

The land required for the Sydney Park construction compound would be used temporarily throughout construction only. The construction compound site would be rehabilitated at the completion of construction, with the exception of the areas of land required permanently for the footprint of the bridge and pedestrian and cycle paths.

An indicative program for works to be conducted within the Sydney Park construction compound is provided in **Table 6-20**.

Table 6-20 **Indicative program for the Sydney Park construction compound (C14)**

Construction activity	Indicative construction timeframe											
	2017				2018				2019			
Site establishment												
Construction of shared path and bridge												
Demobilisation and rehabilitation												

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Figure 6-6 Kingsgrove North (C1) and Kingsgrove South (C2) construction compound layouts

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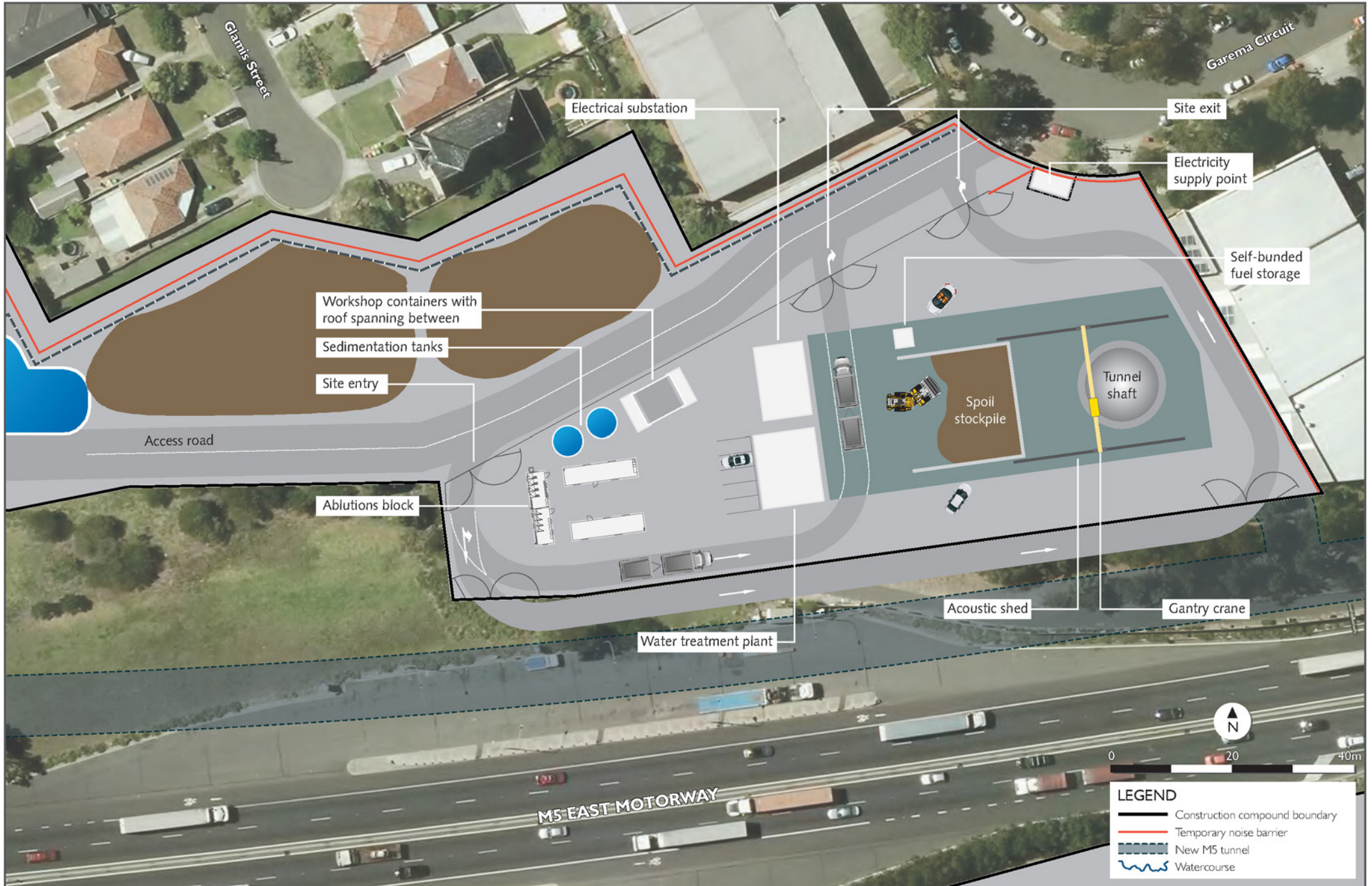


