	330,630	918,760
Tunnel including mid-tunnel access excavation, cross passages, and substations	3,906,497	Nil
Total	**4,693,417**	**1,150,510**
Balance	**3,542,907 surplus (m^3)** **7,794,396 surplus (t)**	

It is expected that excavated material would consist of a combination of:

- tunnel spoil
- surface excavated material
- roadbuilding materials from within existing road corridors, such as concrete and asphalt
- excavated natural material containing coal, acid sulfate rock or other contaminants.

The project design has considered the principles of the resource management hierarchy as defined in the *Waste Avoidance and Resource Recovery Act 2001*. This has included refining the tunnel alignment to achieve a shorter and straighter tunnel which would reduce the amount of spoil generation. Where possible and fit for purpose, spoil would be beneficially reused as part of the project before alternative off-site reuse options are pursued. The approach to management of spoil for the project is shown in Figure 21-2.

Some tunnelling spoil would be reused as backfill within the tunnel to provide a flat surface for road pavement. Where possible, tunnelling spoil would also be stockpiled for future reuse as fill material for the surface road upgrade works to be constructed for the project. Opportunities to use excess spoil that cannot be reused within the project, for adjacent or nearby Transport for NSW (Transport) projects including other components of the Upgrade Program would be considered.

Excess spoil that cannot be reused within the project or for the other adjacent or nearby Transport projects would be removed primarily from Little Hartley for appropriate off-site reuse. Spoil that cannot be reused on-site would be highly dependent on the final classification of spoil and the timing and availability of alternative off-site reuse locations that can accommodate both the class and volume of spoil expected.

All identified re-use locations would be located to the west of the project, reducing spoil haulage through Blackheath and Mount Victoria (including associated potential safety and amenity impacts). Any surplus spoil that is not suitable for reuse would be sent to an appropriately licensed waste management facility. Spoil would be classified prior to leaving the site in accordance with the Waste Classification Guidelines: Part 1 Classifying Waste, and all spoil intended for off-site reuse would be managed in accordance with the resource recovery orders and exemptions under the Protection of the Environment Operations (Waste) Regulation 2014.

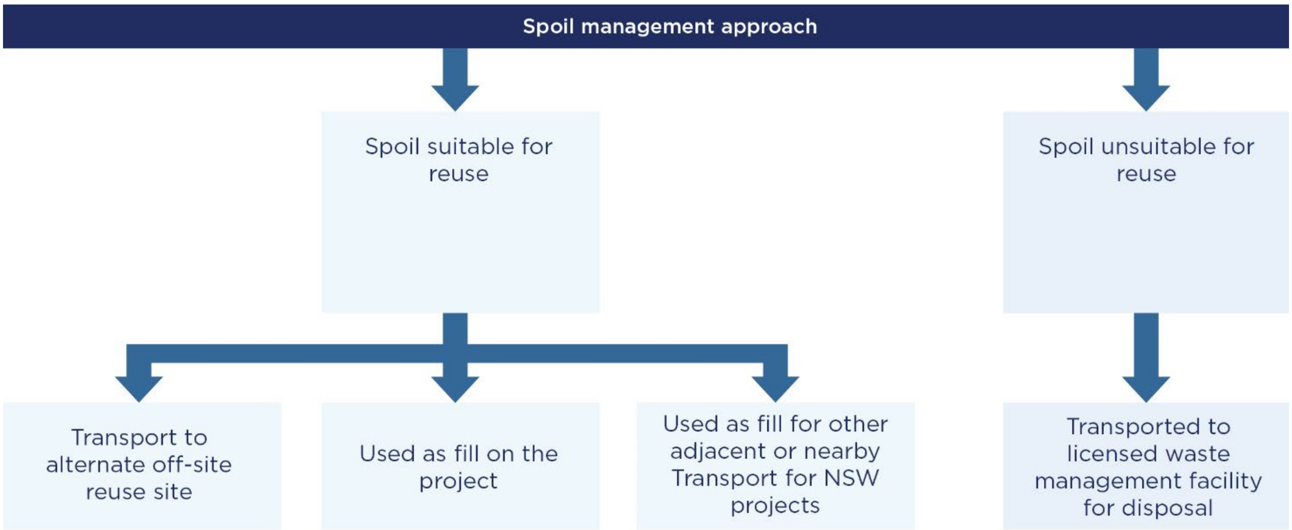

Figure 21-2 Spoil management approach

Table 21-7 lists off-site spoil reuse options that are being investigated for the project. It would be the responsibility of the sites listed in Table 21-7 to obtain the relevant approvals to receive spoil from the project.

