9 Spoil management

This chapter describes the expected volume of spoil generated from the project, the potential for contamination, reuse/disposal options and transportation of spoil during construction. Spoil management is discussed in detail in Technical Paper 2 *Spoil management*.

The Director-General's requirements
The Environmental Assessment must include consideration of, and a management framework for spoil management, including an indication of the expected spoil generation from the project (at each relevant spoil management location), the potential for contaminated spoil to be encountered during construction and an appropriate level of assessment of the contamination in accordance with Managing Contaminated Land: Planning Guidelines, a strategy for stockpiling and handling of spoil to minimise the potential for the generation of dust and contaminated runoff, and identification of potential spoil re-use, disposal and treatment sites (as appropriate). The Environmental Assessment must place a key focus on the beneficial re-use of spoil, in preference to its disposal.

9.1 Overview

9.1.1 Spoil volume and classification

Spoil is the rock or earth removed in the course of an excavation. The total expected volume of spoil generated by this project is about 1.27 million cubic metres (all volumes are quoted as solid not bulked), with about 0.5 million cubic metres extracted via the White Bay Station construction site.

Over 80 per cent of the excavated material (generally sandstone rock or shale) can be classified as Virgin Excavated Natural Material (VENM). VENM is clean, natural material that is uncontaminated with other waste materials or manufactured chemicals. Where an excavated material cannot be classified as VENM, it would need to be disposed of to an appropriately classified landfill, although it may be eligible for reuse.

9.1.2 Potential for contamination

Some spoil generated from surface activities has the potential to be contaminated, especially excavation in former industrial areas such as White Bay and the former Rozelle Marshalling Yard. A review of spoil contamination undertaken in accordance with *Managing Contaminated Land: Planning Guidelines* is provided in Technical Paper 2 *Spoil management*. The potential volume of contaminated spoil is expected to be less than one per cent of the total excavated volume for the project.

There are two areas of shallow soil contamination within the White Bay construction site that pose a potential risk to human health and a constraint on the proposed works. These are shown in Figure 9.1.

The sites are:

- Along the northern boundary of the construction site (blue hatching in Figure 9.1). This site contains shallow hydrocarbon contamination, but the site is currently capped by bitumen, which prevents access to the underlying fill material and contaminants contained within.

- To the south-west of the White Bay Station (orange hatching in Figure 9.1). The ground in this location has lead contamination, but the state of ground cover is unknown.

Where the concrete and bitumen ground cover remains intact, the risk posed to human health is considered to be low. In addition, the impermeable ground cover would prevent precipitation infiltration and potential leaching of the contaminants to groundwater and into Rozelle Bay.

At the former Rozelle Marshalling Yard, there are a number of areas affected by hydrocarbon contamination, as shown in Figure 9.2. One area poses a particular constraint to the project, as it is located near proposed maintenance buildings and the wash plant. In addition, an area with a suspected plume of arsenic contamination exits where some of the depot infrastructure would be situated. The other area, although heavily contaminated, is near the proposed rail tracks leading into the project construction site.

A review of all other construction sites for the project, through data searches and aerial photography, did not identify any additional areas of environmental concern that have not previously been identified by the review of the DECCW Records. The Millers Point Gas Works site is located about 300 metres to the north of the proposed Barangaroo-Wynyard Station and the presence of potentially contaminated groundwater raises the possibility that any dewatering activities undertaken as part of the construction of the Barangaroo-Wynyard Station may draw contaminants towards the construction site. The Millers Point Gasworks, White Bay Power Station and the former Rozelle Marshalling Yard may also require management and/or remediation.