Figure 6-7 Kingsgrove North construction compound (C1) - tunnelling support layout

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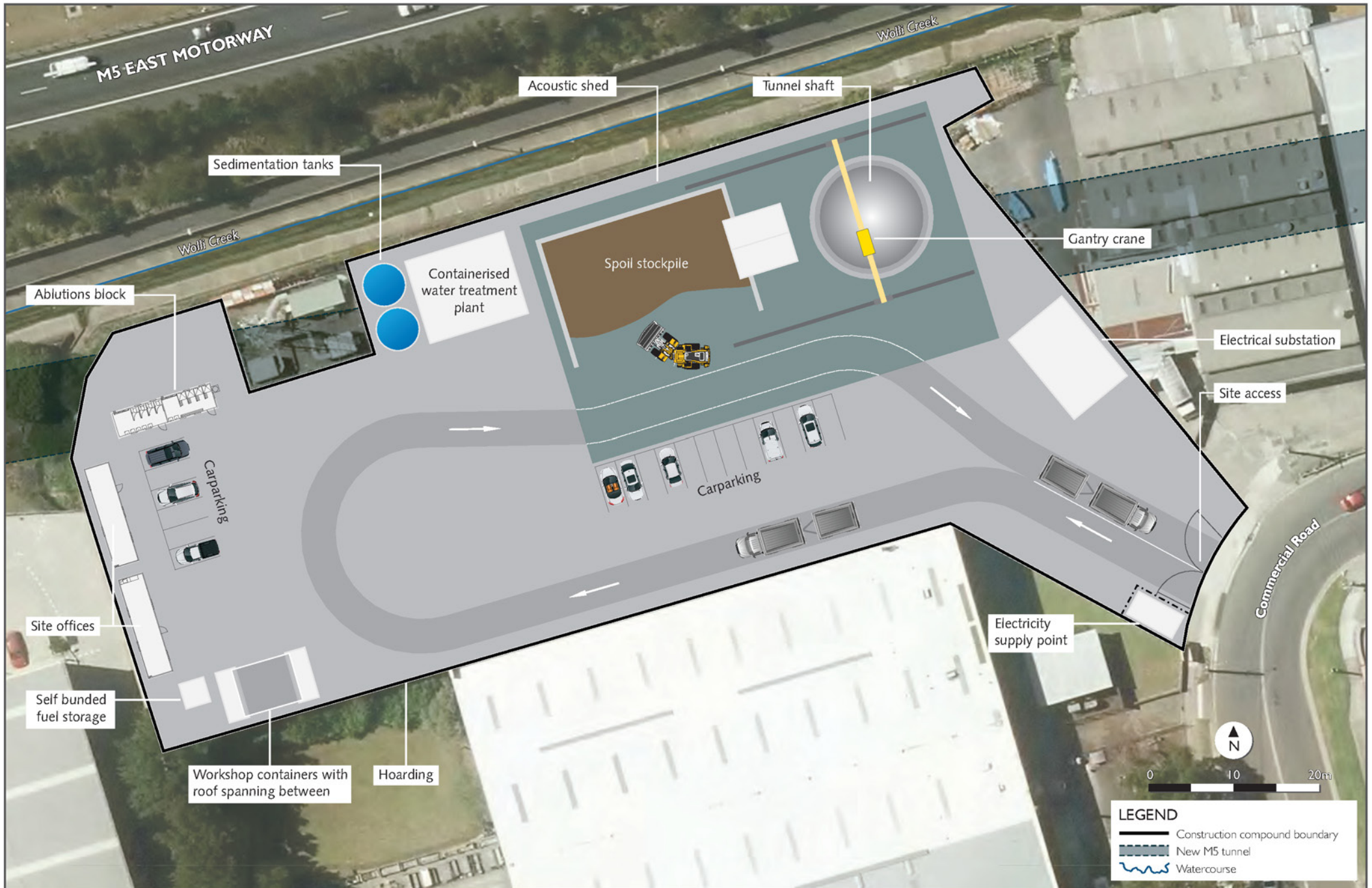


Figure 6-8 Commercial Road construction compound (C3) layout

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Figure 6-9 Bexley Road North construction compound (C4) layout