Table 21-7 Off-site spoil reuse options currently being considered

Site	Location	Approximate distance west from Little Hartley
Little Hartley to Lithgow Upgrade	Little Hartley	Adjacent
Lidsdale/Kerosene Fly Ash Repository (associated with former Wallerawang power station)	Wallerawang, NSW	30 km
Hytec Austen Quarry	Hartley, NSW	15 km
Hanson Quarry	Clarence, NSW	25 km
Metromix	Marrangaroo, NSW	20 km
Invincible Colliery	Cullen Bullen, NSW	40 km
Cullen Valley Colliery	Cullen Bullen, NSW	40 km

Stockpile management

Stockpiles would be located at all construction sites at Blackheath, Soldiers Pinch and Little Hartley. The estimated stockpiling capacities of these construction sites are provided in Table 21-8. These volumes are indicative and may be subject to change following detailed construction planning by the construction contractor(s) when appointed.

Table 21-8 Indicative estimated stockpile capacities

Stockpile location	Indicative stockpile capacity (m^3)
Blackheath construction site	5,000
Soldiers Pinch construction site	2,500
Little Hartley construction site	20,000

Stockpiles would be located away from nearby sensitive receivers. TBM generated spoil would be managed within an acoustic shed at Little Hartley to minimise the potential impacts from runoff and sedimentation associated with stockpiling, and potential noise impacts from the loading of spoil trucks. Stockpiles would be managed appropriately to avoid potential impacts associated with runoff and sedimentation.

Potential impacts related to stockpiles from runoff and sedimentation are further discussed Section 14.3.1 of Chapter 14 (Surface water and flooding). Potential impacts resulting from the generation and dispersion of dust are assessed in Section 9.5.1 Chapter 9 (Air quality). Potential contamination impacts are discussed in Section 15.3.2 of Chapter 15 (Soils and contamination). The project does not involve excavation or disturbance of landfill areas, or other major contaminated sites and therefore it is not anticipated that leachate would be encountered. Stockpiles would be managed appropriately to avoid potential impacts associated with runoff and sedimentation.

Contaminated spoil

There is potential to discover contaminated material during surface excavation work for the project. There is also the potential for TBM generated spoil from tunnelling work to contain coal, acid sulfate rock and other contaminants.

A contamination assessment has been carried out to determine the potential for encountering contaminated material during construction (refer to Chapter 15 (Soils and contamination)).

The contamination assessment identified a number of areas of environmental interest with contaminants of potential concern near the project. These locations, and types of contaminated material, are detailed in Chapter 15 (Soils and contamination).

Management of contaminated spoil would be carried out in accordance with the mitigation measures outlined in Chapter 15 (Soils and contamination). Any contaminated material disturbed during construction would be separated from uncontaminated material to prevent cross contamination. This spoil would be loaded into sealed and covered trucks for disposal at a suitably licensed waste facility. An Acid Sulfate Rock Management Plan will be prepared as part of the Construction Environmental Management Plan to manage potential acid sulfate rock in spoil.

21.3 Potential impacts – operation

Potential impacts during operation of the project relate to:

- operational resource use, including operational materials, water and electricity
- generation and management of waste.

21.3.1 Operational resource use

Operational materials

Materials used for the operation of the project would be limited to those required for ongoing maintenance activities, and for the operation of the tunnel operations facility and support activities, including the substation and water treatment plant at Little Hartley.

During operation, the project would achieve a minimum 15 per cent reduction in carbon emissions associated with operations, when compared to business as usual.

Water

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

- testing and operation of the tunnel deluge system, which forms part of the fire and life safety system
- tunnel cleaning systems
- tunnel operations facility amenities
- landscape irrigation.

Measures to avoid and minimise water use, particularly potable water, have been included in the project design. An example of these measures includes the reuse of groundwater entering the project tunnels where possible to satisfy the project's requirements and to reduce the demand for potable water.

Water for operation of the project would be sourced according to the following hierarchy, where feasible and reasonable and where water quality and volume requirements are met:

- treated groundwater (non-potable water)
- stormwater/ rainwater harvesting (non-potable water)
- mains supply (potable water).

Indicative volumes of water for each operational activity are provided in Table 21-9.

Table 21-9 Indicative operational water requirements

Operational activity	Total water demand (kilolitres/year)
Deluge testing	7,300
Washdown and cleaning	530
Amenities	5,110
Landscaping	8,980[1]
Total	**21,920 (first year)** **12,940 (subsequent years)**

Table notes:
1. Only required for planting/establishment in the first year of operation

Power

As described in Chapter 3 (Project alternatives and options), two options for tunnel ventilation are being considered for the project: emissions discharged via ventilation outlets or via the tunnel portals. The anticipated operational power supply requirement for the project under a ventilation outlet option would be about 128,000 kWh/day. Under a portal emissions option, the anticipated operational power supply requirement would be about 55,000 kWh/day.

Permanent power supply would be required for the tunnels (including associated mechanical and electrical equipment), traffic control facilities (including the tunnel operations facility and electronic signage), tunnel lighting and surface road lighting. As described in Chapter 4 (Project description), the project would include a series of underground substations at 1.5 kilometre intervals within the tunnel, and an aboveground substation at Little Hartley. Permanent power supply would be provided via connection to the substation and switching station at Little Hartley, established prior to construction commencing (see Section 21.2.1).