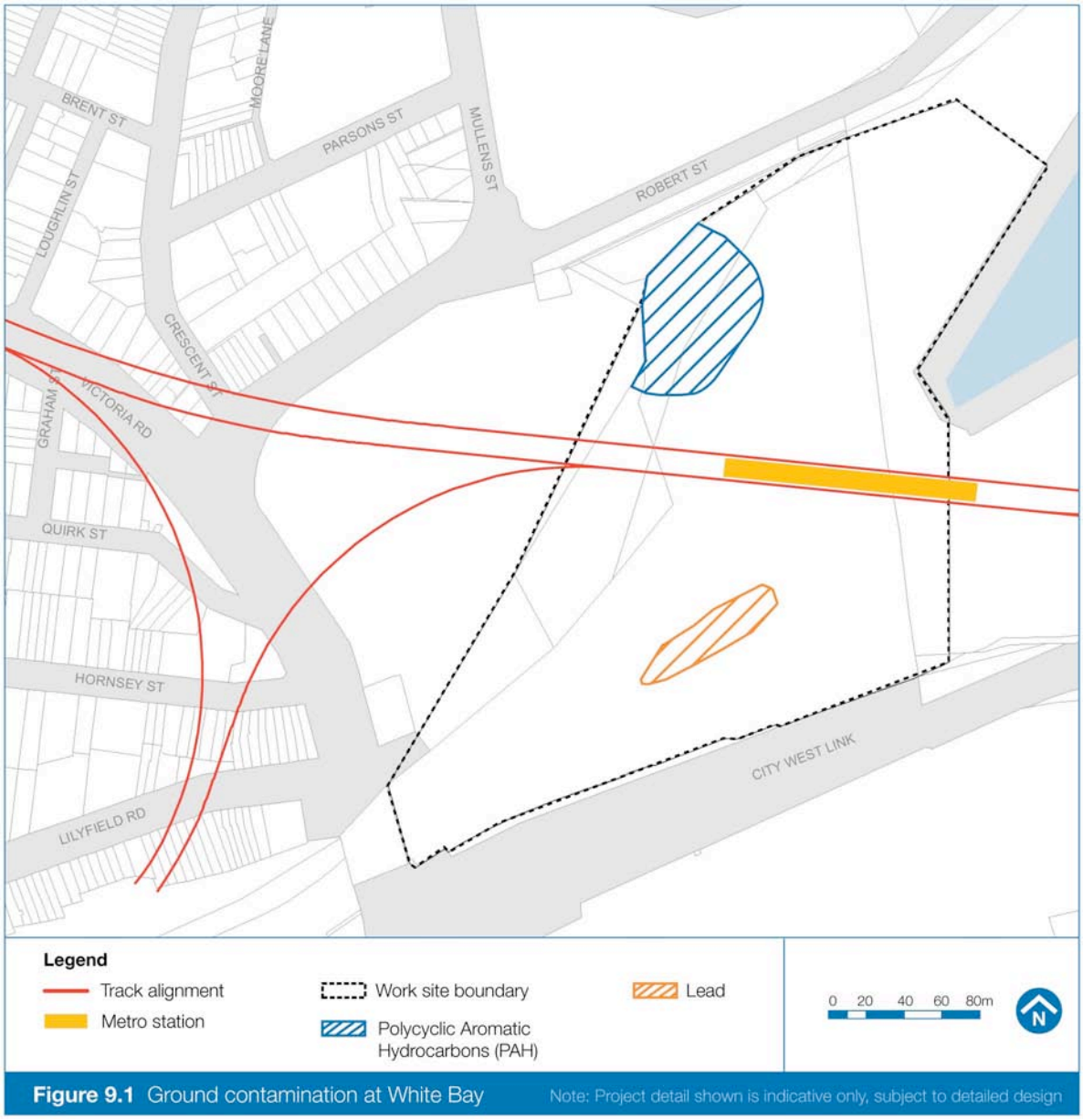


Figure 9.1 Ground contamination at White Bay

Note: Project detail shown is indicative only, subject to detailed design

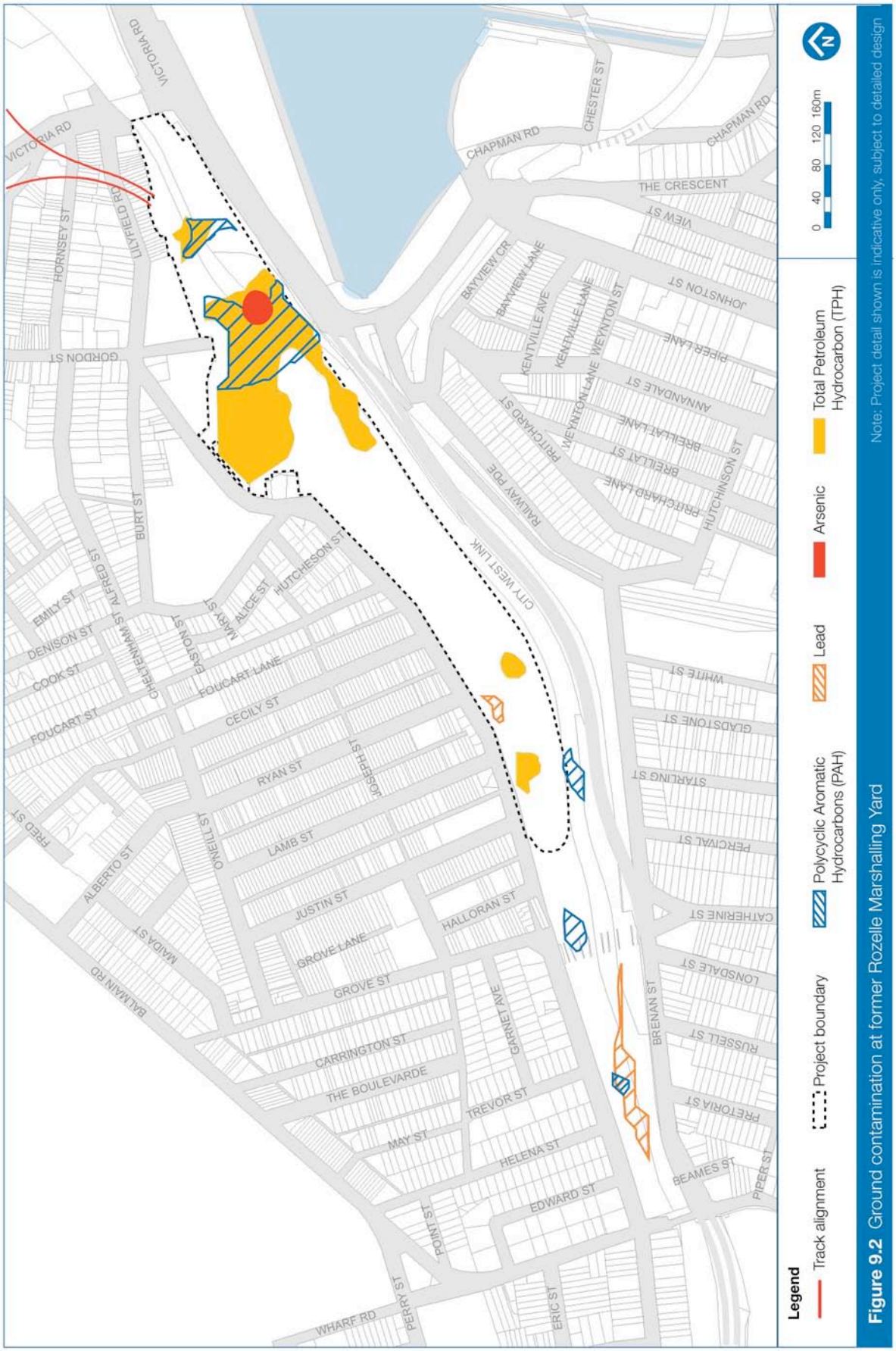


Figure 9.2 Ground contamination at former Rozelle Marshalling Yard

9.1.3 Excavation volumes

A summary of the volume of spoil produced at each spoil management location is presented in Table 9.1. The volumes of spoil produced at each construction site are depicted in Figure 9.3.