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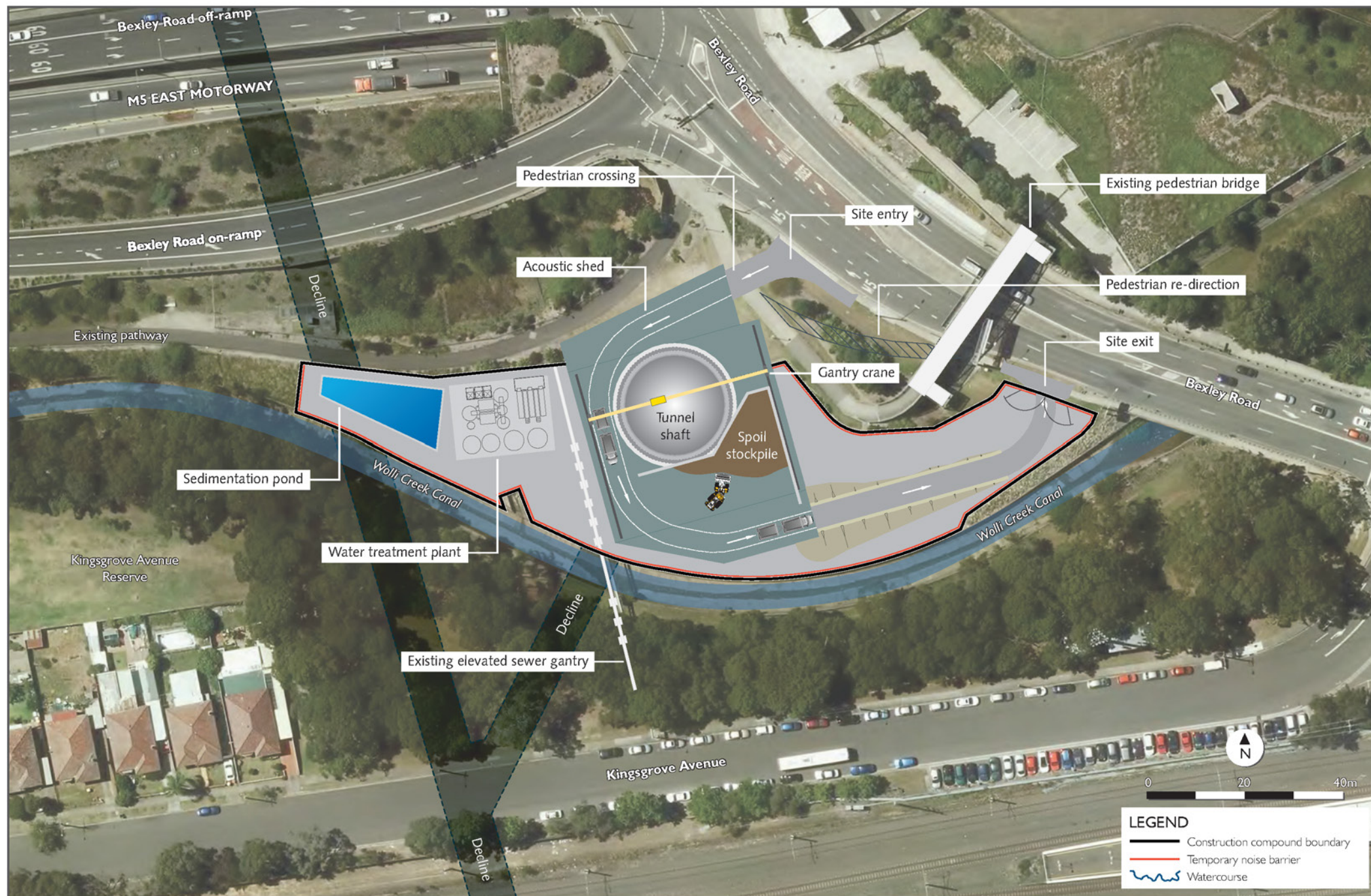


Figure 6-10 Bexley Road South construction (C5) compound layout

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Figure 6-11 Bexley Road East construction compound (C6) layout

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Figure 6-12 Indicative Arncliffe construction compound (C7) layout

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Figure 6-13 Canal Road construction compound (C8) layout