Measures to minimise energy consumption and maximise energy efficiency have been included in the project design in line with Transport's initiative to improve operational energy efficiency across the sector, and Transport's commitment to net zero transport operations by 2035 (Transport, 2020a). Examples of these measures include:

- adopting energy efficient lighting technology and smart lighting control systems to reduce operational energy requirements
- adopting an efficient and effective longitudinal tunnel ventilation system design
- locating ventilation outlets close to tunnel exit portals (under the ventilation outlet option only), taking advantage of the movement of vehicles within tunnels to reduce fan usage and energy needed to move exhaust to outlet locations
- exploring opportunities to install solar panels at the tunnel portals and on operational ancillary buildings to supplement non-renewable power sources as part of Transport's initiative to transition to a secure, cost-effective, low emission energy supply (Transport, 2020a).

Opportunities to further minimise energy consumption and maximise energy efficiency would be considered during further design development, in alignment with Transport's commitment to net zero emissions by 2050 (Transport, 2021g).

21.3.2 Operational waste generation

General waste

The type and volume of waste generated from operation of the project would depend on the nature of the activity but would predominantly consist of minor volumes of general waste (such as paper, plastics and food waste). Maintenance and repair activities would also generate a small amount of waste.

The volume and type of waste would be typical of an operational tunnel and could be accommodated by existing waste management facilities. With the implementation of standard waste management practices, the overall impact of operational waste streams would be minimal.

Water

The tunnels would include drainage infrastructure to capture groundwater and stormwater, spills, maintenance water, fire deluge and other potential water sources. The tunnel drainage streams would receive water containing a variety of pollutants (such as fuel, oil grease, and fire suppressants) requiring different treatment before discharge. Wastewater would also be generated from the operational ancillary facilities at Blackheath.

Wastewater (including collected groundwater) would be pumped to a water treatment plant located near the Little Hartley portal. Following treatment, treated water would be reused or discharged to the environment subject to licensing/ agreement with Water NSW and the Environment Protection Authority. Scour protection and energy dissipation would be provided at discharge points to prevent scouring of existing channels. Water not suitable for treatment or discharge to the receiving environment may be taken to a suitable disposal facility. This may include storage and trucking to a suitable disposal site, or pumping the water to a local sewer network. Further information is provided in Chapter 14 (Surface water and flooding) including potential impacts associated with operational stormwater runoff and water discharge.

Operational water would be treated so it meets the requirements for discharge to the Sydney drinking water catchment, including the need to have a neutral or beneficial effect (NorBE) on water quality. Further information on potential water quality impacts is provided in Chapter 14 (Surface water and flooding).

21.4 Environmental mitigation measures

21.4.1 Performance outcomes

Performance outcomes for the project in relation to resource use and waste management are listed in Table 21-10 and identify measurable performance-based standards for environmental management.

Table 21-10 Resource use and waste management performance outcomes

SEARs desired performance outcome	Project performance outcome	Timing
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.	Manage waste in accordance with the resource management hierarchy including minimisation and reuse of waste to protect environmental values.	Construction and operation

21.4.2 Mitigation measures

Mitigation measures to avoid, minimise or manage resource use and waste generation as a result of the project are detailed in Table 21-11. A full list of environmental mitigation measures for the project is provided in Appendix R (Compilation of environmental mitigation measures).

Table 21-11 Environmental mitigation measures – resource use and waste management

ID	Mitigation measure	Timing
RW1	Construction materials will be sourced with a preference for Australian materials and prefabricated products with low embodied energy, where reasonable and feasible. Resource replacement opportunities will be identified for achieving circular economy outcomes under the NSW Waste and Sustainable Materials Strategy 2041 (DPIE, 2021b).	Design and construction
RW2	The Construction Environmental Management Plan (CEMP) will include specific measures to manage waste, including: • documenting expected waste types and volumes • procedures for managing waste materials including separation, recycling, treatment, and disposal in accordance with relevant guidelines • waste reporting requirements including the implementation of a waste register • the process for identifying waste re-use sites including approval requirements.	Construction
RW3	A Spoil Management Plan (SMP) will be prepared as part of the Construction Environmental Management Plan (CEMP). The SMP will detail spoil management measures including spoil storage and handling, spoil haulage routes, opportunities for spoil reuse and a framework for identifying spoil reuse sites.	Construction

ID	Mitigation measure	Timing
RW4	The project will be designed and implemented with the aim of achieving the following during construction: • at least a 10 per cent reduction in water use during construction • source at least 33 per cent of the project's construction water requirements from non-potable sources • implement rainwater harvesting and reuse systems at construction sites.	Design and construction
RW5	Opportunities to reduce water consumption and to reuse and recycle water within the project will be considered during further design development and implemented during operation, where reasonable and feasible.	Design
RW6	Waste will be managed in accordance with applicable legislation, policies and guidelines, including the *Waste Avoidance and Resource Recovery Act 2001* and the NSW Waste and Sustainable Materials Strategy 2041 (DPIE, 2021b).	Construction and operation