Table 9.1 Spoil volumes generated from each construction site

Construction site	Total volume (m^3) #	Source of spoil	Material/ percentage
Central Station	214,900	Entrances, shafts, station cavern and mined tunnels	Sandstone and shale Rock 70% Soft 30%
Town Hall Square Station	80,300	Entrances, shafts, station cavern and mined tunnels	Sandstone Rock 85% Soft 15%
Martin Place Station	113,600	Shafts, station cavern and mined tunnels	Sandstone Rock 88% Soft 12%
Barangaroo-Wynyard Station	148,000	Shafts, station cavern and mined tunnels, pedestrian link	Sandstone Rock 75% Soft 25%
Pyrmont Station	90,900	Shafts, station cavern and mined tunnels Station	Sandstone Rock 95% Soft 5%
White Bay Station Rozelle stabling and maintenance depot	400,100 86,200	Future station box, running tunnels from White Bay to Rozelle, White Bay to Central, and White Bay to Rozelle depot Surface material	Sandstone Rock 77% Soft 23%
Rozelle Station	139,000	Entrance shafts, station cavern and mined tunnels	Sandstone Rock 95% Soft 5%
Total Volume	**1,273,000**		

Note that the volumes are likely to reduce by up to 10% with further design refinements.

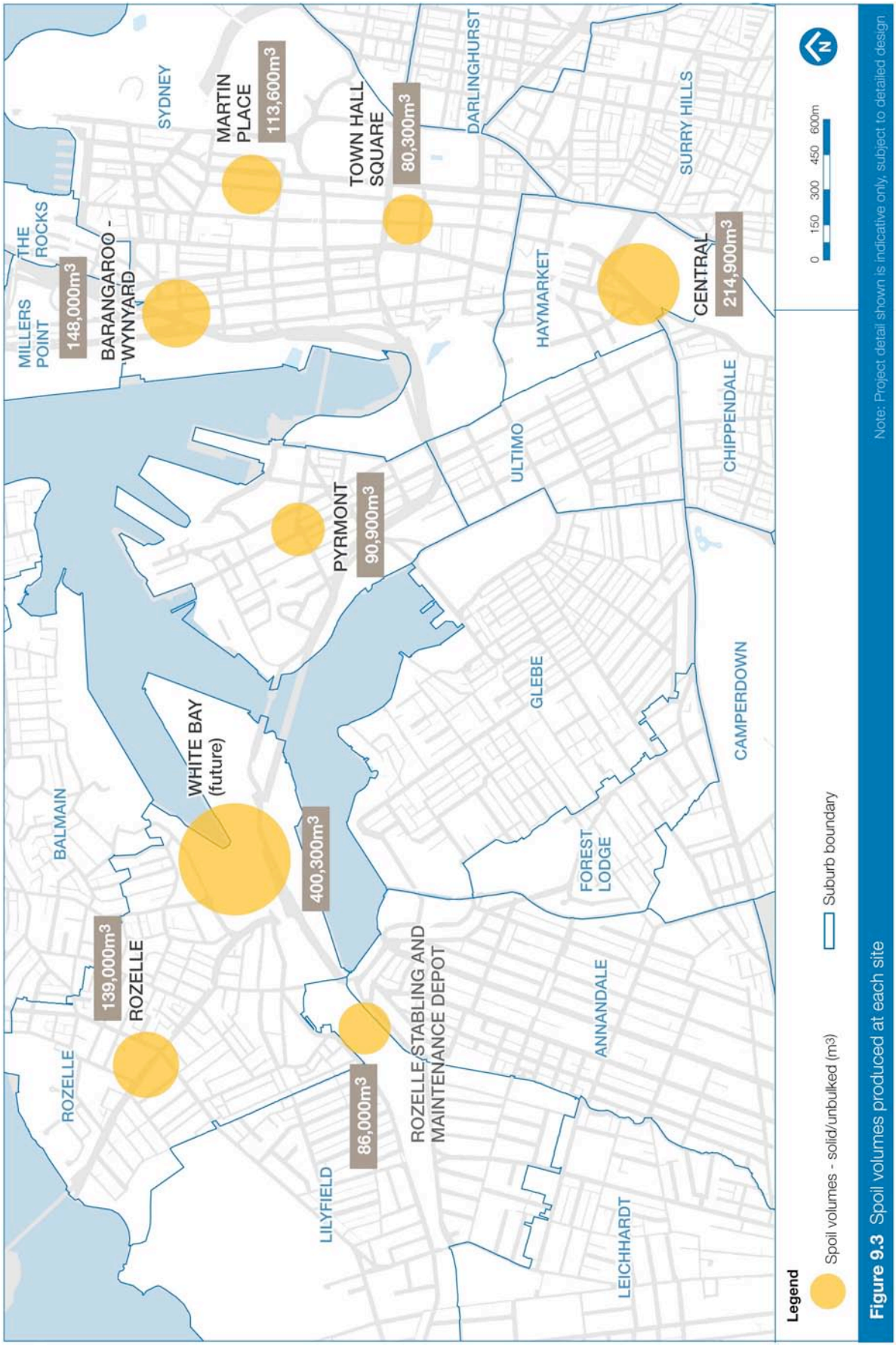


Figure 9.3 Spoil volumes produced at each site

9.2 Objectives and strategy

Sydney Metro has set the following objectives for the project to guide the management of spoil produced during construction.