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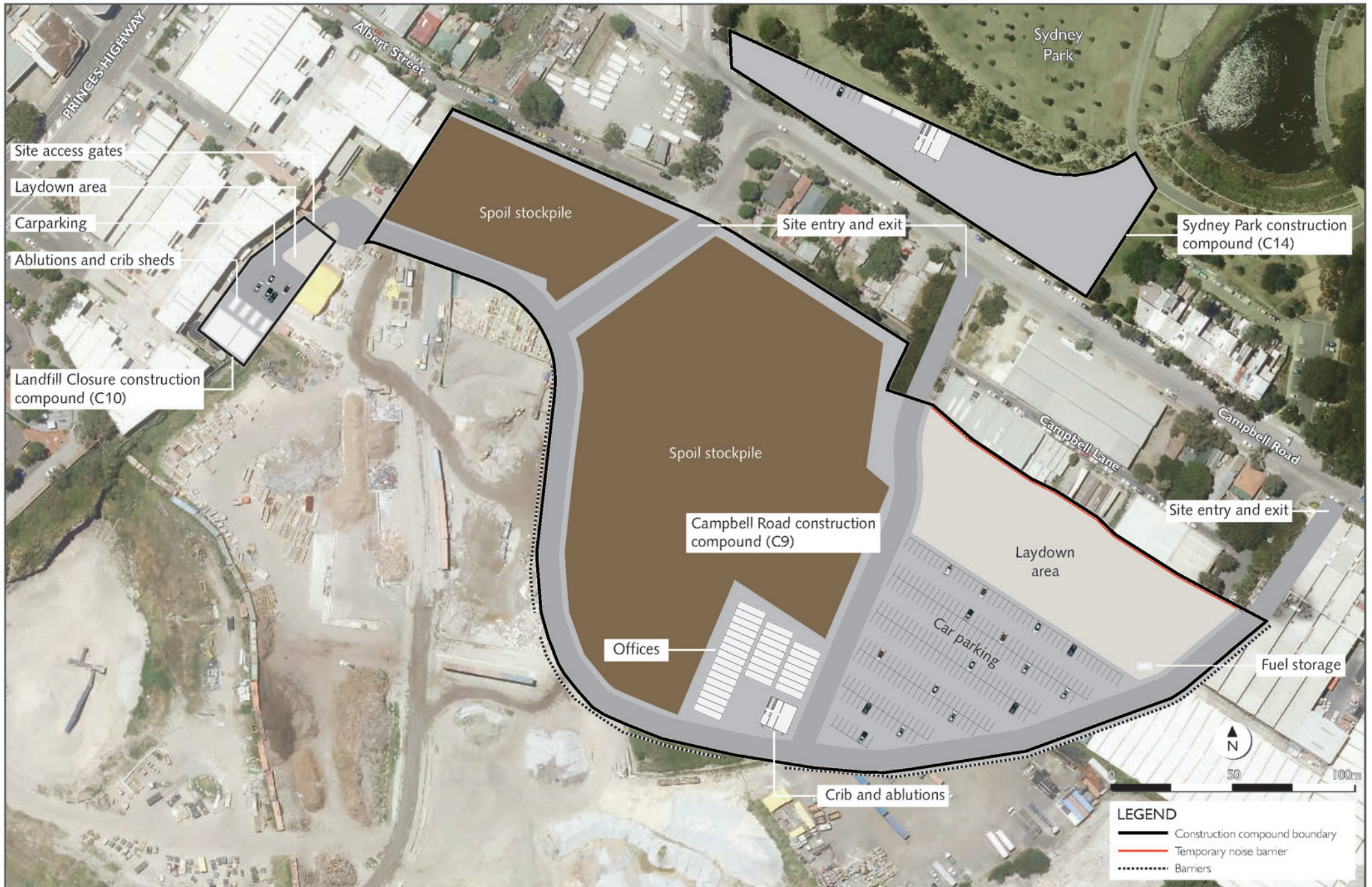


Figure 6-14 Campbell Road (C9) and landfill closure (C10) construction compound layouts

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Figure 6-15 Burrows Road (C11), Campbell Road bridge (C12) and Gardeners Road bridge (C13) construction compound layouts

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Figure 6-16 Sydney Park construction compound (C14) layout

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6.5.4 Tunnelling

Construction of the project tunnels would require excavation, civil finishing works and fit-out with operational systems.

Tunnel excavation

The project would involve tunnel excavation for:

- The main alignment tunnels (two tunnels each about nine kilometres in length), including the St Peters caverns and the southern extension caverns
- Cross passages between the mainline tunnels at approximately 120 metre spacing for emergency pedestrian egress
- Vehicular cross passages
- Low point sumps
- On-and off-ramps
- Stub tunnels for future connection to the possible future M4-M5 Link and the possible future Southern extension.