- Objective 1: Maximise the beneficial reuse of spoil from the project.
- Objective 2: Avoid any further contamination of land or water from contaminated spoil.
- Objective 3: Manage the transportation of spoil with consideration to traffic impacts and transport related emissions.

To achieve these objectives, a Spoil Management Sub-Plan would be developed and implemented in accordance with the Construction Environmental Management Plan (CEMP). The Sub-Plan would incorporate the spoil management strategy, which has been developed for the project and is outlined in Technical Paper 2 *Spoil management*.

The spoil management strategy would address the stockpiling and handling of spoil to minimise the potential for generation of dust and contaminated run-off. The strategy would focus on opportunities for beneficial reuse of spoil in preference to disposal. It would also include the transportation requirements from the construction sites to the reuse or disposal sites via road, rail or water.

The Spoil Management Sub-Plan would also address the management of contaminated spoil. Management would be in accordance with *Managing Contaminated Land Planning Guidelines SEPP 55 – Remediation of Land* (DUAP 1998) and would include options for disposal or treatment of contaminated material.

9.3 Specific issues

9.3.1 Spoil handling and management

The construction sites and the processes for handling and management of spoil at these sites are described below. All sites except White Bay would involve the construction of shafts and subsequent excavation of underground station caverns. At White Bay, the station site would be constructed by cut and cover.

A typical construction site would contain a temporary spoil storage bin and drive-through access for trucks to allow the loading of spoil within the boundary of the construction site. The spoil bin could be a vertical hopper that feeds spoil down into a truck, and/or a three-sided vertical walled bin where a front-end loader shovels the spoil into each truck as it arrives on the construction site. Waiting trucks may be able to queue on-site at some construction sites, but at Town Hall, Martin Place, Pyrmont and part of Barangaroo-Wynyard the construction sites are relatively small and trucks would not be able to queue on-site.

Spoil from the shaft excavation and underground station cavern excavation would be lifted out by a skip bucket pulled by either a mobile, gantry or tower crane. The spoil would be tipped directly into the on-site storage bin or directly onto a truck.

9.3.2 Air quality management

Dust impacts from spoil handling and transportation would be minimised at each construction site by a variety of methods, including vehicle wash down services, truck covers, operating within enclosures when appropriate, and using water jets and hoses. All dust transported by air ducts would be filtered at the surface and each construction site would be surrounded by a hoarding which would help to confine any dust generated within the construction site. These options are discussed in detail in section 19.2.

9.3.3 Water quality management

Sediment-laden water would be generated at the surface, in the shafts and during the excavation of the station caverns. Sediment-laden water would be pumped to the surface and treated to encourage flocculation and slow setting prior to the excess water being pumped into the stormwater drainage system. Water management is described in Chapter 12.

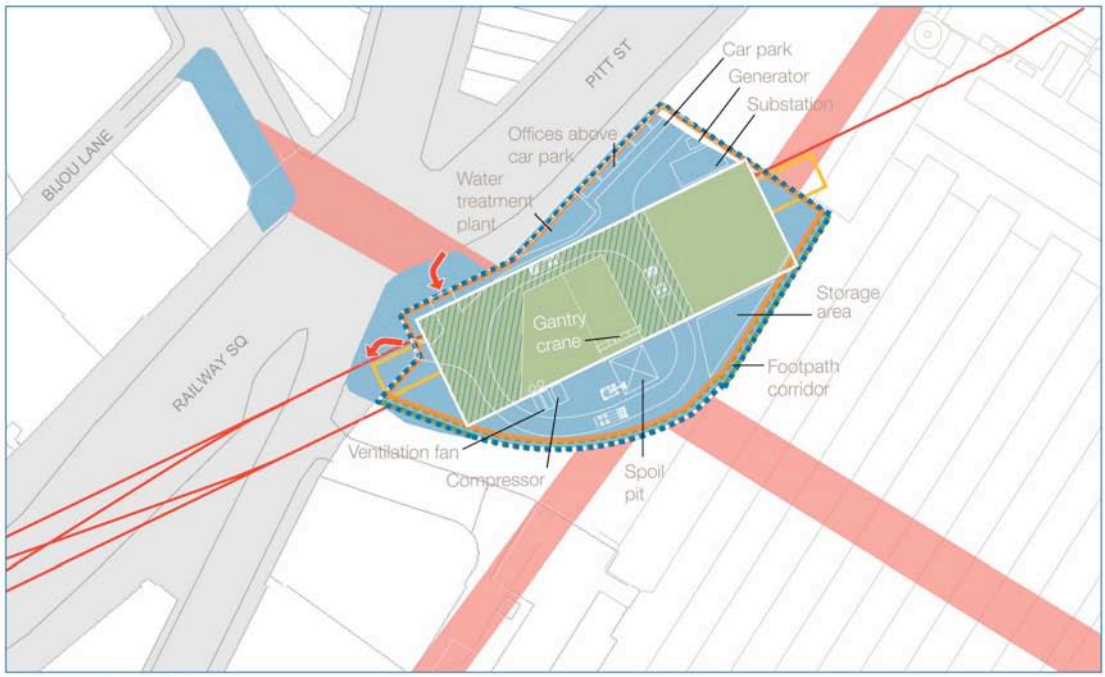
9.3.4 Construction sites

White Bay would be the largest construction site for the CBD Metro project and is the location where the tunnel-boring machines (TBM) would be launched. The layout for this site, including areas of spoil storage and the spoil transportation route, is shown in Figure 7.12. The main sources of spoil generated at this site would be the open excavation for the future White Bay Station, the TBM-driven tunnels to Central Station, the roadheader-excavated tunnels to Rozelle Station, and the tunnel excavations initiated from the former Rozelle Marshalling Yard.

The spoil would be temporarily stored at the White Bay site until transported off-site. The spoil storage area would have a capacity of about 10,000 cubic metres, and would be able to accommodate about a week of high productivity from two TBMs. In addition, the site may be used as a spoil storage location for spoil from all other CBD sites, whilst spoil transit is arranged and scheduled.

All construction sites would have similar elements such as air treatment processes and water treatment plants. Given the small size of the construction sites in the CBD, and at Pyrmont and Rozelle, only very limited spoil storage capacity would be provided at these sites. The spoil pits would have a capacity of about 200 cubic metres and would provide about half a day of storage based on predicted production rates. From these pits the spoil would be transported off-site or to the main spoil storage facility at White Bay. However, once the station caverns are about 50 per cent complete (after about 18 months), there would be the opportunity to temporarily store spoil within the station caverns.

The indicative layouts for Central Station and Barangaroo-Wynyard Station construction sites are shown in Figure 9.4 and for Pyrmont Station and Rozelle Station construction sites in Figure 9.5. These figures show indicative locations of the spoil pit, cranes and truck access.



Central Station

Barangaroo-Wynyard Station

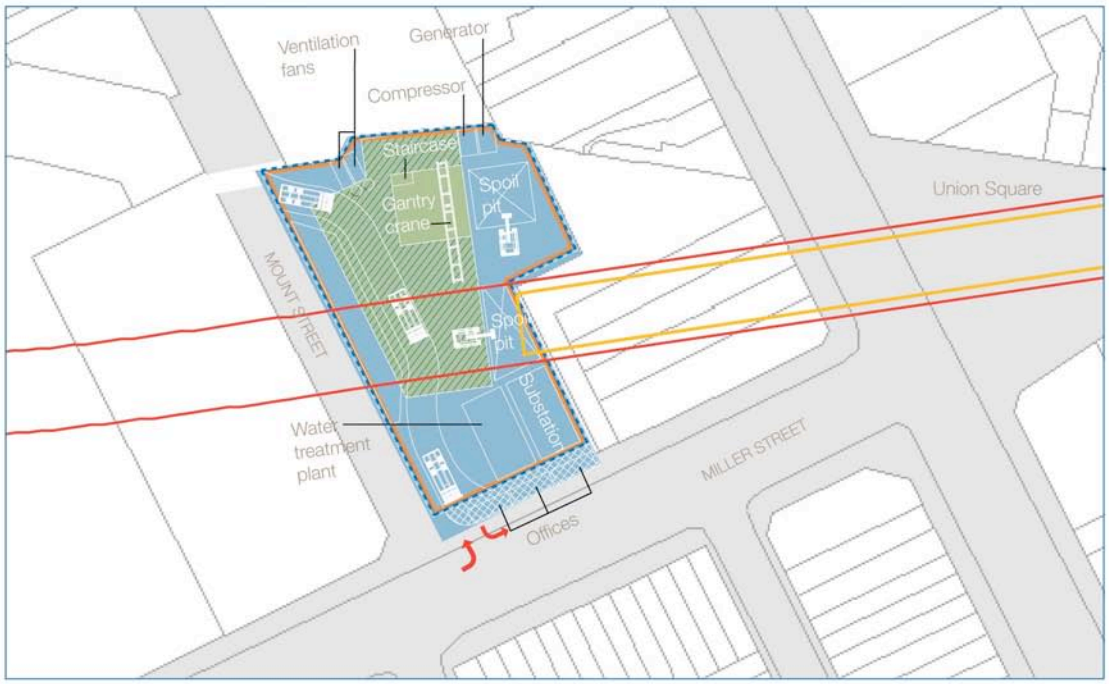
Legend

Track alignment | Metro station | Work site area | Staged work site | Site boundary

Truck access | Noise shed | Excavation | Decking over excavation | Hoarding

Figure 9.4 Proposed layout for the main construction sites at Central and Barangaroo-Wynyard

Note: Project detail shown is indicative only, subject to detailed design



Pyrmont Station

Rozelle Station

Legend

Track alignment
Metro station
Work site area
Decking over excavation
Site boundary
Truck access
Noise shed
Excavation
Hoarding

Figure 9.5 Proposed layout for the main construction sites at Pyrmont and Rozelle

Note: Project detail shown is indicative only, subject to detailed design

9.3.5 Spoil reuse and disposal

Although about 150,000 cubic metres of fill (15 per cent of the total) would be required to raise the ground levels at the Rozelle stabling and maintenance depot, there is very limited opportunity for reuse of excavated spoil material within the rest of the project. However, there is potential to reuse the spoil off-site, as follows:

- As the excavations would be predominately in Sydney sandstone, with some shale, there is a very high potential to reuse this material off-site for construction purposes.
- Spoil could be reused for engineering fill.
- Spoil could be recycled to produce by-products such as sand and crushed rock, which could be sold by the recycler. There are a number of recycling plants located around the Sydney metropolitan area and within 100 kilometres of the Sydney CBD.