The depth of the main alignment tunnels would vary depending on geological constraints. The maximum depth of the tunnels would be about 80 metres below the ground surface, with shallower sections on the approach to the western and eastern tunnel portals.

Tunnel excavations would be carried out with roadheaders. A roadheader is a machine which comprises a boom-mounted rotating cutter head on track-mounted frames and a loader device (usually on a conveyor). Roadheader excavation method is illustrated in **Figure 6-17**.

Rock breaking and controlled blasting would be used in some areas of the tunnel excavation to improve the efficiency of excavation activities and shorten the overall excavation program. Areas that are likely to require controlled blasting would be confirmed during detailed design and refined where necessary in response to geological conditions experienced during construction. It is anticipated that controlled blasting would be suitable for cross passage and bench excavations throughout the project. Roadheaders would be launched from:

- The Kingsgrove North construction compound (C1)
- The Commercial Road construction compound (C3)
- The Bexley Road North construction compound (C4)
- The Bexley Road South construction compound (C5).
- The Arncliffe construction compound (C7)
- The Canal Road construction compound (C8).

The installation of ground support, including structural lining would be carried out progressively as the roadheaders advance. Two types of structural lining would be used for the project, depending on the local geology. In relatively dry sections of tunnel (namely areas of sandstone), ground support would consist of corrosion-protected rock bolts and a primary (permanent) shotcrete lining. In wet sections of the tunnel (mostly areas of shale and shallow areas above sandstone), ground support may consist of temporary rock dowels, an initial shotcrete lining with a membrane and a secondary shotcrete lining.

The tunnel cross section would be a relatively flat arched profile. The arch profile would vary slightly depending on the local geology. Indicative dimensions of the main alignment tunnels (without fit-out) are summarised in **Table 6-21**.

Table 6-21 Indicative tunnel dimensions

Tunnel section	Width – tunnel floor (metres)	Width – arched tunnel roof (metres)	Height (metres)
From the western portals to the southern extension caverns.	12.4	14.1	6.5
From the southern extension caverns to the St Peters caverns.	16.9	19.4	7.3
M4-M5 Link and Southern extension stub tunnels.	12.4	14.1	6.5
Areas with breakdown bays.	14.5	18.7	7.1

Note: indicative tunnel dimensions are within Hawkesbury Sandstone and without tunnel fit-out. Widths and heights may vary locally along the length of the project due to geological constraints, and areas where additional tunnel features are present.

To accommodate traffic 'line of sight' requirements and enlargements of egress tunnels and emergency breakdown bays, some sections of the project tunnels would be widened beyond these standard widths. In addition to the space required for the traffic envelope, the tunnels would also provide space required for tunnel services, including deluge systems, drainage infrastructure, communications cables, mechanical and electrical equipment, incident response infrastructure and ventilation infrastructure.

Pedestrian and vehicular cross passages would be excavated between the main alignment tunnels at regular intervals. These cross passages would be excavated using either, roadheaders, excavators and blasting.