An alternative to reuse of spoil as construction materials would be to reuse it for land management (reclamation) or for land rehabilitation (former and existing quarries). The least preferred option would be disposal at designated landfill sites.

Spoil management options are presented in more detail below, and the proposed spoil management hierarchy is shown in Figure 9.6.

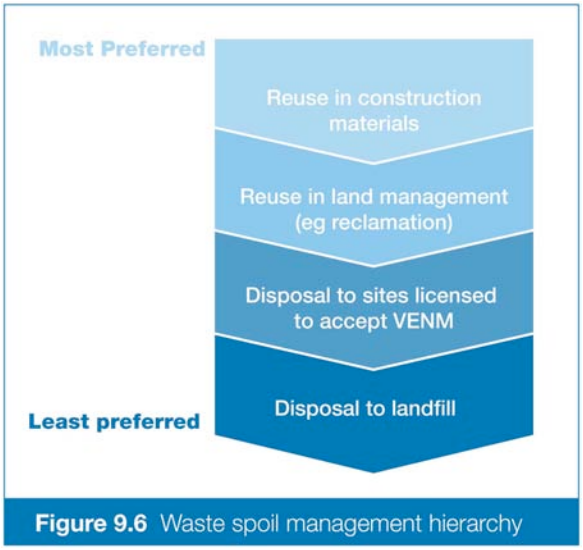


Figure 9.6 Waste spoil management hierarchy

Reusable spoil

Table 9.2 lists some potential recycling sites for the CBD Metro project.

Table 9.2 Potential recycling sites

Name/Company	Location and distance from CBD	Recycle	Recycling capacity	Operating hours
Eastern Creek/ Dial a Dump	Eastern Creek, 40 km	Sandstone and shale	Recycling plant will commence operation end of 2009. Greater than 500,000 m^3 3,000 tonne/day	Not known
Rocla Sand Quarry	Calga, 70 km	Sandstone	400,000 m^3 total, 1,500 tonne/day	Mon to Sat, 5am to 10pm
CSR Schofields Quarry	Schofields, 47 km	Sandstone and shale	500 tonne/day clay for brick production, requiring 10 per cent sandstone and 50 per cent shale	Mon to Fri 7am to 5pm
CSR Cecil Park	Cecil Park, 50 km	Sandstone and shale	1,000 tonne/day clay brick production, 10 per cent sandstone and 50 per cent shale	Mon to Sat 7am to 5pm
Austral Plant 3	Horsley Park, 40 km	Shale of appropriate quality	Active Brickworks– capacity not known	Mon to Fri 7am to 5pm

Yellow Block sandstone

Yellow Block sandstone may occur in the geological profile in the Pyrmont area. Due to the importance of this geological resource, all practicable efforts would be made to extract accessible Yellow Block sandstone during excavation. If it occurs and is of suitable quality, the method of excavation would be via cutting in manageable blocks. Management, storage and reuse would be coordinated in consultation with the NSW Department of Commerce.

Land reclamation

Port Kembla Port Corporation has produced a master plan for the Outer Harbour port development, and part of the plan involves land reclamation requiring over five million cubic metres of fill material. In March 2009, the NSW Government announced that the first stage of the reclamation would proceed in 2010 and 2011, subject to project approval planned for 2009/2010.

An opportunity exists to transport spoil material from the CBD Metro to Port Kembla by sea or rail for placement in the reclamation area.

Disposal of VENM

Of the total volume of spoil, about 85 per cent would be sandstone rock, 10 per cent shale and five per cent 'Other Than Rock' (OTR).

As described above, the sandstone rock and shale would have the potential for reuse as construction materials, which is the preferred reuse option. However, some may need to be sent to landfill sites for disposal.

The OTR would be either fill material, highly weathered rock or contaminated material that would need to be sealed or sent to an appropriate landfill site.

Potential disposal sites for VENM are shown in Table 9.3. The determination of the disposal site would be the ultimate responsibility of the contractor.

Table 9.3 Potential large-scale spoil disposal sites for Virgin Excavated Natural Material (VENM)

Name/Company	Location and distance from CBD	Capacity	Operating hours
Penrith Lakes Development Corporation	Penrith	1 million m^3 per annum for 10 years	Mon to Fri 7am to 5pm
Hornsby Shire Council/Hornsby Quarry	Hornsby	3 million m^3, but currently not an approved disposal site	Not applicable
Wallgrove Quarry	Eastern Creek, 40 km	11 million m^3, but currently not an approved disposal site	Not applicable
Rocla Sand Quarry	Calga, 70 km	To be confirmed	Mon to Sat 5am to 10pm
CSR Schofields Quarry	Schofields, 47 km	1 million m^3	Mon to Fri 7am to 5pm
CSR PGH Horsley Park	Horsley Park, 40 km	2 million m^3	Mon to Fri 7am to 5pm
Austral Plant 3	Horsley Park, 40 km	1.5 million m^3	Mon to Fri 7am to 5pm

9.3.6 Spoil contamination handling

If excavated materials (spoil) are classified as waste (that is, their physical or chemical characteristics do not allow them to be classified as VENM), they must be disposed of at an appropriately licensed landfill. There are sites in Western Sydney (such as Penrith Waste Services at Mulgoa) that regularly accept lightly contaminated soils. For more heavily contaminated materials, the SITA landfill at Elizabeth Drive, Kemps Creek would be the likely option.