Tunnel civil finishing works

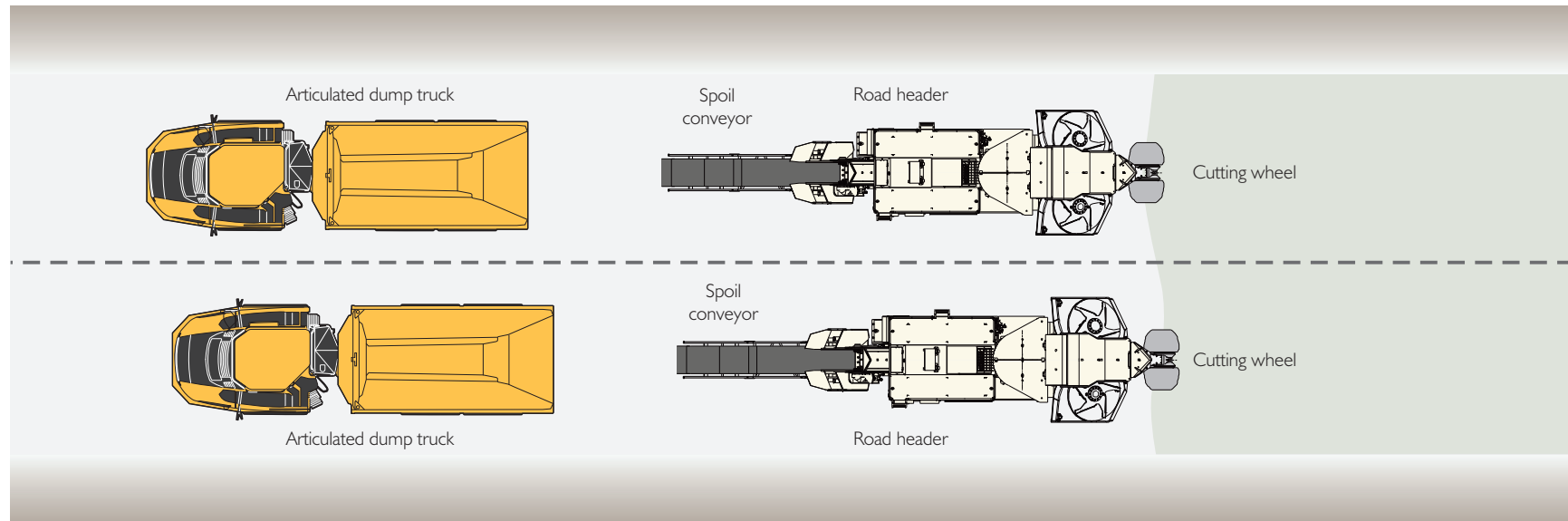
On completion of the tunnel excavation, civil finishing works would be carried out, including the installation of:

- Roadway drainage
- Road pavement
- Road furniture
- Electrical substations
- Low point sumps
- Cross passages, including electrical rooms
- Emergency smoke extraction outlets.

Tunnel fit-out

Tunnel excavation and civil finishing works would be followed by fitting out the tunnel with operational infrastructure. This would include power, ventilation, fire safety systems, communications infrastructure, traffic control, tunnel lighting and the operational management control systems and secondary tunnel lighting (refer to **Section 5.8.2**).

TUNNEL EXCAVATION METHOD - PLAN



TUNNEL EXCAVATION METHOD - ELEVATION

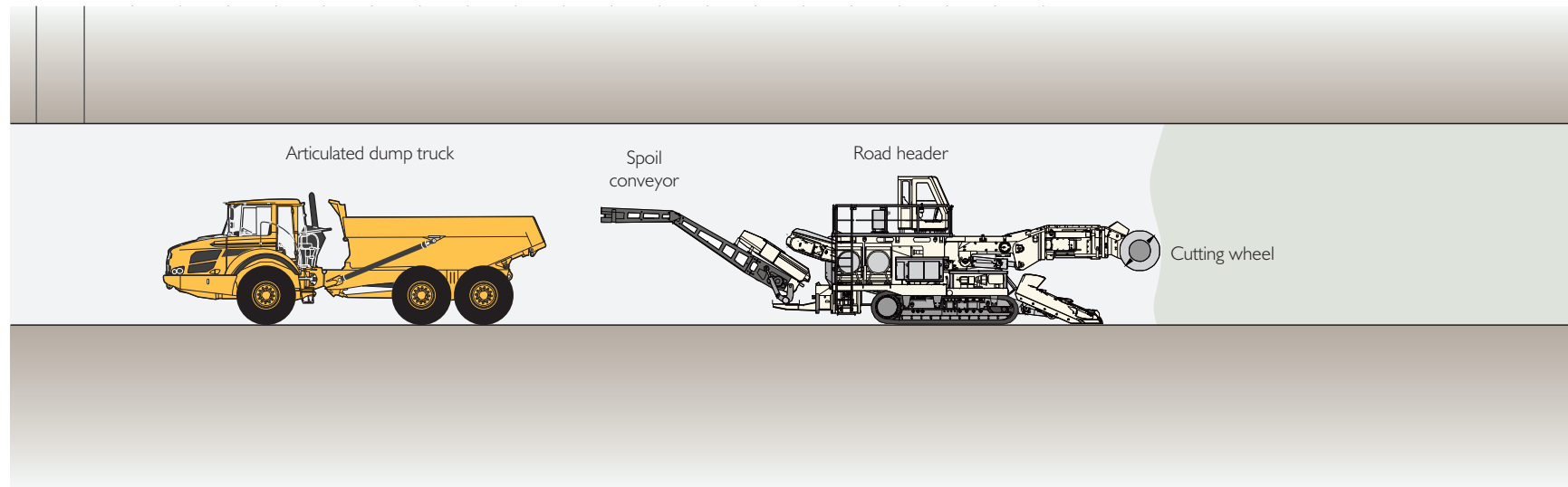


Figure 6-17 Conceptual road header excavation method

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6.5.5 Other bulk earthworks

In addition to tunnel excavation, bulk earthworks would also be required for:

- Cut and cover structures
- Landfill closure
- Surface road works.

Cut and cover structures

'Cut and cover' is a tunnel excavation methodology that involves excavation downwards from the surface of the ground, installation of a roof structure across the top of the excavation, and backfilling with spoil or other material.

Three cut and cover structures would be constructed for the project:

- The western main alignment tunnel portals
- The eastern main alignment tunnel portals
- The structure beneath Campbell Road as part of the potential future connection with the possible future M4-M5 Link.

Typical construction activities associated with the construction of these structures would include:

- Piling works
- Construction of capping beams
- Excavation
- Installation of temporary and permanent roof beams
- Installation of permanent struts and form, reinforcement and pouring of walers
- Form, reinforcement and pouring of base slab
- Finishing works.

The Campbell Road cut and cover structure would be constructed to provide a connection between the St Peters interchange and future M4-M5 Link. The cut and cover structure would be constructed as part of the project to avoid repeated disruption of Campbell Road with the future construction of the future M4-M5 Link. The northern and southern sections of the cut and cover structure would be constructed offline, and the section of cut and cover immediately below Campbell Road would be constructed simultaneously with the upgrades to Campbell Road as part of the local road upgrades.

Landfill closure

Earthworks within the St Peters interchange site as part of the closure of the Alexandria Landfill would include constructing a raised and vegetated containment mound in the south-western portion of the site. The mound would contain around 70,000 cubic metres of material excavated from a stockpile in the north-western corner of the Alexandria Landfill site. The construction of the containment mound would be staged, with the final form of the mound being around 25 metres AHD and would be the highest point of the final landform within the St Peters interchange. The location of the stockpile mound is shown on **Figure 5-46**.

Across the Alexandria Landfill site, about 620,000 cubic metres of material would be cut during construction and an estimated total of about 556,000 cubic metres would be filled. The volume of cut material is expected to be compacted by about 10 per cent, resulting in a balanced cut and fill across the site. The classification, management and treatment (if required) of this material is described in **Section 17.3.4** of **Chapter 17** (Contamination) and **Chapter 24** (Resource use and waste minimisation).

Surface road works

Earthworks would be required for the construction of aboveground sections of the project, including the western surface works, St Peters interchange and local road upgrades. Earthworks would be completed using conventional road construction methodologies including:

- Vegetation clearance and topsoil stripping. Mulched vegetation would be stockpiled for later re-use in site rehabilitation and landscaping works
- Areas of new cut and fill to design levels, including the construction of retaining walls
- Installation of road drainage infrastructure
- A Landfill Closure Management Plan is included in **Appendix F** (Landfill Closure Management Plan).

6.5.6 Landfill closure

The Alexandria Landfill site was acquired by the NSW Government in December 2014 and the operations of the previous landowner ceased at that time. Activities consistent with the existing planning approvals are continuing on site. Typical continuing operations include:

- Sorting through the various stockpiles of waste and materials stored for resource recovery
- Evaluating opportunities to recycle and/or recover materials for reuse
- Processing of materials scheduled for reuse
- Removing and disposing of waste materials assessed to be unsuitable for recycling/reuse, to the landfill, or to another suitably licensed landfill facility in accordance with EPA requirements
- Stabilisation of a cliff face landslip.

A landfill closure management plan has been prepared for the project, in consultation with the EPA.

Closure of the Alexandria Landfill would involve:

- Bulk earthworks to prepare the site for construction of the St Peters interchange
- Installation of a capping layer
- Installation of a cut off wall to minimise inflow from the Botany Sands aquifer
- Upgrade of the leachate management system
- Installation of a landfill gas collection and management system
- Installation of a groundwater management system.

Bulk earthworks

Earthworks within the St Peters interchange site as part of the closure of the Alexandria Landfill would include constructing a raised and vegetated containment mound in the south-western portion of the site. More information about the earthworks activities to be undertaken for the closure of the Alexandria Landfill is provided in **Section 6.5.5**. The classification, management and treatment (if required) of this material is described in **Section 17.3.4** of **Chapter 17** (Contamination) and **Chapter 24** (Resource use and waste minimisation).