The areas of shallow soil contamination within the White Bay construction site and the former Rozelle Marshalling Yard may be able to be retained on site. If there is a need to remove the material off-site, then it would be sent to an appropriate landfill site.

A review of other CBD Metro sites through data searches and aerial photography did not identify any additional areas of potential or existing soil contamination and it is likely spoil removed from these areas would be classified as VENM and be available for reuse or disposal at appropriate landfill sites. Should subsurface investigations or excavations identify areas that have potential for contamination, further assessment of potential contamination would be undertaken, to assess the extent of presence of contamination or hazardous materials within the project construction footprint. An appropriate Construction Environmental Management Plan (CEMP) would be required to outline appropriate operational and personal protective equipment requirements to protect workers from soil contamination.

9.3.7 Transportation of spoil

There are a number of options available for the transportation of spoil, as outlined in the following sections.

Within the CBD area, transport of spoil from station sites would be via trucks. Potential impacts associated with truck transport include impacts on neighbourhood amenity, access and traffic congestion. For the main tunnel drives under the CBD commencing from White Bay, excavated spoil would be transported back along the tunnels to this site, thus avoiding surface spoil transport in the CBD area.

Opportunities for removal of spoil by rail and barge were considered at White Bay. The spoil transport options for White Bay are shown in Figure 9.7.

Road transport

The opportunities and impacts associated with spoil removal by truck are discussed in Chapter 10. Potential impacts would be managed as follows:

- Access to and egress from the construction sites would ensure the safety of pedestrians, cyclists and other motorists and avoid suburban or residential streets, wherever practicable.
- Hours of transport would be appropriate for the maintenance of public amenity and safety in the vicinity of the construction site.
- The Construction Traffic Management Plan, prepared for the site, would include processes to minimise safety and amenity impacts on the neighbours to the site.
- Travel to recycling or disposal sites would be via the arterial road network, where practicable.
- Trucks would be prevented from queuing in the streets around the construction site perimeter, where not approved under a Traffic Management Plan, with dedicated waiting zones allocated along the truck routes.

Rail transport

Rail haulage is often regarded as more cost effective over longer distances than road haulage and can be considered in some circumstances as having lower environmental impacts than road travel.

A review was undertaken to consider the implications of the transport of spoil by rail. A train comprising either 30 by 76 tonne gross (58 tonne net capacity) or 23 by 100 tonne gross (77 tonne net capacity) bottom discharge hopper wagons would provide an average net capacity in the order of 1,650–1,700 tonnes and appears to be the preferable configuration for efficient operations.

The rail infrastructure from White Bay to Dulwich Hill is generally in a suitable condition for transporting the spoil, but would first require some rehabilitation works (the rehabilitation works could be completed within the project establishment timeframe).

Three potential locations for the loading of trains using front-end loaders have been identified in the White Bay area. From a rail perspective, the use of the former Rozelle Marshalling Yard area appears to be the most feasible.

It is likely that sufficient locomotives, wagons and train paths would be available to transport the spoil produced at White Bay. A preliminary review of the identified receival sites was undertaken and the removal of spoil to Port Kembla appears to be the most promising, although this site and others considered would require the construction of rail wagon discharge facilities and other infrastructure to accommodate double-handling of the spoil.