Landfill capping

Landfill capping would include:

- Preparatory works including clearing and levelling the ground surface, where required
- Installation of landfill capping layers, in accordance with the landfill closure management plan. This would include the installation of the subsurface drainage and gas collection systems, where required
- Land forming works to the final landform for the site, in accordance with the landfill closure management plan
- Stabilisation and revegetation of the new ground surface.

Additional detail regarding the landfill capping system is provided in **Section 5.9** and **Section 17.3.4** of **Chapter 17** (Contamination).

Leachate management system

The existing leachate management system across the Alexandria Landfill site would be retained and augmented where required to suit the final landform of the site. Upgrades to the existing leachate management system are occurring under existing consents. Augmentation of the existing leachate system as part of the project would include the installation of a new leachate barrier underneath the containment mound, upgrades to the leachate collection and transfer system and the construction of a new leachate treatment plant. The leachate collection, management and treatment system is summarised in **Section 5.9.3** and detailed in **Section 17.3.4** of **Chapter 17** (Contamination).

Construction activities to be undertaken as part of the works to the leachate management system within the Alexandria Landfill site would include:

- Installation of leachate barrier as part of the containment mound in accordance with the specifications prescribed in the Alexandria Landfill closure management plan
- Upgrades and augmentation of the existing leachate collection system throughout the site, including the leachate collection pipework
- Installation of new leachate drainage network in accordance with the landfill closure management plan, including a system of feeder and collector pipes and three leachate collection sumps
- Decommissioning of the existing leachate treatment plant
- Removal of redundant infrastructure off-site
- Extension and augmentation of the existing sump and well riser, and connection into the new leachate management network
- Construction of a new leachate treatment plant, including:
 - Excavation, footing and base slab installation with retaining walls as required
 - Construction of a building to house the leachate treatment plant, including construction of blockwork walls, erection a roof and columns and enclosure of building with precast walls and lightweight cladding
 - Internal fit-out of treatment plant, including the installation of nine storage tanks, polymer blender and dosing system, dewatering screw press, sludge bun, plant control room and operations room.

Gas collection and management system

The gas collection and management system as part of the closure of the Alexandria Landfill would comprise both active and passive components (refer to **Section 5.9**).

The construction of the gas collection and management system would include:

- Drilling and installation of around 30 vertical gas extraction wells and 30 gas extraction well heads for the active gas collection system to an average depth of about 10 metres below the ground level
- Trenching and installation of gas collection trenches underneath the landfill capping layer
- Drilling and installation of around 40 passive gas vents
- Trenching and installation of pipework to connect the extraction wells with the flare
- Construction and installation of four wellhead stations
- Construction of a gas flare, including fencing controls for safe access
- Drilling and installation of between 40 and 100 subsurface gas monitoring wells around one metre below ground level
- Decommissioning and disposal of redundant gas collection and management system.

Additional detail is provided in **Section 17.3.4** of **Chapter 17** (Contamination).

Groundwater management system

A sub-surface cut-off wall would be installed along parts of the western, eastern and southern boundary of the landfill site. The cut-off wall would be about 10 to 12 metres deep and would replace the existing groundwater extraction system within the site.

Depending on the final location and ground conditions, the cut-off wall would be constructed by one of two ways:

- Excavation of a trench and construction of a bentonite clay slurry wall
- Sheet piling of a pre-fabricated cut off wall.

The final construction methodology for the cut-off wall would be confirmed during detailed design.

Additional detail regarding the management of groundwater for the project is provided in **Section 17.3.4** of **Chapter 17** (Contamination) and **Chapter 19** (Groundwater).

6.5.7 Construction of permanent operational infrastructure

As detailed in **Section 5.1**, permanent operational infrastructure would be required for the ongoing management and operation of the project. This operational infrastructure would be mainly located in five motorways operations complexes:

- The Kingsgrove motorway operations complex (MOC1), to be constructed on the site of the Kingsgrove South construction compound (C2)
- The Bexley Road South motorway operations complex (MOC2), to be constructed on the site of the Bexley Road South construction compound (C5)
- The Arncliffe motorway operations complex (MOC3), to be constructed on the site on the Arncliffe construction compound (C7)
- The St Peters motorway operations complex (MOC4), to be constructed on the site of the Canal Road construction compound (C8)
- The Burrows Road motorway operations complex (MOC 5), including the New M5 motorway control centre, to be constructed on the site of the Burrows Road construction compound (C11).