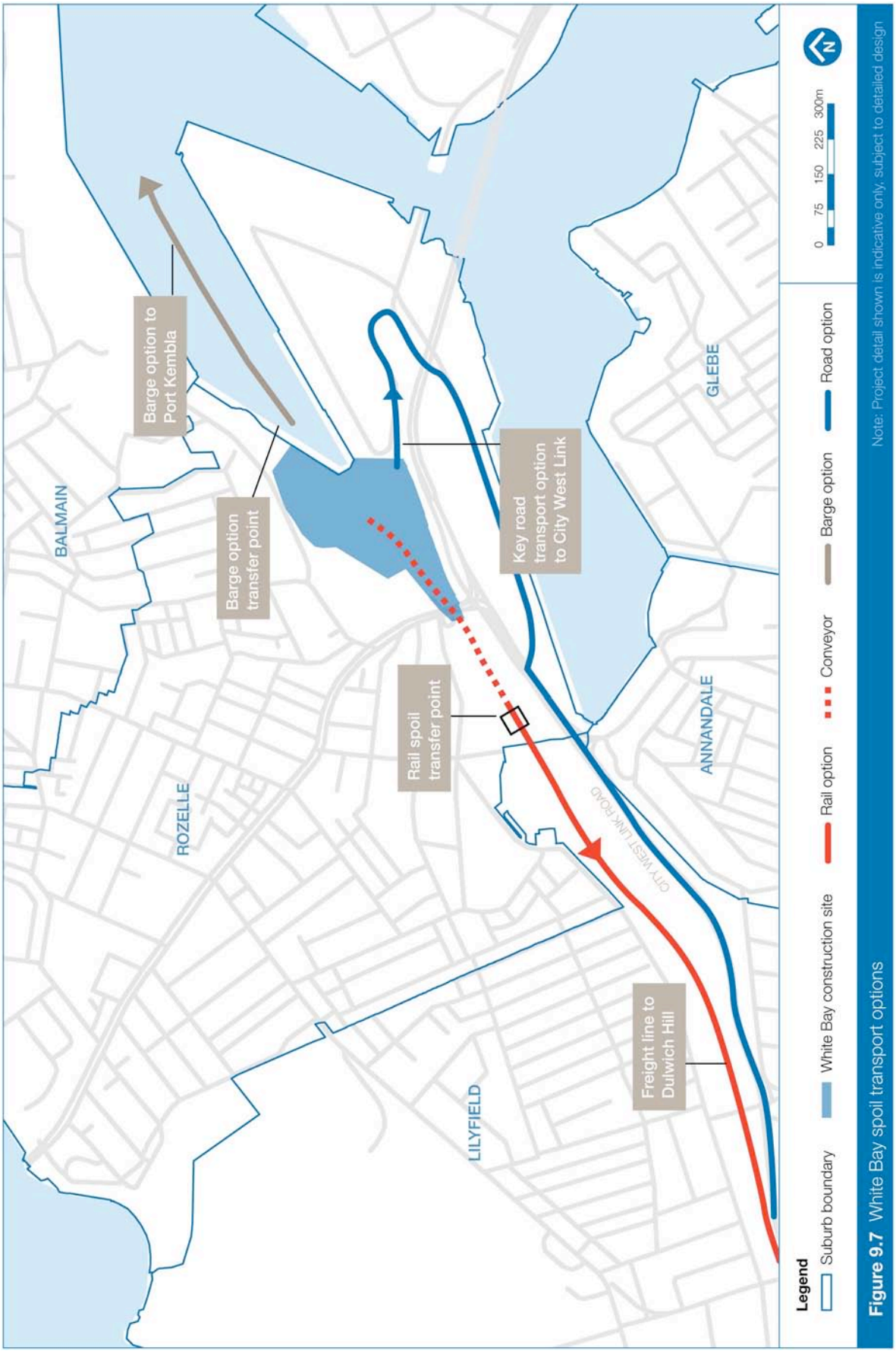


Figure 9.7 White Bay spoil transport options

A number of potential environmental risks related to the train operations have been identified. These include noise associated with loading and rail transport outside normal construction working hours. These would need to have mitigation strategies identified and implemented.

Water transport by barge

The proximity of construction sites to Sydney Harbour foreshores at White Bay provides an opportunity for removal of spoil by barge. (Consideration was also given to spoil removal by barge from Barangaroo, but the scale of works required for the limited amount of spoil to be removed meant this option was regarded as impractical.) The barges from White Bay could transport material from the project by sea to Port Kembla for land reclamation as part of the proposed Outer Harbour Port Development.

The barges could be loaded using one of three methods:

- Conveyor loading system.
- Truck loading systems.
- Direct front-end loader system (the viability of this method would be dependent on the distance from the spoil receipt/stockpile location to the barge loading point).

A split hopper barge is the ideal barge for transport and direct discharge of spoil at Port Kembla. These barges can be either self propelled or towed by tug.

The return trip to Port Kembla could be achieved within a 24-hour cycle, with the barge loading undertaken during daylight hours, followed by transit to Port Kembla, unloading and return at night to White Bay.

While there may be an opportunity to use the waterways to transport spoil excavated from the tunnels and stations, this has potential costs associated with the provision of barges and new infrastructure for handling spoil at either end. Environmental impacts associated with the use of waterways would relate primarily to loading noise at White Bay and potential impacts on marine ecology from spills or accidents.

9.4 Mitigation and management

A Spoil Management Sub-Plan would be prepared and implemented in accordance with the CEMP and would include, but not be limited, to the following mitigation and management measures:

- Spoil generated from construction activities would comprise mostly VENM, with limited potential for contaminated material to be removed.
- The preferred hierarchy for spoil management of VENM would be (in order of preference) on-site reuse, recycling and disposal to landfill as waste. Advice would be provided to contractors regarding that preference, along with available information on potentially available receiving locations.
- Procedures for assessing potential contamination of spoil generated at each site would be developed and implemented. Contaminated spoil would be treated on site or removed to an appropriately licensed landfill.
- Construction sites would be managed to ensure that dust from spoil handling is controlled to minimise amenity impacts on neighbours and water contaminated by spoil handling is treated before discharge to meet the requirements of the *Protection of the Environment Operations Act 1996* (POEO Act).
- For spoil removed from construction sites by truck, Traffic Management Plans would be developed for each site to ensure impacts on public amenity are managed adequately. Particular attention would be paid to timing for truck loading and movements and truck queuing in the adjoining streets.
- The timing for spoil handling and transport at each site would be based on the potential impacts on public amenity and safety and potential impacts on the road network. Arterial roads would be used wherever practicable to transport spoil to recycling or disposal locations.
- Further assessment of spoil transport alternatives would continue to be undertaken to determine opportunities for removal of spoil from White Bay by rail or barge. The results of that evaluation would form part of the contract options during construction and a decision as to whether alternatives to truck transport are implemented would be determined in the context of available disposal sites, cost and environmental impacts.

9.5 Conclusions

Spoil management is an issue that would occur during construction only. While the excavations for the CBD Metro would result in a significant amount of spoil – due to the fact the metro would be an underground transport link – this volume of spoil could be managed with limited environmental or social impacts.

Over 80 per cent of the excavated material is likely to be clean, natural material suitable for reuse, with some of it being high quality Yellow Block sandstone.

While some of the spoil generated from surface activities has the potential to be contaminated, especially excavation in former industrial areas such as White Bay and the former Rozelle Marshalling Yards, the potential volume of contaminated spoil is expected to be less than one per cent of the total excavated volume for the project and the contaminated material would be treated according to DECCW guidelines.

The opportunity exists for spoil from White Bay and the Rozelle stabling and maintenance depot to be removed via rail or barge instead of trucks. Road transport is the only practicable means of spoil removal from sites other than White Bay.